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FINAL CORRECTIVE MEASURES STUDY REPORT SOLID WASTE MANAGEMENT UNIT 69 WITH TRANSMITTAL AND RESPONSE TO COMMENTS NAVAL ACTIVITY PUERTO RICO
4/26/2013
BAKER ENVIRONMENTAL, INC.

Michael Baker Jr., Inc.
A Unit of Michael Baker Corporation

Airside Business Park
100 Airside Drive
Moon Township, PA 15108
Office: 412-269-6300
Fax: 412-375-3995

April 26, 2013

U.S. Environmental Protection Agency - Region II
290 Broadway – 22nd Floor
New York, New York 10007-1866

Attn: Mr. Phil Flax
Chief, Resource Conservation and Special Projects Section

Re: Contract N62470-10-D-3000
IQC for A/E Services for Multi-Media
Environmental Compliance Engineering Support
Delivery Order (DO) JM01
U.S. Naval Activity Puerto Rico (NAPR)
EPA I.D. No. PR2170027203
Final Corrective Measures Study Report for SWMU 69

Dear Mr. Flax:

Michael Baker Jr., Inc. (Baker), on behalf of the Navy, is pleased to provide you with one hard copy and one electronic copy provided on CD of the Final Corrective Measures Study Report for SWMU 69. This report has been revised to address EPA comments dated November 3, 2011 and February 26, 2013. The Navy's responses to these comments are attached for your review. Additional distribution has been made as indicated below.

If you have questions regarding this submittal, please contact Mr. David Criswell at (843) 743-2130.

Sincerely,
MICHAEL BAKER JR., INC.

John W. Mentz
Activity Coordinator

Attachments

cc: Ms. Debbie Sanders, BRAC PMO SE (letter only)
Mr. David Criswell, BRAC PMO SE (1 CD)
Mr. Pedro Ruiz, NAPR (Electronic Submission)
Mr. Stacin Martin, NAVFAC Atlantic (1 hard copy and 1 CD)
Mr. Doug Pocze US EPA Region II (2 hard copies and 2 CDs)
Mr. Jose Font, US EPA Caribbean Office (1 hard copy and 1 CD)
Mr. Felix Lopez, US F&WS (1 hard copy and 1 CD)
Ms. Wilmarie Rivera, PREQB (1 hard copy and 1 CD)
Ms. Gloria Toro, PREQB (1 hard copy and 1 CD)
Ms. Connie Crossley, Booz Allen Hamilton (1 hard copy and 1 CD)

WORKING DRAFT RESPONSE TO THE REVIEW OF THE RESPONSE TO EPA AND PREQB COMMENTS ON THE REVISED DRAFT CORRECTIVE MEASURES STUDY REPORT FOR SWMU 69 DATED AUGUST 11, 2011

This document provides the Navy's responses to government comments on the Revised Draft Corrective Measures Study Report for SWMU 69 and also responses to government reviews of the Navy's Response to Comments on the Draft Corrective Measures Study Report for SWMU 69. Following provides a brief timeline for this document:

- Draft Corrective Measures Study Report for SWMU 69 submitted by the Navy to EPA on September 15, 2008

- Retraction of Draft Corrective Measures Study Report for SWMU 69 (due to changed site conditions) letter from the Navy submitted to EPA on December 3, 2008

- EPA Comments of the Draft Corrective Measures Study Report for SWMU 69 received by the Navy from EPA on January 15, 2009

- Revised Draft Corrective Measures Study Report for SWMU 69 and the Navy's Response to EPA Comments dated January 15, 2009 on the Draft CMS Report for SWMU 69 submitted by the Navy to EPA on August 11, 2011

- EPA Comments on the Revised Draft Corrective Measures Study Report for SWMU 69 and the Navy's Response to the January 15, 2009 EPA Comments on the Draft CMS Report for SWMU 69 received by the Navy from EPA on November 3, 2011

- Working Draft Navy Response to EPA Comment Letter dated November 3, 2011 on the Revised Draft Corrective Measures Study Report for SWMU 69 and the Navy's Response to the January 15, 2009 EPA Comments on the Draft CMS Report for SWMU 69 submitted by the Navy to EPA and PREQB on April 4, 2012

- Working Draft Review of the Responses to PREQB Comments on the Revised Draft Corrective Measures Study Report for SWMU 69 received by the Navy via email from PREQB (Gloria M. Toro Agrait) on April 19, 2012

- Working Draft Review of the Responses to EPA and PREQB Comments on the Revised Draft Corrective Measures Study Report for SWMU 69 received by the Navy via email from EPA (Doug Pocze) on February 26, 2013

- Response to the Review of the Response to PREQB Comments on the Working Draft Revised Draft Corrective Measures Study Report for SWMU 69 submitted by the Navy to EPA and PREQB on April 26, 2013 (this document)

Note that, with the exception of the following comments, as discussed below, the Navy's responses to EPA and PREQB comments on the Revised Draft Corrective Measures Study Report were accepted by EPA and PREQB on April 19, 2012. There are two additional PREQB comments that were inadvertently not included in the attachment to the November 3, 2011 EPA comment letter. Responses to these two additional PREQB comments are provided herein.

Dates corresponding to the above timeline are included in parenthesis after each comment or response for reference. Regulator comments are provided in *italics*, while the Navy's responses are provided in regular print.

EPA COMMENTS

GENERAL COMMENTS

EPA General Comment 1 (February 26, 2013): *Regarding SWMU 69 and the CMS and Response to Comments. I've (EPA, Doug Pocze) looked through the information and documents. Based upon the information, I find the responses acceptable. However, I did find that the revisions made to EQB's Comment #31 were partially addressed. Although the groundwater elevation contours shown north of the SWMU are now shown as inferred, the same notation should be used when drawing contour lines south of the SWMU and outside the vicinity of available monitoring wells. You may want to update or revise Figure 5-3.*

Navy Response (April 26, 2013): The groundwater elevation contours shown south of the SWMU, with the exception of the contour line drawn at 130 feet, were not shown as inferred because the contours were drawn within acceptable boundaries of data obtained from monitoring wells 69SB26 and 69SB12 (i.e., within the vicinity of available monitoring wells). This is acceptable hydrogeologic practice when estimating groundwater contours. No revisions to Figure 5-3 are proposed.

EPA General Comment 2 (February 26, 2013): *Also I think Table 6-1 actually contains subsurface soil results rather than surface soil results. The surface soil results from the 2010 investigation were presented in Table 6-6 and surface soil results from 2008 were moved to Appendix B as noted.*

Navy Response (April 26, 2013): As stated in the comment, Table 6-1 contains analytical results of subsurface soil samples collected from depths greater than 3 feet during the 2008 investigation. Subsurface soil samples collected from depths greater than 3 feet bgs during the 2008 CMS field investigation were still considered representative of site conditions and as such, were presented along with the analytical results from the 2010 Disturbed Soil Sampling investigation. Table 6-6 contains the analytical results of the surface soil samples collected during the 2010 investigation. Analytical results for surface and shallow subsurface soil collected during the 2008 CMS investigation were no longer representative of current site conditions and were moved to Appendix B. No revisions to the document are proposed.

PREQB COMMENTS

EVALUATION OF NAVY'S RESPONSES TO COMMENTS

1. **PREQB Page-Specific Comment 1: Page 2-3, Section 2.3, paragraph 2 (January 15, 2009):** *Please include the depth to groundwater and reference to a figure with the monitoring well locations for the UST investigation discussed in this paragraph.*

   Navy Response (August 11, 2011): Based on the Site Characterization of UST 794 in 1994 by Blasland, Bouck & Lee, Inc. (BB&L, 1994), the depth to water across the site was approximately 14 feet bgs. Soil boring and monitoring well locations are referenced on Figure 3-1 of that report. The second paragraph of Section 2.3 – Previous

Investigations has been revised to include the depth to groundwater and a reference to Figure 3-1 of the BB&L report showing the monitoring well locations.

PREQB Evaluation of Response (November 2, 2011): *The 1994 investigation appears to be the basis for concluding that groundwater is not impacted by the former UST. Therefore, please add sufficient detail from that investigation in this section to support this assumption. As part of the more detailed discussion, please provide the following: analysis performed on the samples; a figure that provides the locations of the UST and soil and groundwater samples; the soil depths at which TPH DRO was detected and associated TPH DRO concentrations, well screen intervals, and concentrations detected in groundwater. Please discuss whether concentrations left in soil could leach to groundwater above Puerto Rico UST levels for DRO (especially over the last 18 years). Please also discuss groundwater velocity and expected travel distance for groundwater since the USTs were removed.*

Navy Response to PREQB Evaluation of Response (March 27, 2012): Section 2.3 – Previous Investigations is intended to provide a brief historical summary of past site investigations. As indicated in Section 2.3, the site characterization report prepared by BB&L (BB&L, 1994) concluded that groundwater was not impacted by the release of fuel compounds. Since one of the objectives of the CMS investigation was to complete characterization and delineation of site contaminants, new groundwater monitoring wells were installed at the site and sampled for a broad range of constituents so that current groundwater quality could be quantitatively measured and evaluated. The results of the CMS Investigation groundwater sampling and analysis are presented in detail in the CMS Investigation Report; similarly, conclusions and recommendations in the CMS Investigation Report are based, as much as possible on current site data rather than on historical data. No additional revisions to the text are proposed.

PREQB Evaluation of Response (April 19, 2012): *It appears that no further investigation of groundwater in the vicinity of the USTs was conducted after 1994; therefore, it appears that the 1994 investigation forms the basis for concluding that no groundwater contamination is present associated with the tanks. Additional investigation of the site has been conducted since that time; therefore, the historic investigation needs to be re-evaluated in the context of the current understanding of the site to ensure that the investigation methods, sampling and conclusions are appropriate and support the recommendations of the CMS report. Therefore, please include the information requested in the original comment.*

Navy Response (April 26, 2013): The Site Characterization by BB&L indicated that TPH was not leaching to groundwater at concentrations in excess of Puerto Rico UST levels as of 15 months following the UST removal. At that time, assuming groundwater flow was equivalent to conditions presented in Section 5.2.4, groundwater is estimated to have migrated up to 18 feet in fractured clay and 511 feet in sand and gravel (15 months elapsed since UST excavation, velocity 0.04 feet/day for fractured clay and 1.12 feet/day for sand and gravel). Additionally, as part of the 2008 CMS investigation, seven groundwater monitoring wells were installed and sampled. Groundwater flow direction was determined to be from east to west, and the monitoring wells are located downgradient of the former UST. The results of the 2008 groundwater sampling did not indicate TPH contamination. Therefore, an evaluation of historic and recent data support the conclusions of the CMS Investigation Report that groundwater has not been impacted by the former UST.

The second paragraph of Section 2.3 will be revised as follows to add more historic information.

> A Site Characterization of UST 794 was performed in June and July 1994 by BB&L subsequent to the excavation of the UST in April 1993 (BB&L, 1994). Building 794 housed air compressors for use at the airfield, and the aforementioned UST was used to store diesel fuel for the air compressors. Ten soil borings were advanced as part of the site characterization for soil and groundwater collection. The former Building 794 and associated UST are shown on Figure 2-3. Soil boring and monitoring well locations are shown on Figure 3-1 of the BB&L report, as presented in Attachment 1 of this CMS Report. Subsurface soil samples were collected for field screening using an organic vapor analyzer (OVA). Select samples underwent field screening for total petroleum hydrocarbon (TPH) vapors and/or benzene, toluene, ethylbenzene, and xylenes (BTEX). Twenty samples were submitted for fixed base laboratory analysis for BTEX and TPH. BTEX concentrations did not exceed detection limits (i.e., no detections). TPH was detected above PREQB limits of 100 mg/kg TPH in one boring location (794-SB1: 460 mg/kg at 4 to 6 feet below ground surface [bgs] and 360 mg/kg at 8 to 10 feet bgs) (BB&L, 1994). Groundwater (borehole) samples were collected from each soil boring and were field analyzed for BTEX and TPH. All field screening results were below detection limits. Five soil borings were converted to monitoring wells, each with a screen interval of 10 to 20 feet bgs. At the time of the well installation, the depth to water across the site was approximately 14 feet bgs (BB&L, 1994). Groundwater was collected from each well and submitted for laboratory analysis of BTEX, methyl-tert-butyl ether (MTBE), and TPH; three samples were also analyzed for polynuclear aromatic hydrocarbons (PAHs), total naphthalenes, and lead. No groundwater concentrations of benzene, BTEX, MTBE, TPH, PAHs, total napthalenes, or lead exceeded method detection limits or PREQB target levels for UST sites. The site characterization report concluded that subsurface soil contamination was present at the site but that the groundwater was not impacted by the release of fuel compounds.

ADDITIONAL COMMENTS ON REVISED DRAFT CORRECTIVE MEASURES STUDY REPORT

1. **General Comment 1 (April 19, 2012):** *Please provide a figure that shows the area of disturbance and the soil sample locations for the 2008 and 2010 investigations. It is unclear from the report whether the soil disturbance occurred throughout the SWMU or within a portion. This information is needed to evaluate the datasets used in the risk assessments.*

   Note – Comment was deleted from PREQB comment letter by involuntary error, therefore it was not included in Navy's response to comments.

Navy Response (April 26, 2013): The third paragraph of Section 1.0 describes the excavation area. For further clarification, the following sentence will be added as the second to last sentence of that paragraph:

> The trench was offset approximately 10 feet from the edge of the concrete or asphalt pavement at the southern portion of the expanded apron.

Photo 1 attached to this Response to Comment document shows the soil disturbance along the southern edge of the concrete apron. Note that 2010 soil sample locations were placed several feet south of monitoring wells 69SB07, 69SB08, 69SB11, and 69SB12 shown in the photo (located in the background). This area of disturbance (southern edge of the expanded concrete

apron) is contained within the proposed soil sampling grid cell identified on Figures 4-1 through 4-3. Figures 4-1 through 4-3 have been revised to show the location of the electric buried line installed by PRPA in relationship to the expanded apron and sample locations.

Additionally, Section 4.1, *2010 Disturbed Soil Sampling Investigation*, will be revised to include the following information:

> The sample locations for this sampling event were located within the soil disturbance area (resulting from the excavation of the trench for the electric buried line) to the drainage ditch south of the expanded concrete apron (refer to Figures 4-1 through 4-3).

2. **General Comment 2 (April 19, 2012):** *Puerto Rico Water Quality Standards Regulation (2010) classifies all groundwater for potable use. Please clarify how this applicable, relevant and appropriate requirement (ARAR) is being address, especially with respect to the development of Corrective Action Objectives (CAOs) in Section 9.3. Please discuss whether contaminated soil was evaluated for the potential for leachate to impact groundwater and whether contamination detected in groundwater is above or below the applicable PRWQS.*

   > *Note – Comment was deleted from PREQB comment letter by involuntary error, therefore it was not included in Navy's response to comments. PREQB acknowledge that this issue is pending agreements on the Technical Memorandum on Groundwater Usability Assessment. However, it is worth noticing that this comment is relevant on this document.*

Navy Response (April 26, 2013):

Concerning 2010 Puerto Rico Water Quality Standards Regulation:

As per the technical memorandum Groundwater Usability Assessment, Naval Activity Puerto Rico, Ceiba, Puerto Rico (NAVFAC, 2012), although Section 1302.3(A) of PRWQS regulation (PREQB, 2010) classifies all groundwater in Puerto Rico as SG, which is groundwater intended for use as source drinking water supply, the "low yield of groundwater beneath NAPR and its naturally occurring high levels of TDS and salinity prevent the attainment of that use. In addition, groundwater is not currently used as a potable (or other) source and it has been recognized that there is no intention to use it as such (Navy, 2011)." Although potable use of groundwater is considered in the human health risk evaluation, the Groundwater Usability Assessment specifies that "corrective action determinations that do not include achieving potable use standards are warranted based on low yield and naturally poor water quality underlying NAPR" (NAVFAC, 2012). The following statement will be added to Section 9.3.

> As per the Technical Memorandum, Groundwater Usability Assessment (NAVFAC, 2012), the low yield of groundwater beneath NAPR and its naturally occurring high levels of total dissolved solids and salinity prevent attainment of potable use standards in accordance with the PRWQS regulation (PREQB, 2010). In addition, groundwater is not currently used as a potable (or other) source, and it has been recognized that there is no intention to use it as such (Navy, 2011). Since the HHRA did not identify any unacceptable risks for the industrial worker or construction worker receptor scenarios, and potable use of groundwater is considered an incomplete exposure pathway, human health quantitative CAOs were not developed for groundwater. However, because risk estimates exceeded target limits for future residential receptors, and the land will not allow for unrestricted use, establishment of an institutional control restricting potable use

of groundwater was developed as a qualitative human health CAO for the SWMU 69 property.

NAVFAC, 2012. Technical Memorandum. Groundwater Usability Assessment, Naval Activity Puerto Rico, Ceiba, Puerto Rico. Prepared for NAPR Project Team. April 13, 2012 .

U.S. Department of the Navy. 2011. Supplemental Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads). May 2011.

Concerning soil leachate impacts to groundwater:

Surface soil data were compared to the USEPA Soil to Groundwater Screening Levels (SSLs) to evaluate the potential for constituents detected in the surface soil to leach to groundwater. This comparison shows that, except for arsenic in one samples and cobalt in one sample, there are no inorganic exceedances of background that also exceed the SSLs, which indicates a very low potential for groundwater contamination resulting from leaching of constituents from site surface soil. Table 6-6 – Summary of Detected Laboratory Results – 2010 Surface Soil was revised to include the SSLs. Additionally, the text of Section 6.1 – Surface Soil was revised as follows:

Additionally, of the fifteen metals detected in the surface soil samples, several metals (arsenic, barium, cadmium, cobalt, copper, lead, mercury, selenium, thallium, and vanadium) were detected at concentrations exceeding the respective USEPA Soil to Groundwater Screening Values (SSLs) (USEPA, 2011) using the most conservative assumption of a dilution attenuation factor (DAF) of 1. All but copper and thallium also exceeded the NAPR airfield background screening value at one or more locations. Zinc did not exceed its SSL in any sample but did exceed background in one sample. It is noted that, while soil data are compared to SSLs for completeness, groundwater data were collected and evaluated at the SWMU (refer to Section 6.4). Furthermore, the soil and groundwater data were quantitatively evaluated in ecological and human health risk assessments (Sections 7.0 and 8.0, respectively).

USEPA, 2011. Regional Screening Levels Table, http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. November 2011.

Note that the comparison of subsurface soil data to soil-to-groundwater SSLs was addressed in the Navy Response to EPA Comment Letter Dated November 3, 2011 on the Revised Draft Corrective Measures Study Report for SWMU 69 Dated August 11, 2011 (specifically, Navy Response to PREQB Evaluation of Response [March 27, 2012]). However, the SSLs previously presented have been revised from using a DAF of 20 to a DAF of 1. Therefore, Table 6-7 – Summary of Detected Laboratory Results – 2010 Subsurface Soil was revised to include SSLs with a DAF of 1. Additionally, the text of Section 6.2 – Subsurface Soil was revised as follows:

Additionally, of the fifteen metals detected in the subsurface soil samples, several metals (arsenic, barium, cobalt, copper, mercury, thallium, and vanadium) were detected at concentrations exceeding the respective USEPA Soil to Groundwater SSLs using the most conservative assumption of a DAF of 1 (USEPA, 2011). Arsenic, barium, mercury, and vanadium also exceeded the NAPR airfield background screening value at various

locations. It is noted that, while soil data are compared to SSLs for completeness, groundwater data were collected and evaluated at the SWMU (refer to Section 6.4). Furthermore, the soil and groundwater data were quantitatively evaluated in ecological and human health risk assessments (Sections 7.0 and 8.0, respectively).

Concerning comparison of groundwater data to PRWQS:

Groundwater data were compared to PRWQS (PREQB, 2010) as requested. This comparison shows that there are no detections in groundwater that exceed PRWQS. Table 6-2 – Summary of Detected Laboratory Results – 2008 Groundwater was revised to include the PRWQS. Additionally, the text of Section 6.4 – Groundwater was revised as follows:

> Additionally, concentrations of organic and metals detected in groundwater were compared to PRWQS (PREQB, 2010). As shown in Table 6-2, there were no chemical concentrations detected in groundwater that exceeded the applicable PRWQS for class SG waters (PREQB, 2010).
>
> PREQB, 2010. Puerto Rico Water Quality Standards Regulation. Puerto Rico Environmental Quality Board. http://www.gobierno.pr/NR/rdonlyres/B1978466-1AA0-4E48-899A-48D50311D7DF/0/Water_Quality_Standards_Reg_2010.pdf.

3. **PREQB Comment 17, Page 8-11, Section 8.3.2.4, paragraph 4 (November 3, 2011):** *Please note that in order to combine all groundwater data for use in calculating exposure point concentration (EPCs), a demonstration that groundwater concentrations for all chemicals of potential concern (COPCs) are consistent throughout the plume (if identified) or aquifer is needed. Otherwise, groundwater data from only source area wells are used in calculating EPCs to ensure that risks associated with the installation of a private well in that area are evaluated. Note that for this assessment, the maximum detected concentration (MDC) was used; however, the rationale for grouping all groundwater data into one dataset needs to be addressed.*

   Navy Response to PREQB Comment 17 (March 27, 2012): Paragraph 4 of Section 8.3.2.4 was revised to include the following statement concerning the rationale for combining all groundwater data into one dataset. Note that as a contaminant plume was not identified and no extreme fluctuations in COPC concentrations were observed, all groundwater data were combined into one data set.

   PREQB Evaluation of Response (April 19, 2012): *Please define "extreme."*

Navy Response (April 26, 2013): In general, an extreme fluctuation between groundwater concentrations would be that greater than one order of magnitude. The following clarification will be added to the statement.

> Note that as a contaminant plume was not identified and no extreme fluctuations in COPC concentrations were observed (i.e., minimum and maximum detections were within one order of magnitude), all groundwater data were combined into one data set.

4. **PREQB Comment 28, Table 8-2 (November 3, 2011):** *Please provide the rationale for COPC selection in this table rather than referring to Table 8-1, which presents the rationale for a different dataset.*

Navy Response to PREQB Comment 28 (March 27, 2012): The rationale for COPC selection is provided in the eighth column of Table 8-2 (titled "Rationale for Selection or Deletion") and is specific to the medium presented in that table (i.e., total soil). No changes to Table 8-2 are proposed.

PREQB Evaluation of Response (April 19, 2012): *For numerous chemicals the referenced column states "See Surface Soil Exposure" as the rationale for COPC selection, without explanation as to why the reader is supposed to refer to surface soil exposure for total soil. Please revise this table to clarify the intent. Based on the Navy's responses to this comment on other documents, it appears that the intent is to indicate that the surface soil EPC was selected for that chemical. If this is the intent here, please add a footnote clarifying this.*

Navy Response (April 26, 2013): Footnote (4) in Table 8-1 and 8-2 will be clarified as follows:

Exposure concentrations were calculated for both surface soil (0-1 ft bgs) and total soil (0-10 ft bgs). The greater of the two exposure concentrations for each COPC was used in the risk calculation to produce a conservative risk estimate.

Table 8-1 only: "See Total Soil Exposure" indicates that the greatest exposure concentration is in total soil. The basis of that concentration (i.e. maximum or UCL concentration) is indicated in Table 8-2.

Table 8-2 only: "See Surface Soil Exposure" indicates that the greatest exposure concentration is in surface soil. The basis of that concentration (i.e. maximum or UCL concentration) is indicated in Table 8-1.

Photo 1. Soil disturbance along the southern edge of the concrete apron looking west. Groundwater monitoring wells 69SB07, 69SB08, 69SB11, and 69SB12 in background.
Photo Taken: September 22, 2008

NAVY RESPONSE TO EPA COMMENT LETTER DATED NOVEMBER 3, 2011
ON THE
REVISED DRAFT CORRECTIVE MEASURES STUDY REPORT FOR SWMU 69
DATED AUGUST 11, 2011

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- Draft Corrective Measures Study Report for SWMU 69 submitted by the Navy to EPA on September 15, 2008

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- EPA Comments on the Revised Draft Corrective Measures Study Report for SWMU 69 and the Navy's Response to the January 15, 2009 EPA Comments on the Draft CMS Report for SWMU 69 received by the Navy from EPA on November 3, 2011

- Working Draft Navy Response to EPA Comment Letter dated November 3, 2011 on the Revised Draft Corrective Measures Study Report for SWMU 69 and the Navy's Response to the January 15, 2009 EPA Comments on the Draft CMS Report for SWMU 69 (this document)

The original comment number is retained to provide ready reference to EPA's January 15, 2009 comment letter. Also for reference, dates corresponding to the above timeline are included in parenthesis after each comment or response. Regulator comments are provided in *italics*, while the Navy's responses are provided in regular print.

EPA COMMENTS

GENERAL COMMENTS

EPA General Comment 2 (Janu ary 15, 2009): *Throughout the Draft CMS Report, the groundwater monitoring wells installed at locations 69SB25, 69SB26 and 69SB27 are referred to as temporary monitoring wells. These wells were installed and developed similarly to the permanent monitoring wells with the exception of steel bollards installed around the concrete pads for additional protection. Therefore, it is not clear why these wells are described as "temporary." Because monitoring wells 69SB25, 69SB26 and 69SB27 were installed and developed similarly to permanent wells, and apparently remain in place, please remove "temporary" from the description of these wells or indicate why they are considered to be "temporary".*

Navy Response (August 11, 2011): As indicated by this comment, "temporary" refers to the lack of steel bollards around the monitoring well. The reference to "temporary" will be removed from the description of monitoring wells 62SB25, 62SB26, and 62SB27.

Evaluation of Response to EPA General Comment 2 (November 3, 20 11): *The response addresses the comment. However, Table 4-1, Summary of Sampling and Analytical Program – Environmental Samples, indicates that 69SB25, 69SB26, and 69SB27 are temporary wells. Revise the CMS Report to remove this description.*

Navy Response to Evaluation of Response to EPA General Comment 2 (March 27, 2012): Reference to "temporary well" for 69SB25, 69SB26, and 69SB27 was removed from Table 4-1 as requested.

EPA General Comment 3 (January 15, 2009): *Risk and hazard to future residential populations were not evaluated in the human health risk assessment (HHRA). While this is consistent with the Final Corrective Measures Study Work Plan SWMU 69 dated December 6, 2007 (Work Plan), please note that if future land use changes, no evaluation of risk and hazard to residential populations will be available for use in making informed risk management decisions. Because this property is being transferred out of federal control, a residential exposure scenario or the application of land use controls to preclude residential exposures should be considered. Please revise the HHRA to address this issue.*

Navy Response (August 11, 2011): Future residential land use will conservatively be assumed for SWMU 69, although it is not included in the RCRA §7003 Administrative Order on Consent (USEPA, 2007) as a likely scenario given expected future land use. The site is part of a regional airfield and is not conducive in its current setting to residential use. However, this scenario is included to evaluate unrestricted land use and to provide the most conservatively protective risk estimation. Section 8.0 text and associated tables, figures, and appendices will be revised accordingly.

Evaluation of the Response to EPA General Comment 3 (November 3, 201 1): *The response is partially adequate. The Human Health Risk Assessment (HHRA) now quantifies exposure to future hypothetical adult and child residents. However, the HHRA states in Section 8.3.2.5, Exposure Parameters (p. 8-14), "An IR [ingestion rate] of 0.005 L/hour (professional judgment, assumes one order of magnitude less than the USEPA default ingestion rate for swimming) was used for surface water along with an ET [exposure time] of 2 hours/day (USEPA, 1997a) for both the adult and young [child] assuming a wading scenario. The EF [exposure frequency] was assumed to be 52 events/year (professional judgment) for surface water and sediment exposure." These statements and others in the HHRA suggest that surface water exposures were quantitatively evaluated in the HHRA, but the HHRA risk and hazard summary tables and Response to EPA Specific Comment 16 indicate that surface water was not quantitatively evaluated. Revise the HHRA to correct this discrepancy.*

Navy Response to Evaluation of the Response to EPA General Comment 3 (March 27, 2012) : Surface water exposure was not evaluated as part of the HHRA for SWMU 69. References to surface water exposure parameters were inadvertently included in Section 8.3.2.5. The HHRA was revised to remove all references to surface water exposure.

EPA General Comment 4 (January 15, 2009): *It is unclear from the HHRA whether method detection limits (MDLs) were below applicable screening criteria. Revise the HHRA to include further discussion of data quality relevant to the HHRA and clarify whether MDLs were below applicable screening criteria for all constituents. If MDLs were above screening criteria for any constituent, discuss the implication of these exceedances on the representativeness of the data set discussed in Section 8.3.2.4, Data Analysis.*

Navy Response (August 11, 2011): The Navy is aware that some of the reporting limits exceed the human health screening levels. A discussion of these exceedances and associated uncertainties will be included in the uncertainties section of the human health risk assessment (specifically, Section 8.3.6.2).

Evaluation of the Response to EPA General Comment 4 (November 3, 201 1): *The response is adequate. However, it should be noted that future CMS reports should also clarify those compounds that have sample quantitation limits (SQLs) (rather than method detection limits [MDLs]) that exceed risk-based screening criteria. Any compound not detected in any media with corresponding SQLs above risk-based screening criteria should be qualitatively evaluated in the HHRA based on factors such as current/historic site operations, potential as a breakdown product of a known site constituent of potential concern (COPC), or otherwise characterize its likelihood to be present at the site.*

Navy Response to Evaluation of the Response to EPA General Comment 4 (March 27, 2012) : Evaluation of the response is acknowledged.

EPA General Comment 6 (January 15, 2009): *Tables 4.1 through 4.3 in Appendix K provide exposure factors and equations used in the HHRA to quantify chronic daily intake (CDI) values. While most of the exposure factors have been appropriately obtained from applicable guidance documents, several exposure factors were selected based on professional judgment or were obtained from guidance documents without sufficient justification. Please revise Section 8.3.2.5, Exposure Input Parameters, to provide the complete decision rationale for the use of all exposure factors and model inputs. Examples include, but are not limited to:*

- *An exposure frequency (EF) of 52 days/year was used for adult and adolescent trespasser exposures to surface soil. Please revise the HHRA to further justify the use of this EF.*

Navy Response (August 11, 2011): The HHRA will be revised to provide justification for the EF.

- *50 mg/day was used for the ingestion rate of soil (IR-S) for future industrial/commercial workers exposed to surface and subsurface soil. However, the Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites dated December 2002 (SSL Guidance), indicates that a soil ingestion rate of 100 mg/day should be used for industrial workers. Revise the HHRA to use a soil ingestion rate of 100 mg/day for future industrial/commercial workers in CDI calculations associated with soil exposure.*

Navy Response (August 11, 2011): The IR-S for the future industrial/commercial worker will be revised to 100 mg/day as per the December 2002 SSL Guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

- *An EF of 180 days/year was used for future construction workers. Revise the HHRA to further justify the use of this EF.*

Navy Response (August 11, 2011): The EF for the future construction worker will be revised to 250 mg/day as per the USEPA 2004 RAGS Part E guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

- *For evaluating exposures from fugitive dust, a particle emission factor (PEF) of 1.32E+09 was used. However, the use of this PEF has not been justified in the HHRA. Revise the HHRA to discuss the appropriateness of using a PEF of 1.32E+09 to calculate CDIs for various receptors.*

Navy Response (August 11, 2011): The HHRA will be revised to use USEPA's current default PEF of 1.36E+09 m^3/kg for residential and generic industrial settings and to calculate a PEF specific for use in evaluating construction worker exposures as per the December 2002 SSL Guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

- *0.02 L/day was used for the ingestion rate of groundwater (IR-W) for future construction workers. This value was selected based on professional judgment. Revise the HHRA to further justify the use of this IR-W for future construction workers.*

Navy Response (August 11, 2011): The IR-W of 0.02 L/day used for evaluation of future construction worker exposure to groundwater was taken from the Virginia Department of Environmental Quality (VDEQ) Voluntary Remediation Program Risk Assessment Guidance. This value was agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB. The HHRA will be revised to provide the VDEQ reference for this IR-W.

- *An EF and exposure duration (ED) of 18 and 1, respectively, were used for calculating groundwater exposures associated with future construction workers. These values were selected based on professional judgment; however, the use of these values is not fully supported in the HHRA. Revise the HHRA to provide the rationale for the use of these EF and ED values.*

Navy Response (August 11, 2011): The HHRA will be revised to include an EF of 50 days/year for calculating groundwater exposures associated with future construction workers. This value is based on professional judgment and assumes 20 percent of time spent in a trench. The ED of 1 year is also based on professional judgment and conservatively assumes a construction period of 1 year. These values were agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB. The HHRA will be revised to provide the rationale and references to support these exposure parameters.

Evaluation of the Response to EPA General Comment 6 (November 3, 201 1): *The response is partially adequate. The response indicates that the HHRA would be revised to use a particulate emission factor (PEF) of 1.36+09 m^3/kg; however, Table 8-4, Summary of Exposure Parameters, indicates that a PEF of 1.39E+09 m^3/kg was used. Revise the HHRA to resolve this discrepancy.*

Navy Response to Evaluation of the Response to EPA General Comment 6 (March 27, 2012): The HHRA was revised to use a PEF of 1.36E+09 m^3/kg. All tables and appendices were revised accordingly.

SPECIFIC COMMENTS

EPA Specific Comment 1: ***Figure 2-3, Site Layout and ECP Sample Location Map, and Figure 2-4, 1961 Aerial Photograph (January 15, 2009):*** *Figures 2-3 and 2-4 depict a number of color coded polygon features from 1961, 1964, 1977, 1985 and 1995. It is not clear what these polygon features signify. Revise the Draft CMS Report to include an explanation of the polygon features shown on Figures 2-3 and 2-4.*

Navy Response (August 11, 2 011): During the Aerial Photography Analysis, as presented in the Environmental Condition of the Property Report (LANTDIV, 2004) the Navy conducted an analysis of aerial photography, covering the period of 1936 through 1999 from multiple sources (as discussed in the Phase I ECP report). In addition to records review, the Navy used the aerial photographs to identify anomalies (e.g., large spills/stains, ground scars, debris piles, pits, possible disposal areas, etc.) that were not identified in previous investigations. The polygons represent areas of disturbance from the year in which the aerial photograph showed anomalies. Section 2.2 (SWMU 69 Description and History) will be edited to provide a brief summary of how the polygons on Figures 2-3 and 2-4 were derived.

LANTDIV, 2004. Phase I Environmental Condition of Property Report, U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Prepared for Commander, Navy Region Southeast (CNRSE), U.S. Navy, by Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. March 31, 2004.

Evaluation of Response to EPA Specific Comment 1 (November 3, 201 1): *The response is partially adequate. The response indicates that brief descriptions of how the polygons on Figure 2-3 and 2-4 were derived would be included in Section 2.2, SWMU 69 Description and History. However, this section does not discuss how each of the polygons was determined, and instead includes a brief statement that identifies polygons as relating to areas of disturbances. Revise the CMS Report to describe the disturbances that the polygons represent for each year in greater detail.*

Navy Response to Evaluation of Response to EPA Specific Comment 1 (March 27, 2012): The second paragraph in Section 2.2 was revised, as follows, to describe the disturbances that the polygon features represent for each year:

> The polygon features shown on Figures 2-3 and 2-4 represent areas of disturbance from the year in which the aerial photograph showed anomalies and were derived as follows:
>
> - 1961 Polygon Feature – Three horizontal, above ground storage tanks (ASTs) were identified just off the aircraft parking area (see Figure 2-4); staining was identified on the concrete apron
> - 1964 Polygon Feature – Three ASTs remained just off the aircraft parking area; staining was identified on the apron and extended off its southern edge; standing liquid was also visible off the southern edge of the apron
> - 1977 Polygon Feature – Staining was identified on the apron and extended off its southern edge
> - 1985 Polygon Feature – Staining was identified on the apron
> - 1995 Polygon Feature – Staining was identified on the apron
>
> The three ASTs identified on the aerial photographs were removed sometime between January 1964 and March 1965. No other information pertaining to the ASTs was readily available.

EPA Specific Comment 6: ***Table 6-2, Summary of Detected Results – Subsurface Soil, Page 2 of 3(January 15, 2009):*** *In Table 6-2, sample 69SB27-05 shows an acetone detection of 520 R micrograms per liter (µg/kg). In Table 6-4, Summary of Detected Results – QA/QC, sample 69TB02 shows a detection of 2-butanone at 5 R µg/L and toluene at 0.31 R µg/L. The Notes/Qualifiers sections of these tables do not provide a definition for R. The qualifier "R" typically means the analytical result was rejected. If that is the case, the results should be removed from Table 6-2 and Table 6-4. If this is not the case, include a definition for R in Table 6-2 and Table 6-4.*

Navy Response (August 11, 2011): The "R" qualifier indicates that the result is rejected. Tables 6-2 and 6-4 will be revised to include definitions of the qualifiers.

Evaluation of Response to EPA Specific Comment 6 (November 3, 20 11): *The response partially addresses the comment. The "R" qualifier is defined in the footnotes to indicate that the result has been rejected and the presence or absence of the analyte cannot be verified. However, to ensure that rejected*

concentrations are not used, the associated numeric values should be removed from the tables. Revise these tables to remove the numeric values associated with the rejected results.

Navy Response to Evaluation of Response to EPA Specific Comment 6 (March 27, 2012): The data tables will not be revised to eliminate the numeric values associated with rejected results. It is acknowledged that these results are rejected and not usable, which is clearly indicated in the notes/qualifiers of the data tables. However, the reported concentrations of the rejected results can provide insight into potential contaminant concentrations exceeding screening values at those locations. The rejected results were not used in any way to characterize the extent of contamination at this site nor were they used in the human health or ecological risk calculations.

EPA Specific Comment 12: ***Section 7.4.1.2, Groundwater Screening Values, Page 7-18 (January 15, 2009):*** *Chronic-based screening values were extrapolated from acute no-observed-effect-concentrations (NOECs), no-observed-effect-levels (NOELs), low-observed-effect concentrations (LOECs), low-observed-effect-levels (LOELs), concentrations at which 50% of the population would experience lethality (LC_{50}), and concentrations at which 50% of the population would experience an exposure (EC_{50}). The uncertainty factors noted in the Work Plan differ from those used in the SLERA. For example, an uncertainty factor of 30 was used in the SLERA to convert an acute NOEC or NOEL to a chronic-based screening value, versus an uncertainty factor of 10 as outlined in the Work Plan. While an uncertainty factor of 30 is more protective, please provide the rationale for this deviation from the Work Plan in the revised CMS Report.*

Navy Response (August 11, 2011): The uncertainty factors used in the draft CMS report, including the uncertainty factor used to convert an acute NOEC or NOEL value to a chronic-based screening value, are based on uncertainty factors presented within Wentsel et al. (1996). With the exception of the uncertainty factors used for converting acute-based LC_{50} and EC_{50} values and chronic-based LOEL, and LOEC values to chronic-based NOEC or NOEL values (100 for LC_{50} and EC_{50} values and 10 for LOEL and LOEC values) and 10 [USEPA, 1997]), uncertainty factors were arbitrarily selected (an uncertainty factor of 10 was applied to acute NOEC/NOEL and LOEC/LOEL values). Because Wentsel et al. (1996) provide uncertainty factors for converting a variety of acute toxicity values, including safety factors for converting acute NOEL/NOEC and LOEL/LOEC values to a chronic-based screening value (chronic NOEC/NOEL), these uncertainty factors were used in place of arbitrarily selected values within the draft CMS report.

References cited in the Navy response to EPA Specific Comment No. 12:

USEPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final). Office of Solid Waste and Emergency Response. EPA/540/R-97-006.

Wentsel, R.S, T.W. Pa Point, M. Simini, R.T. Checkai, and D. Ludwig. 1996. Tri-Service Procedural Guidelines for Ecological Risk Assessments. Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD. ADA297968.

Evaluation of the Response to EPA Specific Co mment 12 (November 3, 2011): *The response is somewhat unclear. The response seems to indicate that the arbitrary uncertainty factors were used in the CMS Work Plan, but then replaced in the Screening Level Ecological Risk Assessments (SLERA) by uncertainty factors from Wentsel et al. (1996). The response is acceptable if this interpretation is correct. The response should be further clarified if this interpretation is incorrect.*

Navy Response to Evaluation of the Response to EPA Specific Comment 12 (March 27, 2012): The EPA's interpretation of the Navy response is correct. The arbitrarily selected uncertainty factors identified in the CMS Work Plan were replaced by the literature-based uncertainty factors identified and used in the ERA.

EPA Specific Comment 16: ***Section 8.3.2.1, Potential Human Receptors, Page 8-9 (January 15, 2009):*** *It is unclear from the HHRA why surface water exposures to human receptors were not evaluated. A drainage ditch is located adjacent to SWMU 69 and it appears that site receptors, particularly trespassers, may encounter the ditch. Revise the HHRA to clarify why surface water exposures to human receptors were not evaluated.*

Navy Response (August 11, 2011): Surface water was not present in the drainage ditch during either the 2004 Phase II ECP investigation or the 2008 CMS investigation. As such, surface water samples were not collected and that exposure pathway was not evaluated. Surface water was subsequently observed in the drainage ditch during the 2010 Disturbed Soil Sampling Investigation but was not sampled. Rather, sediment samples were collected (in the southern and eastern drainage ditches) as part of the 2010 Disturbed Soil Sampling Investigation to evaluate the potential for surface soil migration into the SWMU 69 drainage ditches resulting from soil disturbance by contractors in 2008 (which occurred after the 2008 CMS field investigation) and surface runoff from the adjacent expanded apron during precipitation events. Therefore, sediment exposure will be evaluated for the trespasser and on-site worker receptor scenarios as part of the 2010 Disturbed Soil Sampling Investigation HHRA.

Evaluation of the Response to EPA Specific Co mment 16 (November 3, 2011): *The response is not adequate. Clarify why the lack of surface water data is not a HHRA data gap. Surface water was observed in the drainage ditch during the 2010 Disturbed Soil Sampling Investigation, but was not sampled. Both surface water and sediment samples are helpful in gaining an understanding of contaminant fate and transport associated with surface runoff from the adjacent expanded apron during precipitation events. Revise the uncertainty analyses for both the 2008 and 2010 HHRAs to describe the uncertainties associated with omission of surface water characterization.*

Navy Response to Evaluation of the Response to EPA Specific Comment 16 (March 27, 2012): The 2008 HHRA will not be revised as surface water was not present during that investigation and as such, was not thought to represent a complete pathway. Section 8.4.6 will be revised to add the following subsection (note that existing subsections will be renumbered accordingly):

> 8.4.6.2 Exposure Assessment
>
> Surface water was not present in the drainage ditch during either the 2004 Phase II ECP investigation or the 2008 CMS investigation. As such, surface water samples were not collected and that exposure pathway was not evaluated. Surface water was subsequently observed in the drainage ditch during the 2010 Disturbed Soil Sampling Investigation but was not sampled. Surface water in the drainage ditch is a transient condition at this site and is only present during heavy precipitation events. Additionally, since the ditch drains a larger area than SWMU 69, surface water in the ditch resulting from a precipitation event is likely comingled from numerous sources. Consequently, as per the approved Final Corrective Measures Study Work Plan for SWMU 69 (Baker, 2007) and the Final Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area (Baker, 2010), the ditch was to be characterized by collection of soil/sediment samples. Sediment samples were collected (in the southern and eastern drainage ditches) as part of the 2010 Disturbed Soil Sampling Investigation to evaluate the potential for surface soil migration into the SWMU 69 drainage ditches resulting from soil disturbance by

contractors in 2008 (which occurred after the 2008 CMS field investigation) and surface runoff from the adjacent expanded apron during precipitation events. Subsequently, sediment exposure was evaluated for the trespasser, on-site worker, and residential receptor scenarios as part of the 2010 Disturbed Soil Sampling Investigation HHRA. It is not expected that this approach will underestimate risks.

ADDITIONAL GENERAL COMMENT

EPA Additional General Comment 1 (November 3, 2011): *The Data Validation Reports (DVRs) included in Appendix C indicate that data were rejected; however, the data reported in Table 6-6, Summary of Detected Laboratory Results – 2010 Surface Soil, and in Appendix B, Laboratory Analytical Results, do not identify all of the rejected data. For example, the DVR for sample delivery group (SDG) 68060189-1 indicates that all vanadium results were rejected due to high matrix spike/matrix spike duplicate (MS/MSD) percent recoveries (%Rs). This SDG includes samples 69SB101-00 through 69SB106-02. However, Table 6-6 (i.e., page 1 of 7) and Appendix B (i.e., page 1 of 6) do not indicate that the vanadium results are rejected. Revise Table 6-6 and Appendix B to indicate that the data have been rejected. Additionally, remove the numeric values associated with the rejected data from Table 6-6.*

Navy Response to EPA Additional General Comment 1 (March 27, 2012): Table 6-6 and Appendix B are correct as they stand. It is acknowledged that vanadium was rejected in SDG 68060189-1. However, the laboratory was requested to re-analyzed these samples for vanadium. The re-analysis was reported under SDG 68060189-10, and vanadium was not rejected (see Section 6.5.11). Consequently, the later data is reported on Table 6-6 and in Appendix B. This also applies to the re-analysis of zinc under SDG 68060189-11 (see Section 6.5.14), lead under SDG 68060189-12 (see Section 6.5.16), and barium under SDG 68060189-13 (see Section 6.5.18). No changes to the report are warranted.

PREQB COMMENTS ON NAVY'S RESPONSES TO COMMENTS

1. **PREQB General Comment 7 (January 15, 2009):** *Surface water samples should be collected from the same ditch segments during a rainfall event and analyzed to evaluate potential transport and offsite migration of surface soil chemicals of potential concern (COPCs) in surface water runoff from source areas. Due to the ephemeral nature of surface water runoff events any related ecological exposures would be brief. Please clarify why marine chronic ambient water quality criteria AWQC and other groundwater screening values were used rather then fresh water AWQC for surface water.*

   Navy Response (August 11, 2011): The Navy offers the following points of clarification relative to this comment. Based on groundwater flow direction, the Los Machos mangrove forest represents the most likely discharge point for SWMU 69 groundwater. As the Los Machos mangrove forest represents an estuarine environment, saltwater-based screening values were preferentially used to screen the groundwater analytical data.

   PREQB Evaluation of Response (November 3, 2011): *The response only partially addresses the comment. Please provide the justification why surface water samples were not collected within the drainage ditch during the four to five months when surface water was apparently present within the ditch.*

   Navy Response to PREQB Evaluation of Response (March 27, 2012): Please refer to the Navy's response to EPA Specific Comment 16.

2. **PREQB Page-Specific Comment 1: Page 2-3, Section 2.3, paragraph 2 (January 15, 2009):** *Please include the depth to groundwater and reference to a figure with the monitoring well locations for the UST investigation discussed in this paragraph.*

   Navy Response (August 11, 2011): Based on the Site Characterization of UST 794 in 1994 by Blasland, Bouck & Lee, Inc. (BB&L, 1994), the depth to water across the site was approximately 14 feet bgs. Soil boring and monitoring well locations are referenced on Figure 3-1 of that report. The second paragraph of Section 2.3 – Previous Investigations has been revised to include the depth to groundwater and a reference to Figure 3-1 of the BB&L report showing the monitoring well locations.

   PREQB Evaluation of Response (November 3, 2011): *The 1994 investigation appears to be the basis for concluding that groundwater is not impacted by the former UST. Therefore, please add sufficient detail from that investigation in this section to support this assumption. As part of the more detailed discussion, please provide the following: analysis performed on the samples; a figure that provides the locations of the UST and soil and groundwater samples; the soil depths at which TPH DRO was detected and associated TPH DRO concentrations, well screen intervals, and concentrations detected in groundwater. Please discuss whether concentrations left in soil could leach to groundwater above Puerto Rico UST levels for DRO (especially over the last 18 years). Please also discuss groundwater velocity and expected travel distance for groundwater since the USTs were removed.*

   Navy Response to PREQB Evaluation of Response (March 27, 2012): Section 2.3 – Previous Investigations is intended to provide a brief historical summary of past site investigations. As indicated in Section 2.3, the site characterization report prepared by BB&L (BB&L, 1994) concluded that groundwater was not impacted by the release of fuel compounds. Since one of the objectives of the CMS investigation was to complete characterization and delineation of site contaminants, new groundwater monitoring wells were installed at the site and sampled for a broad range of constituents so that current groundwater quality could be quantitatively measured and evaluated. The results of the CMS Investigation groundwater sampling and analysis are presented in detail in the CMS Investigation Report; similarly, conclusions and recommendations in the CMS Investigation Report are based, as much as possible on current site data rather than on historical data. No additional revisions to the text are proposed.

3. **PREQB Page-Specific Comment 15: Page 6-2, Section 6.1, Paragraphs 1 and 3 (January 15, 2009):** *The text states that the detected analytical results for the surface soil samples are provided in Table 6-1. However, Table 6-1 only provides the detected analytical results for metals and not VOCs and SVOCs. Please update Table 6-1 to include all detected analytical results in surface soils.*

   Navy Response (August 11, 2011): In Table 6-1, Summary of Detected Results – Surface Soil, the first four pages include VOC and SVOC detected analytical results.

   PREQB Evaluation of Response (November 3, 2011): *Please verify the response. Table 6-1 presents metals results for subsurface soil samples collected in 2008. Table 6-2 presents only VOC results for those same subsurface soil samples.*

   Navy Response to PREQB Evaluation of Response: (March 27, 2012): After further review, it was noted that the header and page numbers for Table 6-1 were incorrect in the Revised Draft CMS Report for SWMU 69. Table 6-1 was revised such that page 1 of 2 presents the results of the inorganic analyses and page 2 of 2 presents the organic results for the 2008 subsurface soil samples.

4. **PREQB Page-Specific Comment 74: Page 11-2, Section 11.1, last paragraph (January 15, 2011):** *Confirmatory sampling should be intended to verify effectiveness of the corrective measures implementation. Sampling the bottom of the excavation area is recommended. It should be included at the Site-Specific Field Sampling and Analysis Plan that will be prepared and submitted for review.*

Navy Response (August 11, 2011): As discussed in Section 10.1- Description of Remedy and Section 11.1 – Conceptual Design, bottom of excavation confirmatory sampling is proposed at the two foot below ground surface for Areas 1, 3 and 5. However, since the excavation depth for all areas is limited to a maximum depth of three feet below ground surface because of a lack of a complete exposure pathway for ecological receptors below this depth, confirmation samples from the three foot bottom of excavation depth are not required.

PREQB Evaluation of Response (November 3, 2011): *Please address whether contamination will remain at 3 feet that could leach to groundwater at levels above Puerto Rico Water Quality Standards. Please clarify what methods were used to evaluate the potential for leaching (i.e., comparison to SSLs?).*

Navy Response to PREQB Evaluation of Response (March 27, 2012): Subsurface soil data was compared to the USEPA Soil to Groundwater Screening Levels (SSLs) to evaluate the potential for constituents detected in the subsurface soil to leach to groundwater. This comparison shows that, except for arsenic in one sample, there are no inorganic exceedances of background that also exceed the SSLs indicating a very low potential for groundwater contamination resulting from leaching of constituents from site subsurface soil. Table 6-7 – Summary of Detected Laboratory Results – 2010 Subsurface Soil was revised to include the SSLs. Additionally, the text of Section 6.2 – Subsurface Soil was revised as follows:

> Additionally, of the fifteen metals detected in the subsurface soil samples, two metals (arsenic and cobalt) were detected at concentrations exceeding the respective USEPA Soil to Groundwater Screening Values (SSLs). Arsenic exceeded the SSL in one of 114 subsurface soil samples (including duplicates) and also exceeded the NAPR airfield background screening value. Cobalt exceeded the SSL in 40 of 114 subsurface soil samples (including duplicates). However, none of these detections exceeded the NAPR airfield background screening value. The overall minimal number of exceedances of the SSLs in the subsurface soil data set, and the lack of exceedances of both background and the SSLs indicates a very low potential for groundwater contamination resulting from leaching of constituents from site subsurface soil.

PREQB COMMENTS ON REVISED DRAFT CORRECTIVE MEASURES STUDY REPORT FOR SWMU 69

PREQB Comment 1: Page 2-3, Section 2.2 or Section 2.3 (November 3, 2011): *Please clarify (and include in the text) the dates of use for the UST and when it was removed.*

Navy Response to PREQB Comment 1 (March 27, 2012): The following text was added to the fourth paragraph of Section 2.2:

> The UST had a capacity of 550 gallons and was used to store diesel fuel for air compressors located in Building 794. The UST was removed in 1993. No other information regarding the dates of use for the UST was readily available.

PREQB Comment 2: Page 2-4, Section 2.3, paragraph 2 (November 3, 2011): *This paragraph states "No groundwater samples were obtained at this site during the ECP investigation, but based on the reduction in concentrations from the surface soil to the subsurface soil collected during the investigation, it was tentatively concluded that groundwater had not been impacted." Please clarify what follow up actions were taken to determine if groundwater has been impacted.*

Navy Response to PREQB Comment 2 (March 27, 2012): Potential impacts to groundwater were investigated as part of the CMS investigation described throughout this report. No changes to the subject text are warranted.

PREQB Comment 3: Page 4-3, Section 4.1, Surface and Subsurface Soil Sampling, 2008 CMS Investigation (November 3, 2011): Please include sample location 69SB27 in the first paragraph when discussing samples collected.

Navy Response to PREQB Comment 3 (March 27, 2012): The following sentence was added to the first paragraph of Section 4.1 to identify 69SB27 as a surface soil sample location:

> A surface soil sample was also collected from soil boring/monitoring well location 69SB27, south of the drainage ditch and approximately 200 feet south of the edge of the expanded concrete apron area.

PREQB Comment 4: Page 4-2, Section 4.0, 2010 Disturbed Soil Sampling Investigation: *Please clarify in the text the disposition of the soil stockpiles, and if unknown, what attempts were made to determine where the soil was taken. As this soil is from a SWMU and potentially contaminated, its disposition needs to be determined.*

Navy Response to PREQB Comment 4 (March 27, 2012): There are no "stockpiles" of soil at SWMU 69, and based on available information, no soil has been removed from the site. The soil piles referenced in this section are remnants of the trenching/backfilling operation and a lack of final grading and not "stockpiles" of soil for disposal. The location of these soil piles was obvious immediately after the soil disturbance activity because vegetation in portions of the site had been stripped during the earthwork; however, revegetation of the site has since obscured these minor features. The following sentence was added to the end of the first paragraph of Section 4.0 – CMS Investigation Activities, 2010 Disturbed Soil Sampling Investigation:

> Note that the scraped soil piles are minor features that are remnants of the trenching/backfilling operation and a lack of final grading and not "stockpiles" of soil for disposal.

PREQB Comment 5: Page 4-4, Section 4.1, paragraph 1: *Please clarify why no samples were collected from 3 feet to 9 feet bgs. Were PID readings used to select these depths or were these depth intervals preselected as part of the work plan? Please clarify in the text. It is unclear whether a data gap exists from 3 to 9 feet for site characterization and human health risk assessment based on the information presented.*

Navy Response to PREQB Comment 5 (March 27, 2012): Samples were collected from pre-established intervals of 1 to 3 feet bgs and 10 feet bgs (i.e., the 9 to 11 foot bgs interval) as per the approved Work Plans (Baker, 2007 and 2010). Alternate sample intervals were not selected because PID measurements and visual/olfactory screening did not indicate contamination in the borings. The exception was for location 69SB27 where subsurface soil samples were collected from intervals with elevated PID measurements (which, coincidentally corresponded to the 1 to 3 and 9 to 11 foot depths intervals). The above information was incorporated into the last paragraph of Section 4.1 – Surface and Subsurface Soil Sampling, 2008 CMS Investigation.

PREQB Comment 6: Page 4-8, Section 4.7, Paragraph 3: *Please indicate if the sediment sample locations were ultimately surveyed using standard methods, as it was noted that the surveyors were on-site in August 2010 and the sediment sampling was completed on November 5, 2010.*

Navy Response to PREQB Comment 6 (March 27, 2012): The sediment samples were not surveyed using conventional methods. However, the samples were field-located by Baker using the GPS unit. Additional text was added to the subject paragraph for clarification.

PREQB Comment 7: Page 4-9, Section 4.8.1, Field Duplicates, 2010 Disturbed Soil Sampling Investigation: *Please remove sample 69SB141-01D from the list of subsurface field duplicates.*

Navy Response to PREQB Comment 7 (March 27, 2012): Sample 69SB141-01D was removed from the list of field duplicates as indicated.

PREQB Comment 8: **Page 5-2, Section 5.2.2:** *Please provide the depth(s) to groundwater in this section – was it also found at depths ranging from 6 to 12 feet bgs?*

Navy Response to PREQB Comment 8 (March 27, 2012): The fourth sentence in Section 5.2.2 was revised as follows:

> The water table was found near the fill/native soil interface at most wells and ranged from approximately 6 to 10 feet bgs (8 feet bgs on average).

PREQB Comment 9: Page 5-4, Section 5.2.4: *Please correct the groundwater velocity (minor typo): "0.0.04 feet/day for the fractured clay…"*

Navy Response to PREQB Comment 9 (March 27, 2012): The groundwater velocity was revised from "0.0.04" to "0.04" feet/day as indicated.

PREQB Comment 10: Page 6-1, Section 6.0:

a. *Please clarify if any surface soil or sediment sample data from the 2008 investigation are from sample locations outside the disturbed area that were not resampled in 2010.*

Navy Response to PREQB Comment 10a (March 27, 2012): Surface soil samples 69SB01, 69SB02, and 69SB03 (2008 investigation) were located within the disturbed area adjacent to the eastern end of the expanded apron. However, these three locations were not re-sampled in 2010 since contamination was not present and they were outside of the area proposed for excavation in the CMS prior to disturbance of the site. In addition, surface soil sample 69SB27-00 was located south of the expanded concrete apron area on the other side of the drainage ditch. This location was outside the disturbed area and was not re-sampled in 2010. Additional text was added to Section 4.1 – Surface and Subsurface Soil Sampling, 2010 Disturbed Soil Sampling Investigation of the report to clarify this point.

b. *Please revise the second paragraph to indicate that the 2008 subsurface soil data are also presented in this section. The analytical data that characterizes the current conditions for all environmental media at the site need to be presented in this section.*

Navy Response to PREQB Comment 10b (March 27, 2012): The subject text was revised to indicate that the 2008 subsurface soil data (greater than 3 feet bgs) are also presented in this section.

PREQB Comment 11: Page 6-2, Section 6.1, Surface Soils, 2010 Disturbed Soil Sampling:

a. *Please revise the text to state that nine metals (not seven) were detected in excess of background screening values.*

Navy Response to PREQB Comment 11a (March 27, 2012): The subject sentence was revised to indicate that nine metals were detected in excess of background screening values.

b. *Please revise the text to state that the lower range of the detected arsenic concentrations is 2.4 mg/kg at 69SB134-00.*

Navy Response to PREQB Comment 11b (March 27, 2012) : The subject sentence was revised to indicate that the lower range of the detected arsenic concentrations is 2.4 mg/kg at 69SB134-00.

c. *Please revise the text to state that mercury was detected above background at 0.12 mg/kg in sample 69SB128-00 (not 69SB131-00D) to 0.18 mg/kg (not 71 mg/kg) in samples 69SB125-00 and 69SB130-00.*

Navy Response to PREQB Comment 11c (March 27, 2012): The subject sentence was revised to indicate that the concentrations of mercury detected above background ranged from 0.12 mg/kg in sample 69SB128-00 to 0.18 mg/kg in samples 69SB125-00 and 69SB130-00.

d. *Please add the detection of barium above the background screening value in sample 69SB126-00 to the text.*

Navy Response to PREQB Comment 11d (March 27, 2012): The following sentence was added to the subject paragraph:

> Barium (470 J mg/kg) only exceeded the background screening value (231 mg/kg) in sample 69SB126-00.

PREQB Comment 12: Page 6-4, Section 6.2, Subsurface Soil, 2010 Disturbed Soil Sampling:

a. *Please revise the background screening value for mercury in the text to 0.10 mg/kg, as per Table 6-7.*
b. *Please revise the text to state that mercury exceeded the background screening value in 12 (not seven) samples.*
c. *Please revise the text to state that the lower range of the detected mercury concentrations is 0.11 mg/kg at 69SB106-02, 69SB121-01, 69SB121-02, 69SB136-02, and 69SB141-*01.

Navy Response to PREQB Comment 12 (March 27, 2012): The subject text was revised as follows:

> The Airfield background screening value for mercury (0.10 mg/kg) was slightly exceeded in 12 samples. The concentrations of mercury detected above background ranged from 0.11 mg/kg (samples 69SB106-01, 69SB121-01, 69SB121-02, 69SB136-02, and 69SB141-01) to 0.18 mg/kg in sample 69SB110-01.

PREQB Comment 13: Page 6-5, Section 6.4, Groundwater:

a. *Paragraph 1: Include well 69GW25 in the list of groundwater samples.*
b. *Paragraph 3: Correct the spelling of acenaphthene.*

Navy Response to PREQB Comment 13 (March 27, 2012): The subject section was revised to include well 69GW25 in the list of groundwater samples. In addition, the spelling of acenaphthene was corrected.

PREQB Comment 14: Page 6-6, Section 6.5, Laboratory Data Validation Summary: *Validation summaries were provided for SDG SWMU 68060189-10 (Section 6.5.11), SDG SWMU 68060189-11 (Section 6.5.14), SDG SWMU 68060189-12 (Section 6.5.16), and SDG SWMU 68060189-13 (Section 6.5.18). However, these data validation reports were not provided in Appendix C. Please submit.*

Navy Response to PREQB Comment 14 (March 27, 2012): Appendix C was revised to include the data validation report summaries for the subject SDGs.

PREQB Comment 15: Page 8-1, Section 8.0, General Comments:

a. *Please note that comments made on the Revised Original HHRA also apply to the Disturbed Soil Sampling Investigation HHRA.*

Navy Response to PREQB Comment 15a (March 27, 2012): The HHRA was revised as noted in the comment with exception of the risk calculations. Revisions made to the risk calculations based on responses to the comments in this document were applied only to the 2010 Disturbed Soil Sampling Investigation HHRA. As stated in the third paragraph of Section 8.1, one of the goals of revising the original HHRA was to support the decision to limit the analysis of 2010 data to inorganics (based on the lack of organic COCs identified from the 2008 data). As discussed in Section 8.3.7, there were no risks from organic COCs exceeding target risks levels upon incorporation of updates to screening and toxicity values, exposure assessment methodologies, and exposure parameters used in the original HHRA. Therefore, since the goal of the Revised Original HHRA was met, it is the Navy's position that further revisions to risk calculations from this portion of Section 8.0 would provide no added value to the overall outcome of the HHRA.

b. *The purpose of presenting an update to a 2008 HHRA which no longer represents current conditions in the body of the CMS is unclear, especially since the conclusions of this earlier HHRA are not pertinent to the conclusions of the CMS. The Revised Original HHRA can be presented in an appendix with an introductory paragraph clarifying why this HHRA is appended to this CMS report. The current baseline HHRA (currently called the 2010 Disturbed Soil Sampling Investigation HHRA) then will be the only HHRA presented in the body of the CMS Report, which supports the conclusions of the CMS.*

Navy Response to PREQB Comment 15b (March 27, 2012): The Navy respectfully disagrees with this comment. The purpose of presenting the update to the original HHRA (2008 data) is stated in the third paragraph of Section 8.1. Furthermore, the conclusions of the Revised Original HHRA are pertinent to the conclusions of the CMS because the decision to limit the analysis of 2010 data to inorganics only was substantiated. Additionally, due to the complexity of the revisions involved in removing the Revised Original HHRA portion from Section 8.0 and presenting it in an appendix, it is the Navy's position that this would not be an effective use of resources and would provide little to no value added to the overall outcome of the HHRA. Therefore, no changes to the HHRA based on this comment are proposed.

PREQB Comment 16: Page 8-1, Section 8.1, paragraph 3: *Please revise the third sentence as subsurface soil and groundwater data are also evaluated in the 2010 HHRA to represent overall site risks for current site conditions.*

Navy Response to PREQB Comment 16 (March 27, 2012): Paragraph 3 of Section 8.1 was revised as follows:

> In Section 8.4 (2010 Disturbed Soil Sampling Investigation HHRA), surface soil, subsurface soil, and sediment data collected as part of the Disturbed Soil Sampling Investigation are evaluated.

Additionally, 2008 groundwater data are included in the 2010 Disturbed Soil Sampling Investigation HHRA to present a total site risk.

PREQB Comment 17: Page 8-11, Section 8.3.2.4, paragraph 4: *Please note that in order to combine all groundwater data for use in calculating exposure point concentration (EPCs), a demonstration that groundwater concentrations for all chemicals of potential concern (COPCs) are consistent throughout the plume (if identified) or aquifer is needed. Otherwise, groundwater data from only source area wells are used in calculating EPCs to ensure that risks associated with the installation of a private well in that area are evaluated. Note that for this assessment, the maximum detected concentration (MDC) was used; however, the rationale for grouping all groundwater data into one dataset needs to be addressed.*

Navy Response to PREQB Comment 17 (March 27, 2012): Paragraph 4 of Section 8.3.2.4 was revised to include the following statement concerning the rationale for combining all groundwater data into one dataset.

> Note that as a contaminant plume was not identified and no extreme fluctuations in COPC concentrations were observed, all groundwater data were combined into one data set.

PREQB Comment 18: Page 8-12, Section 8.3.2.5: *Please provide the rationale for assuming 25% of total body skin surface area exposure for the youth. A preferred approach is to evaluate what portions of the trespasser's body would be exposed (e.g., feet, lower legs, arms, etc.) and sum the skin surface areas for those body parts.*

Navy Response to PREQB Comment 18 (March 27, 2012): USEPA's 1997 *Exposure Factors Handbook* (EFH) provides total body surface areas in square meters for male and female children by age groups (Tables 6-6 and 6-7 of the EFH). The 1997 EFH states that for clothing scenarios roughly 10% to 25% of the skin area may be exposed to soil. Therefore, to maintain a conservative approach, the upper end of this range was selected to calculate skin surface area for the youth trespasser.

PREQB Comment 19: Page 8-12, Section 8.3.2.5: *The vapor intrusion screening criteria presented in EPA's 2002 Vapor Intrusion Guidance are outdated due to updates in toxicity criteria. In order to incorporate these updates into the VI screening value development methodology, the current Regional Screening Level (RSL) for either residential or industrial air (adjusted as appropriate for noncarcinogenic chemicals) is multiplied by the groundwater to indoor air attenuation factor presented in Table 2s in the VI guidance of 0.001. Please update the screening in the revised report.*

Navy Response to PREQB Comment 19 (March 27, 2012): Section 8.3.2.1 (page 8-9, third paragraph) was revised as follows:

> As shown in Table 8-3, three VOCs (2-hexanone, acetone, and chloromethane) were detected in groundwater at concentrations below corresponding tapwater RSLs, indicating that potential exposure to vapors volatilizing directly from water into a shower or trench is not of concern. The VOCs were also compared against vapor intrusion screening levels following methodology presented in USEPA's Draft Subsurface Vapor Intrusion Guidance (USEPA, 2002b) to evaluate the potential for exposure to volatiles in groundwater emitted through soil into buildings. Updated vapor intrusion screening values were calculated for each VOC using the residential air RSL (adjusted as appropriate for noncarcinogens), dimensionless Henry's Law Constant presented in the RSL chemical specific parameter table, and the groundwater to indoor air attenuation factor of 0.001 presented in Table 2s in the 2002 vapor intrusion guidance. As shown below, all VOCs were detected at concentrations below their respective vapor intrusion screening levels. Therefore, it is not necessary to quantitatively evaluate the inhalation of VOCs in groundwater (either directly or indirectly) in this HHRA.

VOC	Maximum Concentration (µg/L)	Vapor Intrusion Screening Level (µg/L)
Acetone	15 J	2,200,000
Chloromethane	1.5 J	26
2-Hexanone	1.1 J	814

PREQB Comment 20: Page 8-14, S ection 8.3.2.5: *Please clarify the difference between the on-site worker and the commercial/industrial worker as it appears they have the same exposure scenario in this HHRA. If the commercial/industrial worker exposure scenario evaluates a typical indoor worker, then this future receptor needs to include ingestion of groundwater at 1 L/day (please also note that for an indoor worker receptor, a soil ingestion rate of 50 mg/day is acceptable, consistent with EPA Supplemental SSL guidance).*

Navy Response to PREQB Comment 20 (M arch 27, 2 012): The commercial/industrial worker exposure scenario is intended to evaluate a typical indoor worker, while the on-site worker is assumed to be involved with landscaping/maintenance activities on the property grounds and not exposed to groundwater. Ingestion of 1 liter of groundwater per work day was added to the quantitative evaluation for the future industrial/commercial worker in the 2010 Disturbed Soil Sampling Investigation HHRA only. All corresponding text and tables in the 2010 Disturbed Soil Sampling Investigation HHRA were revised accordingly. Since there were no organic compounds retained as COPCs in the Revised Original HHRA and a comparison of the 2008 groundwater data with the November 2011 RSLs shows that the VOCs are well below corresponding RSLs, it is the Navy's position that further revisions to risk calculations from the Revised Original HHRA portion of Section 8.0 would provide no added value to the overall outcome of the HHRA.

The soil ingestion rate of 100 mg/day will not be revised as there are no risks presented to either receptor from exposure to soil using this ingestion rate and therefore, changing it provides no added value. Additionally, it is noted that the soil ingestion rate of 100 mg/day was agreed upon in the January 9, 2009 conference call with the Navy, EPA, and PREQB.

PREQB Comment 21: Page 8-27, Section 8.3.7: *Please revise the first sentence of the first paragraph on this page for clarity. The cumulative cancer risk for each environmental medium was within the acceptable cancer risk range; whereas the overall site cumulative cancer risk exceeded the range.*

Navy Response to PREQB Comment 21 (March 27, 2012): The sentence was revised as follows:

> The cumulative carcinogenic risk for each medium for the adult and child residential receptors calculated were within USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. However, the total lifetime carcinogenic risk (sum of the cumulative carcinogenic risks for the adult and child receptors) for the future residential receptor exceeded the range.

PREQB Comment 22: Page 8-28, Section 8.4.1.1:

a. Paragraph 2: *Please clarify the following statement, "As previously discussed, an HHRA based upon the data collected from this investigation will be included as a continuation of the present HHRA." Please clarify which HHRA is the present HHRA. If this phrase refers to the 2008 HHRA, it is unclear that the 2010 HHRA is a continuation of that HHRA; rather, it is a stand-alone HHRA that represents baseline conditions subsequent to soil disturbance.*

Navy Response to PREQB Comment 22a (March 27, 2012): The present HHRA is the 2010 HHRA.

The sentence referenced in the comment was deleted and replaced with the following sentence:

> The 2010 Disturbed Soil Sampling Investigation HHRA is based upon the data collected from this investigation and represents baseline conditions subsequent to soil disturbance.

b. Paragraph 4: *Please clarify whether the entire SWMU was disturbed or whether areas remained undisturbed that were characterized during the 2008 investigation. If undisturbed areas remained, please include the data from these areas in this risk assessment.*

Navy Response to PREQB Comment 22b (March 27, 2012): As described in Section 1.0 of the report, soil that had previously been characterized as part of the 2008 CMS field investigation was disturbed by a PRPA contractor, which resulted in a significant alteration of the physical conditions at the SWMU as well as a potential redistribution of the COCs identified within the 2008 Draft CMS Report (Baker, 2008). No surface soil (0 to 1 foot bgs) or shallow subsurface soil (1 to 3 feet bgs) data were retained from the 2008 investigation because of the disturbed site conditions. Additionally, it is important to note that the sampling grid established for the 2010 CMS Disturbed Soil Sampling Investigation covers a larger geographic area than was covered in the 2008 CMS Investigation. It is acknowledged that there are four locations (69SB01, 69SB02, 69SB03, and 69SB27) that were not re-sampled in 2010 and included in the 2010 Disturbed Soil Sampling Investigation HHRA. Although, surface soil samples 69SB01, 69SB02, and 69SB03 (2008 investigation) were located within the disturbed area adjacent to the eastern end of the expanded concrete apron, these three locations were not re-sampled since they were outside of the area proposed for excavation in the CMS prior to disturbance of the site. Boring 69SB27 was located outside of the disturbed area south of the expanded concrete apron area on the other side of the drainage ditch. One surface soil sample and two subsurface soil samples (1-3 feet bgs and 9-11 feet bgs) were collected from this location. Analytical results from 69SB01, 69SB02, 69SB03, and 69SB27 indicate that contamination is not present. Although low levels of PAHs and metals were detected in one or more of these soil samples, the concentrations are not such that they would alter the magnitude of the exposure point concentrations used in the HHRA. Therefore, the re-inclusion of these data would have no effect on the overall outcome of the HHRA. Additional text was added to Section 8.4.1.1 to clarify this point.

PREQB Comment 23: Page 8-29, Section 8.4.1.2.2: *The current RSL table, dated June 2011, includes screening criteria for thallium. Please update the HHRAs accordingly*.

Navy Response to PREQB Comment 23 (March 27, 2012): It is noted that the latest EPA RSLs were published in November 2011, and the 2010 Disturbed Soil Sampling Investigation HHRA was updated to reflect this. COPC selection, as well as site-specific and background-specific risks, were re-evaluated and corresponding text and tables of the 2010 Disturbed Soil Sampling Investigation HHRA were revised as applicable.

PREQB Comment 24: Page 11-2 and 11-3, Bulleted Items: *Please add a bullet requiring the surveying of the achieved lateral and vertical limits of excavation prior to initiation of backfilling. This will serve to confirm the required excavation limits have been achieved. This survey would also be needed to support development of as-built drawings as mentioned in Section 11.2.2 of the CMS Report.*

Navy Response to PREQB Comment 24 (March 27, 2012): Text was added to each of the subject bulleted lists to indicate that the achieved lateral and vertical limits of excavation will be surveyed prior to initiation of backfilling.

PREQB Comment 25: Page 11-3 , Bulleted Items: *Please clarify the fifth from the last bullet which states, "Replace excavated sediments to achieve a ditch slope to promote positive drainage." As excavated sediments are to be disposed of offsite, there should be no replacement of these materials back into the drainage ditch.*

Navy Response to PREQB Co mment 25 (March 27, 20 12): The subject bullet was deleted from the list of bulleted items. In addition, the subsequent bullet was revised as follows:

> Backfill excavated areas with clean, low-permeability soil graded to promote positive drainage; place aggregate rip rap along disturbed portions of the ditch banks to provide future erosion resistance

PREQB Comment 26: Table 4-1: *Please correct the depth of sample 69SB114-01 to 1.0-2.0 feet bgs.*

Navy Response to PREQB Comment 26 (March 27, 2012): The depth of sample 69SB114-01 was revised to 1.0-2.0 feet bgs.

PREQB Comment 27: *Table 7-23: This table identifies cobalt as an ecological COPC that has a maximum concentration above the upper limit of the mean background concentration. However, the maximum detected concentration for cobalt is presented as 27 mg/kg while the background concentration used for the comparison is 44.13 mg/kg. Please clarify.*

Navy Response to PREQB Comment 27 (March 2 7, 2012): The last column in Table 7-23 was revised to indicate that the maximum detected cobalt concentration in SWMU 69 subsurface soil is less than the upper limit of the mean (ULM) background concentration. It is noted that the text in Section 7.9.1.2 of the Draft CMS report (see Page 7-47) correctly indicates that the maximum cobalt concentration in SWMU 69 surface soil is less than the ULM background concentration.

PREQB Comment 28: Table 8-2: *Please provide the rationale for COPC selection in this table rather than referring to Table 8-1, which presents the rationale for a different dataset.*

Navy Response to PREQB Co mment 28 (March 27, 20 12): The rationale for COPC selection is provided in the eighth column of Table 8-2 (titled "Rationale for Selection or Deletion") and is specific to the medium presented in that table (i.e., total soil). No changes to Table 8-2 are proposed.

PREQB Comment 29: Table 8-4: *Please provide a reference to where the PEF calculations are presented in the report in footnote 10.*

Navy Response to PREQB Co mment 29 (March 27, 2 012): Footnote 10 in Table 8-4 was revised as follows:

> PEF calculated based on emissions from truck traffic on unpaved roads (refer to Appendix J).

PREQB Comment 30: Table 8-5 *Please update this table and the spreadsheets in Appendix J to reflect the toxicity criteria presented in the June 2011 version of the RSL table.*

Navy Response to PREQB Comment 30 (M arch 27, 2012): Please refer to the Navy's response to PREQB Comment 23.

PREQB Comment 31: Figure 5-3: *Please amend the ground water elevation contour map to better reflect that which is inferred. The well network configuration at SWMU 69 is such that there is only a fairly narrow area in which ground water contours can be presented as "estimated" (solid line), beyond which the lines should be dashed.*

Navy Response to PREQB Co mment 31 (March 27, 201 2): Figure 5-3 was revised to better reflect those contours which are inferred.

PREQB Comment 32: Appendix A: *The boring/monitoring well log for 69SB27 indicates elevated PID readings associated with several of the soil core intervals. The descriptions associated with select intervals reference odors being present. Please clarify (to the extent possible based on field notes and recollections) what type(s) of odors were detected….petroleum, solvent, etc.*

Navy Response to PREQB Comment 32 (March 27, 201 2): The environmental geologist did not speculate or recollect what type(s) of odors were detected in boring 69SB27. No revisions to the subject boring/monitoring well log are proposed.

PREQB Comment 33: Appendix J: *Please update all spreadsheets to reflect the changes made to exposure factors and methodologies reflecting in the text of the report. For example (not an inclusive list):*

a. Please verify the ingestion rate for the commercial/industrial worker in this table as Section 8.3.2.5 indicates that the ingestion rate for the commercial/industrial worker is 100 mg/day.
b. Please update the inhalation calculations to reflect the current approach, consistent with RAGS Part F.
c. Please update the ingestion rate for the construction worker to 330 mg/day.
d. Please update the exposure frequency for the construction worker to 250 days/year.

Navy Response to PREQB Comment 33 (March 27, 2012): The risk calculation spreadsheets from the Draft CMS Report (Baker, 2008) for SWMU 69 were inadvertently included in this version of the report (Revised Draft CMS Report). Appendix J was revised to present the correct spreadsheets, which contain the exposure factors and methodologies reflected in the text of the report.

NAVY RESPONSE TO EPA COMMENTS DATED JANUARY 15, 2009 ON THE DRAFT CORRECTIVE MEASURES STUDY REPORT FOR SWMU 69 DATED SEPTEMBER 12, 2008

The following comments were generated based on review of the *Draft Corrective Measures Study Report SWMU 69* (Draft CMS Report), Naval Activity Puerto Rico (NAPR) Ceiba, Puerto Rico originally submitted to EPA on September 12, 2008. This Draft CMS Report was retracted by Baker in a December 3, 2008 letter to EPA because of soil disturbance and changed site conditions caused by the Puerto Rico Ports Authority. Comments on the Draft CMS Report for SWMU 69 were issued by EPA on January 15, 2009, after the original Draft Report retraction. Since retraction of the report and issuance of EPA and PREQB comments, some additional study and evaluation has been conducted for this SWMU. The new data and evaluations, as well as the applicable responses to these comments will be incorporated into the Revised Draft CMS Report for SWMU 69. Regulator comments are provided in Italics while the Navy's responses are provided in plain text.

EPA COMMENTS

GENERAL COMMENTS

EPA General Comment 1: *The second paragraph of Section 2.2, SWMU 69 Description and History, indicates that the "expanded concrete apron area" was originally a "photo identified" (PI) site due to "the observation of extensive stains on and just off the apron from 1977-1985. Three aboveground storage tanks (ASTs) were also observed in this area ..." The Draft CMS Report goes on to state "most of the area identified as PI Site 21 is now covered by the expanded concrete apron, including the area where the ASTs were located. The expanded concrete apron area is acting as a cap over the potentially contaminated soil areas ..." It is critical to note that there has been no sampling conducted under the pad, and the last sentence of Section 10.1, Description of the Remedy, indicates "There are no long term restrictions, controls or monitoring associated with [the U.S. Navy's proposed] alternative." Therefore, future owners/operators of the site could remove the concrete pad and be exposed to, as well as be required to manage, contaminated soils. To address this critical issue, additional contaminant characterization should be conducted under the expanded concrete apron, or long term restrictions and controls (e.g., land use controls) should be placed on the area to ensure future users will not be adversely impacted by potentially contaminated soils. Revise the Draft CMS Report to address the potentially contaminated media under the expanded concrete apron.*

Navy Response: Additional contaminant characterization under the expanded concrete apron is not being considered at this time. The Jose Aponte De La Torre (JAT) Airport (former NAPR Ofstie Airfield) is now operating as an active regional airport; therefore, it is unlikely that such an undertaking to remove the concrete pad and expose potentially contaminated soil would be initiated by the Puerto Rico Ports Authority. However, given that the pad covers an area where staining was identified; land use controls will be placed on SWMU 69 to ensure future users will not be adversely impacted by potentially contaminated soils.

EPA General Comment 2: *Throughout the Draft CMS Report, the groundwater monitoring wells installed at locations 69SB25, 69SB26 and 69SB27 are referred to as temporary monitoring wells. These wells were installed and developed similarly to the permanent monitoring wells with the exception of steel bollards installed around the concrete pads for additional protection. Therefore, it is not clear why these wells are described as "temporary." Because monitoring wells 69SB25, 69SB26 and 69SB27 were installed and developed similarly to permanent wells, and apparently remain in place, please remove*

"temporary" from the description of these wells or indicate why they are considered to be "temporary".
Navy Response: As indicated by this comment, "temporary" refers to the lack of steel bollards around the monitoring well. The reference to "temporary" will be removed from the description of monitoring wells 62SB25, 62SB26, and 62SB27.

EPA General Comment 3: *Risk and hazard to future residential populations were not evaluated in the human health risk assessment (HHRA). While this is consistent with the Final Corrective Measures Study Work Plan SWMU 69 dated December 6, 2007 (Work Plan), please note that if future land use changes, no evaluation of risk and hazard to residential populations will be available for use in making informed risk management decisions. Because this property is being transferred out of federal control, a residential exposure scenario or the application of land use controls to preclude residential exposures should be considered. Please revise the HHRA to address this issue.*

Navy Response: Future residential land use will conservatively be assumed for SWMU 69, although it is not included in the RCRA §7003 Administrative Order on Consent (USEPA, 2007) as a likely scenario given expected future land use. The site is part of a regional airfield and is not conducive in its current setting to residential use. However, this scenario is included to evaluate unrestricted land use and to provide the most conservatively protective risk estimation. Section 8.0 text and associated tables, figures, and appendices will be revised accordingly.

EPA General Comment 4: *It is unclear from the HHRA whether method detection limits (MDLs) were below applicable screening criteria. Revise the HHRA to include further discussion of data quality relevant to the HHRA and clarify whether MDLs were below applicable screening criteria for all constituents. If MDLs were above screening criteria for any constituent, discuss the implication of these exceedances on the representativeness of the data set discussed in Section 8.3.2.4, Data Analysis.*

Navy Response: The Navy is aware that some of the reporting limits exceed the human health screening levels. A discussion of these exceedances and associated uncertainties will be included in the uncertainties section of the human health risk assessment (specifically, Section 8.3.6.2).

EPA General Comment 5: *The HHRA does not provide or discuss the cumulative risk and hazard values determined in the quantitative assessment. While these values are presented in Appendix K, they should be presented and discussed in the main text of the Draft CMS Report as part of the HHRA discussion and conclusions regarding the corrective action objectives (CAOs). Cumulative risk and hazard results should be used in Section 8, Human Health Risk Assessment and Development of CAOs, and Section 9, Summary of COCs and CAOs, to justify CAO conclusions. Revise the Draft CMS Report to address these issues.*

Navy Response: Sections 8.0 and 9.0 of the Draft CMS Report will be revised as requested in the comment.

EPA General Comment 6: *Tables 4.1 through 4.3 in Appendix K provide exposure factors and equations used in the HHRA to quantify chronic daily intake (CDI) values. While most of the exposure factors have been appropriately obtained from applicable guidance documents, several exposure factors were selected based on professional judgment or were obtained from guidance documents without sufficient justification. Please revise Section 8.3.2.5, Exposure Input Parameters, to provide the complete decision rationale for the use of all exposure factors and model inputs. Examples include, but are not limited to:*

- *An exposure frequency (EF) of 52 days/year was used for adult and adolescent trespasser exposures to surface soil. Please revise the HHRA to further justify the use of this EF.*

Navy Response: The HHRA will be revised to provide justification for the EF.

- *50 mg/day was used for the ingestion rate of soil (IR-S) for future industrial/commercial workers exposed to surface and subsurface soil. However, the Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites dated December 2002 (SSL Guidance), indicates that a soil ingestion rate of 100 mg/day should be used for industrial workers. Revise the HHRA to use a soil ingestion rate of 100 mg/day for future industrial/commercial workers in CDI calculations associated with soil exposure.*

Navy Response: The IR-S for the future industrial/commercial worker will be revised to 100 mg/day as per the December 2002 SSL Guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

- *An EF of 180 days/year was used for future construction workers. Revise the HHRA to further justify the use of this EF.*

Navy Response: The EF for the future construction worker will be revised to 250 mg/day as per the USEPA 2004 RAGS Part E guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

- *For evaluating exposures from fugitive dust, a particle emission factor (PEF) of 1.32E+09 was used. However, the use of this PEF has not been justified in the HHRA. Revise the HHRA to discuss the appropriateness of using a PEF of 1.32E+09 to calculate CDIs for various receptors.*

Navy Response: The HHRA will be revised to use USEPA's current default PEF of 1.36E+09 m^3/kg for residential and generic industrial settings and to calculate a PEF specific for use in evaluating construction worker exposures as per the December 2002 SSL Guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

- *0.02 L/day was used for the ingestion rate of groundwater (IR-W) for future construction workers. This value was selected based on professional judgment. Revise the HHRA to further justify the use of this IR-W for future construction workers.*

Navy Response: The IR-W of 0.02 L/day used for evaluation of future construction worker exposure to groundwater was taken from the Virginia Department of Environmental Quality (VDEQ) Voluntary Remediation Program Risk Assessment Guidance. This value was agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB. The HHRA will be revised to provide the VDEQ reference for this IR-W.

- *An EF and exposure duration (ED) of 18 and 1, respectively, were used for calculating groundwater exposures associated with future construction workers. These values were selected based on professional judgment; however, the use of these values is not fully supported in the HHRA. Revise the HHRA to provide the rationale for the use of these EF and ED values.*

Navy Response: The HHRA will be revised to include an EF of 50 days/year for calculating groundwater exposures associated with future construction workers. This value is based on professional judgment and assumes 20 percent of time spent in a trench. The ED of 1 year is also based on professional judgment and conservatively assumes a construction period of 1 year. These values were

agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB. The HHRA will be revised to provide the rationale and references to support these exposure parameters.

SPECIFIC COMMENTS

EPA Specific Comment 1: ***Figure 2-3, Site Layout and ECP Sample Location Map, and Figure 2-4, 1961 Aerial Photograph:*** *Figures 2-3 and 2-4 depict a number of color coded polygon features from 1961, 1964, 1977, 1985 and 1995. It is not clear what these polygon features signify. Revise the Draft CMS Report to include an explanation of the polygon features shown on Figures 2-3 and 2-4.*

Navy Response: During the Aerial Photography Analysis, as presented in the Environmental Condition of the Property Report (LANTDIV, 2004) the Navy conducted an analysis of aerial photography, covering the period of 1936 through 1999 from multiple sources (as discussed in the Phase I ECP report). In addition to records review, the Navy used the aerial photographs to identify anomalies (e.g., large spills/stains, ground scars, debris piles, pits, possible disposal areas, etc.) that were not identified in previous investigations. The polygons represent areas of disturbance from the year in which the aerial photograph showed anomalies. Section 2.2 (SWMU 69 Description and History) will be edited to provide a brief summary of how the polygons on Figures 2-3 and 2-4 were derived.

LANTDIV, 2004. Phase I Environmental Condition of Property Report, U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Prepared for Commander, Navy Region Southeast (CNRSE), U.S. Navy, by Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. March 31, 2004.

EPA Specific Comment 2: ***Section 4.7.1, Field Duplicates, Page 4-5:*** *The third sentence in this section states "one field duplicate subsurface soil sample 69SB05D was collected…" It is assumed this sentence is referring to sample 69SB08-05D. Revise the Draft CMS Report to correct this apparent typographical error.*

Navy Response: This sentence will be revised to correctly refer to subsurface soil duplicate sample 69SB08-05D.

EPA Specific Comment 3: ***Section 4.7.5, Equipment Rinsates, Page 4-6:*** *Section 4.7.5 lists the equipment rinsate samples as 69ER03, 69ER04, etc. However, Table 4-2, Summary of Sampling and Analytical Program – QA/QC Samples, lists these samples as ER03, ER04, etc. A consistent identification format should be presented for these samples throughout the Draft CMS Report. Revise the Draft CMS Report to address this issue.*

Navy Response: Equipment rinsate samples should be presented as ER03, ER04, and ER05. This section will be revised accordingly, and the report will be checked for consistency.

EPA Specific Comment 4: ***Section 6.1, Surface Soils, Page 6-3:*** *The second sentence in the first full paragraph on Page 6-3 states "Arsenic exceeded the NAPR basewide background screening value in 18 of 25 samples." According to Table 6-1, Summary of Detected Results – Surface Soil, 19 of 25 samples exceeded the basewide background screening value. Revise the Draft CMS Report to address this apparent discrepancy.*

Navy Response: Arsenic exceedances were recounted, and arsenic exceeded the background screening value in 18 of 25 environmental samples. Note that duplicate samples are not included in this count.

EPA Specific Comment 5: ***Table 6-1, Summary of Detected Results – Surface Soil:*** *According to Section 6.1, Surface Soils, Page 6-2, "The detected analytical results for the surface soil data set are provided in Table 6-1." However, Table 6-1 lists detected results for metals only; the detections for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) are not included in this table. Revise Table 6-1 to include all detected analytical results for the surface soils.*

Navy Response: The first four pages of Table 6-1, Summary of Detected Results – Surface Soil include VOC and SVOC detected analytical results.

EPA Specific Comment 6: ***Table 6-2, Summary of Detected Results – Subsurface Soil, Page 2 of 3:*** *In Table 6-2, sample 69SB27-05 shows an acetone detection of 520 R micrograms per liter (µg/kg). In Table 6-4, Summary of Detected Results – QA/QC, sample 69TB02 shows a detection of 2-butanone at 5 R µg/L and toluene at 0.31 R µg/L. The Notes/Qualifiers sections of these tables do not provide a definition for R. The qualifier "R" typically means the analytical result was rejected. If that is the case, the results should be removed from Table 6-2 and Table 6-4. If this is not the case, include a definition for R in Table 6-2 and Table 6-4.*

Navy Response: The "R" qualifier indicates that the result is rejected. Tables 6-2 and 6-4 will be revised to include definitions of the qualifiers.

EPA Specific Comment 7: ***Section 7.1.3, Biota, Page 7-4:*** *This section states that the specific biota occurring at and immediately contiguous to Solid Waste Management Unit (SWMU) 69 has not been documented during previous investigations. As part of the revised CMS Report, clarify whether this constitutes a data gap in the Screening-Level Ecological Risk Assessment (SLERA). If so, discuss how the data gap will be addressed.*

Navy Response: The Navy offers the following points of clarification relative to this comment. As evidenced by Table 7-1, terrestrial birds occurring or having the potential to occur at NAPR are represented by herbivores, omnivores, and carnivores. Terrestrial avian receptors selected for evaluation in the SERA included a representative from each of these feeding guilds (i.e., mourning dove, American robin, and red-tailed hawk). Furthermore, as discussed in Section 7.1.3.1 of the draft CMS report and the Navy response to EPA Specific Comment 14, all native terrestrial mammals have been extirpated from Puerto Rico (with the exception of bats). Therefore, the selection and evaluation of a ground-dwelling mammalian herbivore, omnivore, and/or carnivore is not warranted. Herbivorous bats (i.e., nectivores and frugivores) are considered potential mammalian receptors at a given SWMU if suitable foraging habitat is present. During sampling events associated with the 2010 disturbed soil sampling investigation, vegetation within the small coastal scrub community bordering the drainage ditch system adjacent to SWMU 69 was observed to include a flowering plant (i.e., white lead tree [*Leucaena leucocephala*]). Pollen and nectar from white lead tree is known to be used as a source of food by bats on Puerto Rico (Gannon et al., 2005). Therefore, a nectivorous bat will be added to the list of upper trophic level receptor species evaluated by the ecological risk assessment (ERA) presented within the Revised Draft CMS Report (see Section 7.3.2.1). The species selected to represent nectivorous bats on Puerto Rico was the brown flower bat. This species is common and found throughout Puerto Rico (Gannon et al., 2005). In addition to the brown flower bat, aquatic receptor groups (aquatic invertebrates, plants, and amphibians) will be added to the list of receptors evaluated by the ERA (see section 7.10 of the Revised Draft CMS Report). These receptor groups were added based on observations made during sampling activities associated with the 2010 disturbed soil sampling investigation (see discussion presented in Section 4.4 of the revised draft CMS document). Based on the considerations discussed above, the Navy does not believe that the lack of documentation of the specific biota occurring at and contiguous to SWMU 69 represents a data gap with unacceptable uncertainty.

References cited in the Navy response to EPA Specific Comment 6:

Gannon, M.R., A. Kurta, A. Rodriguez-Durán, and M.R. Willig. 2005. Bats of Puerto Rico: An Island Focus and a Caribbean Perspective. Texas Tech University Press, Lubbock, TX. 239 pp.

EPA Specific Comment 8: ***Section 7.1.3.2, Birds, Page 7-6:*** *According to Section 7.1.3.2, the Los Machos mangrove forest located approximately 1.1 miles southeast of SWMU 69 and the Ensenada Honda located approximately 1.4 miles southeast of SWMU 69 represent foraging habitat for the Caribbean brown pelican (Pelecanus occidentalis), a federally listed bird species. This section also suggests that no transport pathways exist between SWMU 69 and the surface water bodies of the Los Machos mangrove forest or the Ensenada Honda. However, according to Section 7.1.2, Aquatic Habitats, Page 7-4, the groundwater flow direction at SWMU 69 indicates the Los Machos mangrove forest represents the most likely discharge point for SWMU 69 groundwater. Furthermore, this section indicates that surface water run-off within the drainage ditch adjacent to SWMU 69 discharges directly to the wetland system of the Los Machos. Revise the SLERA to resolve this discrepancy. If transport pathways between SWMU 69 and either the Los Machos or Ensenada Honda systems exist, clarify how hazards to species living or foraging in these systems will be addressed. In addition, this transport pathway should be discussed further in Section 7.3.1.2, Transport Pathways.*

Navy Response: The Navy offers the following points of clarification relative to this comment. First of all, the United States Fish and Wildlife Service (USFWS) has published a Final Rule removing the brown pelican from the federal list of endangered and threatened wildlife throughout its range, including Puerto Rico (see Federal Register: Volume 74, Number 220, Page 59444 dated Tuesday November 17, 2009). This final rule indicates that special consideration of the brown pelican is not warranted. Section 7.1.3.2 will be revised to eliminate text identifying the brown pelican as a federally listed bird species. Secondly, Section 7.1.3.2 of the Draft CMS report does not include text suggesting that there are no transport pathways from SWMU 69 to the Los machos mangrove forest as suggested by EPA Specific Comment 8. The text simply stated that there are no transport pathways from SWMU 69 to the unnamed lagoon north of the Los Machos mangrove forest or the Ensenada Honda. These two surface water bodies were identified in this section since they represent the closest open water habitats to SWMU 69 representing likely foraging habitat for brown pelicans. Thirdly, it is noted that the drainage ditch adjacent to SWMU 69 does not discharge to the Los Machos mangrove forest. As stated by the last paragraph in Section 7.1.3.2 of the Draft CMS report, "*A smaller estuarine wetland system (primarily E2SS3 wetland units) is located approximately 4,000 feet southeast of SWMU 69 (see Figure 7-3). Surface water run-off within the drainage ditch adjacent to SWMU 69, as well as surface run-off from much of the airport facility ultimately discharges to this wetland system*". The estuarine wetland identified by this text is not part of the Los machos mangrove forest. As correctly noted in Section 7.3.1.2, transport pathways from SWMU 69 to downgradient surface water bodies are limited to (1) transport with groundwater to Los Machos mangrove forest, and (2) transport with drainage ditch storm water to an estuarine wetland system located southeast of SWMU 69.

To address the groundwater transport pathway from SWMU 69 to the Los machos mangrove forest, the ERA included a comparison of SWMU 69 groundwater analytical data to estuarine/marine surface water screening values (see Table 7-13 of the draft CMS document). As evidenced by the comparison, no detected chemicals were identified as ecological COPCs in Step 2 of the screening level ERA (i.e., all detected concentrations were less than groundwater screening values). Therefore, it can be concluded with high confidence that that aquatic receptor groups within the Los Machos mangrove forest (i.e., aquatic plants, invertebrates, and fish) are not being impacted by chemicals migrating with groundwater.

It is acknowledged that the groundwater screening values used in the comparison are literature-based toxicological thresholds or toxicological values based on lower trophic level aquatic receptor groups (e.g.,

plants, invertebrates and fish). As such, the comparison does not address upper trophic level receptors (i.e., avian invertivores and piscivores) that may forage within the Los Machos mangrove forest. To address this potential transport pathway, groundwater analytical data were examined. The examination of the groundwater analytical data indicates that three organic chemicals identified by the USEPA (2000) as important bioaccumulative compounds were detected in groundwater collected at SWMU 69 during the 2008 CMS field investigation (acenaphthene, fluorene, and phenanthrene). Each organic was detected in one groundwater sample (0.11J µg/L for acenaphthene, 0.083J µg/L for fluorene, and 0.28 µg/L for phenanthrene). Based on the low magnitude of these detections, it is unlikely that these three chemicals are migrating with groundwater to the Los Machos mangrove forest at concentrations that would present unacceptable risk to avian receptors. In addition to these organic chemicals, four bioaccumulative metals (arsenic, cadmium, nickel, and zinc also were detected within the total recoverable fraction of one or more of the SWMU 69 groundwater samples. However, maximum detected concentrations (0.56J µg/L for arsenic, 0.16J µg/L for cadmium, 0.9J µg/L for nickel, and 10J µg/L for zinc) are less than upper limit of the mean (ULM) concentrations for basewide background groundwater contained in the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds for NAPR (18.9 µg/L for arsenic, 2.21 µg/L for cadmium, 95.7 µg/L for nickel, and 548 µg/L for zinc; Baker, 2010). Therefore, it can be concluded that these four metals are not migrating with groundwater to the Los Machos mangrove forest at concentrations greater than what would be expected under background conditions. The text in Section 7.1.2 will be revised to include the evaluation presented above.

To address the drainage ditch transport pathway, fourteen sediment samples were collected from the drainage ditch adjacent to SWMU 69 during the 2010 disturbed soil sampling investigation. Analytical data for these samples will be evaluated in the revised ERA by examining the spatial distribution of chemical concentrations in drainage ditch sediment in Step 3a of the BERA to determine if chemicals are migrating with storm water to the estuarine wetland system southeast of SWMU 69. As noted in the last paragraph of Section 7.1.2, surface water run-off within the drainage ditch adjacent to SWMU 69, as well as surface water run-off from a significant portion of the airfield ultimately discharges to the estuarine wetland system. Drainage from areas outside of the airfield's boundary also discharges to this wetland. Based on these inputs, it is the Navy's opinion that sediment and surface water quality within the wetland cannot be linked to SWMU 69.

References cited in the Navy Response to EPA Specific Comment No. 8:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. July 30, 2010.

USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs. Bioaccumulation Analysis Workgroup, Washington, D.C.(EPA-823-R-00-001).

EPA Specific Comment 9: ***Section 7.3.1.3, Exposure Pathways and Routes, Page 7-11:*** *The second paragraph on Page 7-11 indicates that the Palustrine Emergent Persistent (PEM1) unit (located approximately 800 feet southwest of SWMU 69) is not hydrologically connected to SWMU 69 and; therefore, ingestion of surface water was not considered in risk calculations for upper trophic level receptors. However, it appears that the surface water drainage ditch adjacent to SWMU 69 may discharge to the PEM1 wetland units. Revise the SLERA to provide further justification for not evaluating hazards from surface water ingestion to upper trophic level receptors.*

Navy Response: Figure 7-3 has been revised to show the drainage ditch system associated with SWMU 69, including storm water flow directions. As evidenced by this figure, freshwater wetland units in the

vicinity of SWMU 69, including the PEM1 wetland unit located approximately 800 feet southwest of SWMU 69, are not hydrologically connected to SWMU 69 via the drainage ditch system. As the Navy believes the revisions to Figure 7-3 adequately address this comment, additional revisions to the document are not deemed necessary.

EPA Specific Comment 10: ***Section 7.3.1.3, Exposure Pathways and Routes, Page 7-11:*** *The third paragraph on Page 7-11 indicates that the dermal exposure pathway was not evaluated in the SLERA. While this appears appropriate for most species that may inhabit the site, this section indicates that burrowing reptiles may inhabit the upland vegetative units at and contiguous to SWMU 69. According to this section, burrowing reptiles would be expected to experience the most significant exposure from dermal absorption. Revise the SLERA to provide further justification for not evaluating dermal exposure to relevant species, or alternatively, revise the SLERA to evaluate dermal exposure quantitatively for burrowing reptiles or an appropriate surrogate species.*

Navy Response: The Navy offers the following points of clarification relative to this comment. Section 7.3.1.3 provides several lines of reasoning for excluding the dermal exposure pathway from evaluation in the SERA. Because these lines of reasoning are consistent with *Attachment 1-3 of Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs): Evaluation of Dermal Contact and Inhalation Exposure Pathways for the Purpose of setting Eco-SSLs* (USEPA, 2003), the Navy does not believe further justification for exclusion of the dermal exposure pathway or an evaluation of the dermal exposure pathway for burrowing reptiles or an appropriate surrogate species is necessary. However, reference to the Draft Ecological Soil Screening Level Guidance (USEPA 2000) in Section 7.3.1.3 has been replaced by the more recent USEPA document identified above. It is noted that site-specific factors were considered when excluding the dermal exposure pathway from evaluation. Specifically, consideration was given to the chemicals detected in SWMU 69 surface and subsurface soil. As stated in section 7.3.1.3, chemicals known or suspected to be of concern via dermal adsorption are not known to be associated with historical site activities (e.g., organochlorine pesticides) or were detected at a low frequency and magnitude of detection (e.g., VOCs).

References cited in the Navy response to EPA Specific Comment No. 10:

USEPA. 2000. Draft Ecological Soil Screening Level Guidance. Office of Emergency and Remedial Response, Washington, D.C. July 2000.

USEPA. 2003. Attachment 1-C of Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs): Evaluation of Dermal Contact and Inhalation Exposure Pathways for the Purpose of Setting Eco-SSLs. Office of Solid Waste and Emergency Response. OSWER Directive 92875.

EPA Specific Comment 11: ***Section 7.3.2.1, Selection of Receptors, Page 7-14:*** *Terrestrial reptiles and amphibians were not selected as receptors in the SLERA. While impacts to these receptors may be difficult to evaluate quantitatively (toxicological data are limited for these species), at a minimum, they should be evaluated qualitatively. Revise the SLERA, to provide a qualitative evaluation of impacts to terrestrial reptiles and amphibians or a quantitative evaluation based on an appropriate surrogate.*

Navy Response: The Navy offers the following points of clarification relative to this comment. As evidenced by Table 7-2, assessment and measurement endpoints were established for terrestrial reptile communities. The measurement endpoint involved a qualitative examination of exposures and risks to ecological receptors occupying similar trophic levels. However, the Navy does acknowledge that beyond the identification of assessment and measurement endpoints, the fate of terrestrial reptiles is not discussed. Therefore, text throughout Section 7.0 will be revised, as necessary, to include a discussion of terrestrial reptiles.

EPA Specific Comment 12: ***Section 7.4.1.2, Groundwater Screening Values, Page 7-18:*** *Chronic-based screening values were extrapolated from acute no-observed-effect-concentrations (NOECs), no-observed-effect-levels (NOELs), low-observed-effect concentrations (LOECs), low-observed-effect-levels (LOELs), concentrations at which 50% of the population would experience lethality (LC_{50}), and concentrations at which 50% of the population would experience an exposure (EC_{50}). The uncertainty factors noted in the Work Plan differ from those used in the SLERA. For example, an uncertainty factor of 30 was used in the SLERA to convert an acute NOEC or NOEL to a chronic-based screening value, versus an uncertainty factor of 10 as outlined in the Work Plan. While an uncertainty factor of 30 is more protective, please provide the rationale for this deviation from the Work Plan in the revised CMS Report.*

Navy Response: The uncertainty factors used in the draft CMS report, including the uncertainty factor used to convert an acute NOEC or NOEL value to a chronic-based screening value, are based on uncertainty factors presented within Wentsel et al. (1996). With the exception of the uncertainty factors used for converting acute-based LC_{50} and EC_{50} values and chronic-based LOEL, and LOEC values to chronic-based NOEC or NOEL values (100 for LC_{50} and EC_{50} values and 10 for LOEL and LOEC values) and 10 [USEPA, 1997]), uncertainty factors were arbitrarily selected (an uncertainty factor of 10 was applied to acute NOEC/NOEL and LOEC/LOEL values). Because Wentsel et al. (1996) provide uncertainty factors for converting a variety of acute toxicity values, including safety factors for converting acute NOEL/NOEC and LOEL/LOEC values to a chronic-based screening value (chronic NOEC/NOEL), these uncertainty factors were used in place of arbitrarily selected values within the draft CMS report.

References cited in the Navy response to EPA Specific Comment No. 12:

USEPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (Interim Final). Office of Solid Waste and Emergency Response. EPA/540/R-97-006.

Wentsel, R.S, T.W. Pa Point, M. Simini, R.T. Checkai, and D. Ludwig. 1996. Tri-Service Procedural Guidelines for Ecological Risk Assessments. Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD. ADA297968.

EPA Specific Comment 13: ***Section 7.6.2, Screening-Level Risk Calculation for Surface Soil, Subsurface Soil, Groundwater and Terrestrial Food Web Exposures, Page 7-26:*** *The top of Page 7-26 states "The sum of maximum LMW [low molecular weight] PAH [polynuclear aromatic hydrocarbon] concentrations (2,652 mg/kg; maximum MDL used for non-detected PAHs) is less than the LMW PAH Eco-SSL value (29,000 µg/kg)." It appears that there is a discrepancy in concentration units. A similar discrepancy was noted in the discussion of high molecular weight (HMW) PAH concentrations. Review this discussion and ensure that Section 7.6.2 presents the correct units for all concentration values.*

Navy Response: The units shown for LMW PAH and HMW PAH should be µg/kg not mg/kg. Section 7.6.2 will be revised to show the correct units.

EPA Specific Comment 14: ***Section 7.7, Uncertainties Associated with the SERA, Page 7-30 through Page 7-31:*** *A terrestrial mammal was not evaluated in the SLERA for reasons noted on Page 7-14. Among the reasons, the text notes "all native terrestrial mammals have been extirpated from Puerto Rico." Revise Section 7.3.2.1, Selection of Receptors, to cite references supporting this assertion. Further, ensure the cited references are listed in Section 7.11, References.*

Navy Response: The statement that "with the exception of bats, all native terrestrial mammals have been extirpated form Puerto Rico" was first included within Section 7.1.3.1 of the draft CMS report with a reference. For clarity, this reference has been added to the discussion in Section 7.3.2.1.

EPA Specific Comment 15: ***Section 7.9.1, Refined Risk Evaluation, Page 7-34:*** *Several metals were dropped as COPCs based on a comparison to background concentrations. According to Section 7.9, Step 3a of the BERA, Page 7-32, this approach was approved by EPA for SWMU 14. However, no information establishing the relationship between SWMU 14 and SWMU 69 is provided in the Draft CMS Report. Revise the Draft CMS Report to include a brief discussion demonstrating that conditions at SWMU 69 are similar to those at SWMU 14 and the comparison of media concentrations to background concentrations proposed for SWMU 14 is applicable to SWMU 69.*

Navy Response: The text referenced on Page 7-32 by EPA Specific Comment 15 above refers to the use of 95 percent upper confidence limit (UCL) of the mean chemical concentrations in Step 3a of the baseline ERA (BERA), not background concentrations. The EPA specified that the ERA at SWMU 14 can use 95 percent UCL of the mean chemical concentrations to refine risk estimates in Step 3a of the BERA if a chemical-specific data sets have a minimum of eight detected values and less than 70 percent non-detected results. This requirement is applied to all ERAs at NAPR. It is noted that the use of 95 percent UCL of mean chemicals concentrations in Step 3a of the BERA is consistent with Navy guidance and policy (Parker et al., 2003).

The use of background concentrations in Step 3a of the BERA is consistent with Navy guidance for conducting ecological risk assessments (available at http://web.ead.anl.gov/ecorisk/process/), as well as Navy Policy on the Use of Background Chemical Levels (available at http://web.ead.anl.gov/ecorisk/policy/pdf/Final_Navy_Background_Policy.pdf). Specifically, If ecological COPCs identified in Step 2 of the screening level ERA (SERA) were detected at or below background levels, as determined by statistical evaluations conducted during the Step 3a evaluation (descriptive and distributional statistics), they exited the ERA process. Background analytical data used in ERAs at NAPR are those specified in the EPA-approved Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds for NAPR (Baker, 2010). As such, the Navy does not believe it is necessary to demonstrate that conditions at SWMU 69 are similar to those at SWMU 14 and the comparison of media concentrations to background concentrations proposed for SWMU 14 is applicable to SWMU 69. It is noted that since submittal of the draft CMS report for SWMU 69, background airfield soil and background airfield drainage ditch sediment data sets have been established and incorporated into the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010) as Addendum B, and C, respectively. As such, the statistical evaluations presented within the Revised Draft CMS Report for SWMU 69 will be based on these airfield background data sets, not the basewide data sets used in the Draft CMS Report.

References cited in the Navy response to EPA Specific Comment No. 15:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. July 30, 2010.

Parker, N., G. McDermott, and D. Neptune. 2003. U.S. Navy Ecological Screening and COPC Refinement for Sediment, Soil, and Surface Water. 18 pp.

EPA Specific Comment 16: ***Section 8.3.2.1, Potential Human Receptors, Page 8-9:*** *It is unclear from the HHRA why surface water exposures to human receptors were not evaluated. A drainage ditch is located adjacent to SWMU 69 and it appears that site receptors, particularly trespassers, may encounter the ditch. Revise the HHRA to clarify why surface water exposures to human receptors were not evaluated.*

Navy Response: Surface water was not present in the drainage ditch during either the 2004 Phase II ECP

investigation or the 2008 CMS investigation. As such, surface water samples were not collected and that exposure pathway was not evaluated. Surface water was subsequently observed in the drainage ditch during the 2010 Disturbed Soil Sampling Investigation but was not sampled. Rather, sediment samples were collected (in the southern and eastern drainage ditches) as part of the 2010 Disturbed Soil Sampling Investigation to evaluate the potential for surface soil migration into the SWMU 69 drainage ditches resulting from soil disturbance by contractors in 2008 (which occurred after the 2008 CMS field investigation) and surface runoff from the adjacent expanded apron during precipitation events. Therefore, sediment exposure will be evaluated for the trespasser and on-site worker receptor scenarios as part of the 2010 Disturbed Soil Sampling Investigation HHRA.

EPA Specific Comment 17: ***Section 8.3.2.4, Data Analysis, Page 8-11:*** *Section 8.3.2.4 indicates that in the surface soil and subsurface soil data sets, there were instances in which the maximum concentration was used as the exposure point concentration (EPC) in risk calculations due to low frequencies of detection. Please clarify in Section 8.3.2.4 which compounds were evaluated in the quantitative risk assessment based on their maximum detected concentration, rather than a calculated EPC based on the 95% upper confidence limit (UCL) on the mean*

Navy Response: Sections 8.3.2.4 and 8.4.2.2 will be revised to include those compounds that were evaluated in the quantitative risk assessment based on their maximum detected concentration rather than a calculated EPC.

EPA Specific Comment 18: ***Table 9-1, Ecological-Based Corrective Action Objectives for Surface Soil, Page 1 of 1:*** *The surface soil samples with concentrations exceeding corrective action objectives for zinc are listed in Table 9-1 as 69SB05, 69SB09, 69SB15 and 69SB15. It is assumed the first reference to 69SB15 should actually be to surface soil sample 69SB14. Revise the Draft CMS Report to address this apparent typographical error.*

Navy Response: Table 9-1 has been revised to include the data from the 2010 Disturbed Soil Sampling Investigation. References to the 2008 CMS Investigation samples 69SB05, 69SB09, 69SB14 and 69SB15 have been removed from the table since they are no longer representative of site conditions.

EPA Specific Comment 19: ***Section 11.1.1, Required Planning Documents, Page 11-3:*** *Section 11.1.1 indicates that the Site Specific Field Sampling and Analysis Plan (FSAP) (part of a Corrective Action Project Plan) will provide laboratory information, sample handling and analysis requirements, and quality assurance/quality control (QA/QC) requirements. However, this information is also typically documented in a site-specific or project-specific quality assurance project plan (QAPP). Revise the Draft CMS Report to indicate whether a QAPP will be prepared for the proposed corrective measures. If not, explain how the QA/QC requirements for the corrective measures implementation project will be documented.*

Navy Response: In letter to EPA dated April 17, 2008, the Navy addressed the DQOs, SOPs, and QAPP requirements for EPA approval. Specifically, the EPA approved Master Project Plans, which include the Project Management Plan (PMP), Data Collection Quality Assurance Plan (DCQAP), Data Management Plan (DMP), and Health and Safety Plan (HASP) for NAPR. These Master Plans and specifically, the Final Data Collection Quality Assurance Plan (DCQAP) (Baker, September 14, 1995), define acceptable data requirements and error levels associated with the field and analytical portions of this CMI. Additionally, a table was developed which provides a map between the DCQAP sections and the sections required by "EPA Requirements for Quality Assurance Project Plans" (QZ/R-5) (EPA 2001).

PREQB COMMENTS

GENERAL COMMENTS

PREQB General Comment 1: *The CMS has not achieved its stated purpose of characterization of all potential sources of risk at SWMU 69. As noted on Page 2-2, Section 2.2 and in Figure 2-4, three (3) above ground storage tanks (ASTs) were identified in the western part of SWMU 69. Since spills and releases may have occurred underneath and around these tanks, sample results are necessary to verify the absence of impact. Additionally, the CMS report describes that the concrete apron was expanded over potentially contaminated areas. Therefore, the area underneath the apron appears to have potential impact and there are no data to verify absence of risk. Based on the very slow groundwater velocity for the clay (Section 5.2.4), contaminated groundwater may not have exited from underneath the apron and encountered screens of existing monitoring wells. The CMS should identify the area underneath the apron as a data gap and propose measures (i.e., institutional controls and groundwater monitoring) to manage potential risk.*

Navy Response: Five groundwater monitoring wells (downgradient of the former ASTs) were installed as part of the site characterization investigation for underground storage tank (UST) 794 (Blasland, Bouck & Lee, Inc. [BB&L], 1994). In that site characterization report, based on actual analytical groundwater data obtained from wells located west of Building 794 near the former UST, it was concluded that the groundwater was not impacted by the release of fuel compounds.

Blasland, Bouck & Lee, Inc. (BB&L), 1994. Site Characterization Site 794. Roosevelt Roads Naval Station, Ceiba, Puerto Rico. October 1994.

Additional contaminant characterization under the expanded concrete apron is not being considered at this time. The Jose Aponte De La Torre (JAT) Airport (former NAPR Ofstie Airfield) is now operating as an active regional airport; therefore, it is unlikely that such an undertaking to remove the concrete pad and expose potentially contaminated soil would be initiated by the Puerto Rico Ports Authority. However, given that the pad covers an area where staining was identified; land use controls will be placed on SWMU 69 to ensure future users will not be adversely impacted by potentially contaminated soils.

PREQB General Comment 2: *The datasets used in the ecological and human health risk assessments included nondetect data reported down to the method detection limit. This is not consistent with the approved CMS work plan and EPA guidance (Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A) Interim Final, December 1989) which requires the use of ½ the SQL for chemicals of potential concern (COPCs) that may be present at a site. It should be noted that reporting limits are typically 3-5 times higher than MDLs prior to adjustment for sample-specific solutions, etc. The use of the MDL, unless equivalent to the reporting limit, will therefore likely underestimate potential risks by assuming a lower surrogate concentration for non-detects than a surrogate based on a reporting limit. Please revise the risk assessments accordingly.*

Navy Response: This issue is currently waiting resolution pending the outcome of the Response to Comment Letter for the Draft Phase I RFI for SWMU 60 (Former Landfill at the Marina) dated September 25, 2009. Once this issue is resolved, the final response will be applied to this document. The Navy position is that revisions to the draft document are not necessary.

PREQB General Comment 3: *Please avoid using EPA Region 3 guidance. The appropriate hierarchy of guidance should be EPA Region 2 guidance (if available), EPA Headquarters guidance and Regional Screening Level guidance and information, which has been adopted by EPA Region 2 for screening purposes.*

Navy Response: References to EPA Region 3 guidance will be removed from the HHRA.

PREQB General Comment 4: *A significant data gap in the spatial coverage of the soil sampling program is the drainage ditch and associated forest habitat located south and east of SWMU 69. The nearest existing sample locations are from 50 to 100 feet from the ditch and it is unclear whether they were collected from a slope or a low-lying depositional area. The lack of surface and subsurface soil samples from this habitat was acknowledged and additional sampling of this area was proposed in the report. But it was not clearly stated which media and how many locations would be sampled, nor what analyses performed to fill this habitat/spatial data gap. At a minimum, surface soil should be sampled from several depositional areas within the lowest elevations of the forest and from within each of the ditch channels. Both forks of the ditch and the main channel downstream of their confluence should be sampled for the full suite of organic and inorganic analytes evaluated for prior samples.*

Navy Response: Due to disturbances (i.e., trenching activities) during the conversion of the airfield to a commercial facility by the Puerto Rico Ports Authority during the summer 2008, surface soil (0.0 to 1.0-foot depth interval) and subsurface soil (1.0 to 2.0-foot depth interval and 2.0 to 3.0-foot depth intervals) were re-sampled in accordance with the EPA and PREQB-approved Final Soil Sampling Strategy for Disturbed Soil Sampling dated June 21, 2010. Soil sampling points included locations within the coastal scrub forest community bordering the drainage ditch. As part of this investigation, sediment samples also were collected from the southern and eastern drainage ditches adjacent to the SWMU in accordance with the June 21, 2010 disturbed soil sampling strategy. The analytical data for these soil and sediment samples will be evaluated for human health and ecological risk as part of the Revised Draft CMS Report. It is the Navy's contention that the sampling activities described by the EPA and PREQB-approved June 21, 2010 sampling strategy adequately addresses PREQB General Comment 4.

PREQB General Comment 5: *The avian food chain-mediated exposure assessment and risk calculations for avian receptors should be revised by incorporating new data from the ditch habitat samples. The new soil samples should be collected from low-lying forested areas, both within and along the ditch, that represent depositional areas and potential avian foraging habitat.*

Navy Response: As discussed in the Navy's response to PREQB General Comment 4 above, surface soil (0.0 to 1.0-foot depth interval) and subsurface soil (1.0 to 2.0-foot depth interval and 2.0 to 3.0-foot depth intervals) were re-sampled in accordance with the EPA and PREQB-approved Final Soil Sampling Strategy for Disturbed Soil Sampling dated June 21, 2010. Soil sampling points included locations within the coastal scrub forest community bordering the drainage ditch. Sediment samples also were collected from the southern and eastern drainage ditches adjacent to the SWMU in accordance with the June 21, 2010 disturbed soil sampling strategy. The soil and sediment analytical data will be used in the Revised Draft CMS Report to evaluate potential risks to avian receptors.

PREQB General Comment 6: *The federally-endangered yellow shouldered blackbird was acknowledged as a local inhabitant and a potential receptor within the forested habitat located along these ditches, but was not discussed in terms of the results of the avian exposure assessment for the American robin. After revising the avian exposure assessment and risk calculations to incorporate new data for additional soil samples within/adjacent to the ditch, potential risks to the yellow shouldered blackbird should be discussed. The revised avian risk calculations for the American robin should be discussed with respect to their potential ecological implications and significance for the yellow shouldered blackbird population.*

Navy Response: It is noted that arboreal insectivores, such as the yellow-shouldered blackbird, would not be expected to experience any significant exposures to chemicals in soil. This line of reasoning is consistent with USEPA's approach to ecological soil screening level (Eco-SSL) development. As

discussed in Guidance for Developing Ecological Soil Screening Levels (USEPA, 2005a), aerial and arboreal insectivorous birds were excluded from Eco-SSL development because they are considered inappropriate (i.e., they do not have a clear or indirect exposure pathway link to soil [indirect exposure pathways involve ingestion of prey that have direct contact with soil]). This discussion will be added to the text in Section 7.1.3.2 and 7.3.2.1 of the revised Draft CMS Report.

Although yellow-shouldered blackbirds are not expected to experience any significant exposures to chemicals in soil at SWMU 69, Section 7.3.2.1 of the Draft CMS Report includes an evaluation explaining that the American robin can be protectively used as a surrogate receptor for the yellow-shouldered blackbird. As such, a conclusion of acceptable or unacceptable risk to the American robin also would apply to the yellow-shouldered blackbird. In summary, based on the low potential for arboreal insectivore exposure to chemicals in SWMU 69 soil and the fact that the text in Section 7.3.2.1 demonstrates that the American robin can be protectively used as a surrogate receptor, an evaluation of the implications and significance for yellow-shouldered blackbird populations within the revised avian risk calculations is not deemed necessary.

PREQB General Comment 7: *Surface water samples should be collected from the same ditch segments during a rainfall event and analyzed to evaluate potential transport and offsite migration of surface soil chemicals of potential concern (COPCs) in surface water runoff from source areas. Due to the ephemeral nature of surface water runoff events any related ecological exposures would be brief. Please clarify why marine chronic ambient water quality criteria AWQC and other groundwater screening values were used rather then fresh water AWQC for surface water.*

Navy Response: The Navy offers the following points of clarification relative to this comment. Based on groundwater flow direction, the Los Machos mangrove forest represents the most likely discharge point for SWMU 69 groundwater. As the Los Machos mangrove forest represents an estuarine environment, saltwater-based screening values were preferentially used to screen the groundwater analytical data.

PREQB General Comment 8: *Throughout the report, the term "ingestion-based screening values" has been misapplied to what are actually toxicity reference values (TRVs). TRVs include does-related toxicity thresholds such as No Observed Adverse Effect Levels (NOAELs) and Lowest Observed Adverse Effect Levels (LOAELs). Screening values are chemical concentrations in physical media above which an adverse biological or ecological effect may occur to a specific receptor group (e.g. AWQC or EcoSSLs). While EcoSSLs can be considered as "ingestion-based screening values" because they are based on comparisons of ingested dietary doses of a chemical to a TRV for that chemical, TRVs are not used as screening values. Please revise the report to eliminate use of the term "ingestion-based screening values" by replacing it globally with either TRV, LOAEL, or NOAEL.*

Navy Response: The term "ingestion-based screening value" will be removed from the document and replaced with a more appropriate term (e.g., toxicity reference value).

PREQB General Comment 9: *The soil-plant, soil-invertebrate and soil-small mammal bioaccumulation factors (BAFs) used to calculate food chain mediated exposure doses and risks to birds are often too low and insufficiently conservative for many chemicals. Many BAFs are based on outdated literature that has been superseded by more recent USEPA guidance for ecological risk assessment (ERA), such as Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs (USEPA OSWER Directive 9285.7-55, Revised April 2007). This document provides a wealth of empirical data on BAFs for plants, soil invertebrates and small mammals as well as regression equations developed using these data to facilitate calculating BAFs based on soil concentrations. These compiled BAFs and*

regression equations were incorporated into the food chain exposure assessment models were used by USEPA to derive the EcoSSLs for avian herbivores, omnivores and carnivores. When available, these same BAF calculation methods should be used in the ERA to calculate chemical concentrations in the food items of avian receptors.

Navy Response: The soil-to-terrestrial plant and soil-to-terrestrial invertebrate bioaccumulation BAFs listed in Table 7-7 and the soil-to-small mammal BAFs listed in Table 7-8 of the Draft CMS Report, will be revised, as necessary, to reflect the compiled BAFs and chemical-specific/general regression equations presented in Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs (USEPA, 2007).

References cites in the Navy response to PREQB General Comment No. 9:

United States Environmental Protection Agency (USEPA). 2007. Attachment 4-1 of Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-55.

PAGE-SPECIFIC COMMENTS

PREQB Page-Specific Comment 1: *Page 2-3. Section 2.3, paragraph 2. Please include the depth to groundwater and reference to a figure with the monitoring well locations for the UST investigation discussed in this paragraph.*

Navy Response: Based on the Site Characterization of UST 794 in 1994 by Blasland, Bouck & Lee, Inc. (BB&L, 1994), the depth to water across the site was approximately 14 feet bgs. Soil boring and monitoring well locations are referenced on Figure 3-1 of that report. The second paragraph of Section 2.3 – Previous Investigations has been revised to include the depth to groundwater and a reference to Figure 3-1 of the BB&L report showing the monitoring well locations.

PREQB Page-Specific Comment 2: *Page 2-3, Section 2.3, paragraph 4. The text referred for analysis of volatile organic compounds (VOCs), semivolatile organics compounds (SVOCs), and metals to Appendix IX. Clarification is needed regarding if the document is making referral to 40 CFR Appendix IX of Part 264, if this is the case, the text should be corrected accordingly.*

Navy Response: Analyses for Appendix IX VOCs, SVOCs, and metals are in accordance with 40 CFR Appendix IX, Part 264. In addition, the proposed VOC, SVOC, and metal constituents were listed in the Final CMS Work Plan for SWMU 69 (Baker, 2007) which was approved by the USEPA on April 10, 2008. The fourth paragraph in Section 2.3 – Previous Investigations has been revised to include reference to Appendix IX to 40 CFR Part 264.

PREQB Page-Specific Comment 3: *Page 2-3, Section 2.3, paragraph 5. Diesel range organics (DRO) concentrations are typically compared to the PREQB Corrective Action concentration of 100 mg/kg. Please include the range of concentrations and whether they exceed this value in this section as well as in Section 6.0.*

Navy Response: The fifth paragraph of Section 2.3 – Previous Investigations has been revised include reference to the PREQB standards for DRO in soil.

PREQB Page-Specific Comment 4: *Page 3-2, Section 3.3.1. Please include the range of depths at which each of the soil formations are found at the site.*

Navy Response: Section 3.3.1 – Soils provides a general description of the soil associations encountered across NAPR. For the Airfield area, and SWMU 69, only the Mabi soil association was encountered**.** According to the United States Department of Agriculture (USDA) Soil Conservation Service's *Web Soil Survey of Humacao Area, Puerto Rico Eastern Part,* this association is typically more than 80 inches deep. The fourth paragraph of Section 3.3.1 – soil has been revised to include this information*:*

> The Mabi-Rio-Arriba-Cayagua Association consists generally of deep, somewhat poorly drained and moderately well drained, nearly level to moderately steep soils found on foot and side slopes, terraces, and alluvial fans. Soils of this association at NAPR are basically clayey and are more than 80 inches thick.

PREQB Page-Specific Comment 5: *Page 3-5, Section 3.3.4. Please provide the thickness of the residuum layer in the text of this section for the inland flats area where the site is located.*

Navy Response: Drilling was terminated prior to encountering competent bedrock, so the full thickness of the residuum layer was not ascertained. Based on the boring log for 69SB25, the residuum extends from approximately 10 feet below ground surface to greater than 18 feet bgs. (or a thickness of more than eight feet). The fifth paragraph of Section 3.3.4 – Regional Hydrogeology will be revised as follows:

> The inland flat land area generally encompasses the airfield and golf course areas. The inland flat land area is typically underlain by relatively thick residuum. The residuum generally consists predominately of clay. Although the total thickness has not been ascertained, more than eight feet of residuum were encountered in soil boring 69SB25, installed during the 2008 CMS Investigation. Fill material overlays the residuum in some areas, particularly the airfield, and generally consists of sand and gravel with lesser amounts of silt and clay.

PREQB Page-Specific Comment 6: *Page 4-2, Section 4.1, Paragraph 1. Based on sample locations depicted in Figure 4-2, please revise the classification of sample 69SB13 as "second line" of samples.*

Navy Response: The fourth sentence of the first paragraph of Section 4.1 – Surface and Subsurface Soil Sampling, 2008 CMS Investigation will be revised to include sample 69SB13:

> The second line of surface soil samples (69SB06, 69SB08, 69SB10, 69SB12, 69SB13, 69SB17, 69SB19, 69SB20 and 69SB22) were collected approximately 50 feet from the edge of the apron area, near the drainage ditch.

PREQB Page-Specific Comment 7: *Page 4-2, Section 4.1, Paragraphs 2 and 4. The text states that soil samples were transferred directly into pre-labeled sample jars. Clarification is required for how the samples for VOCs were collected. It is unclear if these samples were collected in EnCore® samplers or in preserved vials (i.e., sodium bisulfate and methanol) in the field, as required by EPA Region 2. Based on the text of the report as well as field notes and chains-of-custody, this information could not be determined. If soil samples were not collected using proper protocols, data are most likely not usable for the project objectives and should be rejected.*

Navy Response: Surface and subsurface soil samples for VOC analysis were collected using Terra Core kits. The Terra Core kits included one disposal syringe, one dry weight container, two-40 milliliter (ml) VOA vials (with stir bar) including 5 ml of sodium bisulfate solution, and one-40 ml VOA vials (with stir bar) including 5 ml of methanol solution. Section 4.0 has been revised accordingly. Soil samples were

not homogenized prior to collection. The second and fourth paragraphs of Section 4.1 will be revised to include the VOC sample collection procedure followed in the field.

PREQB Page-Specific Comment 8: *Page 4-2, Section 4.1, paragraph 4. It is not clear from what depth the duplicate was taken or if the duplicate was made from the same sampling point, the same number of samples.*

Navy Response: The third sentence of the fourth paragraph of Section 4.1 has been revised as follows:

> Subsurface soil samples were collected from depth intervals of 1 to 3 foot bgs and 9 to 11 foot bgs from five locations (69SB07-01, 69SB07-05, 69SB08-01, 69SB08-05, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05 and 69SB27-01, and 69SB27-05), plus a field duplicate from one location (69SB08-05D), for a total of 11 samples.

PREQB Page-Specific Comment 9: *Page 4-4, Section 4.3. The text incorrectly states that the depth to the groundwater surface was measured on July 22, 2007. Please revise to July 22, 2008.*

Navy Response: The text in Section 4.3 will be revised to indicate that the depth to groundwater was measured on July 22, 2008.

PREQB Page-Specific Comment 10: *Page 4-4, Section 4.2, paragraph 6. The text indicated that field parameters were obtained with appropriate instrumentation during sampling. The report should include detailed information on what was the appropriate instrumentation used.*

Navy Response: The sixth paragraph in Section 4.2 – Monitoring Well Installation and Groundwater Sampling will be revised to include the following information:

> The YSI 556 MPS (multi-probe system with flow cell) was used to measure dissolved oxygen, pH, conductivity, temperature, and ORP. The LaMotte 2020 meter was used to measure turbidity.

PREQB Page-Specific Comment 11: *Page 4-5, Section 4.7.1. The text incorrectly states that there were 24 surface soil samples. Please revise to 25 surface soil samples, as per Table 4-1. In addition, the field duplicate subsurface soil sample is incorrectly listed as 69SB05D; Please revise to 69SB08-05D.*

Navy Response: The text in the second paragraph of Section 4.8.1 – Field Duplicates has been revised to indicate that the total number of surface soil samples is 25 and the correct sample designation for the subsurface soil field duplicate is 69SB-8-05D.

PREQB Page-Specific Comment 12: *Page 4-5, Section 4.7.3. The text incorrectly states that there were 24 surface soil samples. Please revise to 25 surface soil samples, as per Table 4-1.*

Navy Response: The text in the first paragraph of Section 4.8.3 – Matrix Spike/Matrix Spike Duplicates has been revised to indicate that the total number of surface soil samples is 25.

PREQB Page-Specific Comment 13: *Page 5-2, Section 5.5.2, third sentence. The sentence lack of sense since apparently there is a typographical error, revise it accordingly.*

Navy Response: Section 5.2.2 Hydrogeology has been revised accordingly.

PREQB Page-Specific Comment 14: *Page 5-3, Section 5.2.3. Please revise the text to clarify why only certain slug test data were used in calculating average hydraulic conductivity values. For example, data from the rising head test are used for wells 69SB07 and 69SB08, and falling head for well 69SB25 were used to determine the hydraulic conductivity for the fractured clay.*

Navy Response: In general, it is better to evaluate unconfined aquifer slug test data using rising head versus falling head (especially when there is a quick response) because the PVC slug does not "smack" the water surface. Therefore, there is less sloshing of the water and masking the groundwater level recovery to equilibrium. In the case of 69SB25, field evaluation of the data indicated a slower recovery and a good data set retrieved and therefore, a rising head test was not performed at this location and the falling head data set was used for evaluation. Section 5.2.3 - Aquifer Characterization Testing will be revised to include this discussion regarding slug test data set collection and use.

PREQB Page-Specific Comment 15: *Page 6-2, Section 6.1, Paragraphs 1 and 3. The text states that the detected analytical results for the surface soil samples are provided in Table 6-1. However, Table 6-1 only provides the detected analytical results for metals and not VOCs and SVOCs. Please update Table 6-1 to include all detected analytical results in surface soils.*

Navy Response: In Table 6-1, Summary of Detected Results – Surface Soil, the first four pages include VOC and SVOC detected analytical results.

PREQB Page-Specific Comment 16: *Page 6-2, Section 6.2, paragraph 2. Surface and subsurface sediment samples (also could be classified as soil samples due to intermittent nature of the surface water body) should be collected along the drainage ditch to confirm the assumption that no contamination reached the drainage ditch. Depending on overland surface water flow rates and type of contaminant, contamination may have reached the ditch without being adsorbed by surface or subsurface soils between the concrete pad and the drainage ditch. Also, drainage ditch sediment/soil may contain have a higher total organic carbon content and could, over time, accumulate contaminants that would not accumulate in less organic soils nearby.*

Navy Response: As a result of soil disturbance by contractors in 2008 (which occurred after the 2008 CMS field investigation), and surface runoff from the adjacent expanded apron during precipitation events; there was potential for surface soil migration into the SWMU 69 drainage ditches. The Navy proposed a disturbed soil sampling strategy that included sampling of sediment in the southern and eastern drainage ditches. The Final Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area was approved on June 22, 2010. On November 5, 2010, 14 sediment samples (including two duplicate samples – 69SD01D and 69SD02D) were collected and analyzed for Appendix IX metals. Sediment sampling activities are described in Section 4.4.

PREQB Page-Specific Comment 17: *Page 6-4, Section 6.2, Paragraph 4. The text states that, in general, contamination in the subsurface soil is less than in the corresponding surface soil sample. Lead is used as an example at one location (69SB11) to demonstrate this. However, upon review of the data, it was noted that in general, contamination in the subsurface soil was greater than in the corresponding surface soil sample for barium, copper, and vanadium. Please revise the text to explain this increase in concentrations for select metals from surface to subsurface.*

Navy Response: As a result of the conversion of the airfield to a commercial facility by the Puerto Rico Ports Authority (PRPA), significant areas of soil associated with SWMU 69 were disturbed. Surface and shallow subsurface soil (to an approximate depth of 2 feet bgs) collected during the 2008 CMS investigation are not representative of the current site conditions and will not be used to characterize the site.

PREQB Page-Specific Comment 18: *Page 6-5, Section 6.3, paragraph 2. Please identify the monitoring wells where VOCs were detected in the text.*

Navy Response: The following will be added to the second paragraph of Section 6.4 – Groundwater:

Chloromethane was detected in groundwater sample 69GW25 at 1.5 J ug/L, 2-hexanone was detected in groundwater sample 69GW26 at 1.1 J ug/L, and acetone was detected in groundwater sample 67GW27 at 15 J ug/L.

PREQB Page-Specific Comment 19: *Page 6-6, Section 6.3. Please remove the final sentence. No groundwater sample is available from an appropriate location downgradient from 15E-04 to conclude contaminant migration has not occurred. The calculated velocity for the fractured clay is slow enough that groundwater contaminated at 15E-04 may not have had sufficient time to have traveled to 69SB25.*

Navy Response: Section 6.3 – Groundwater in the original draft CMS Report refers to the analytical results for groundwater samples collected and analyzed during the 2008 CMS investigation. The last sentence of this section indicates that there is no evidence that contaminants in the surface soil have migrated to the groundwater. This is based on examination of the surface and subsurface soil data and the observation that elevated metals are primarily confined to the top one foot of the soil column and have not migrated to the deeper soil or groundwater; the statement is not referring to the lateral migration of contaminants. The statement referenced by this comment is not included in the Revised Draft CMS Report because a number of metals were detected in the disturbed shallow subsurface soil sampled during the 2010 Disturbed Soil Sampling investigation.

PREQB Page-Specific Comment 20: *Page 6-7, Section 6.4.2, SVOCs, last paragraph. The text incorrectly states that sample 69B07-01 was reextracted due to compliant surrogate and internal standard recoveries. Please revise to state reextraction was due to "non-compliant surrogate and internal standard recoveries."*

Navy Response: The last paragraph in Section 6.5.2 – Test America SDG SWMU 36289-3, SVOCs was revised to indicate that sample 69SB07-01 was re-extracted due to non-compliant surrogate and internal standard recoveries.

PREQB Page-Specific Comment 21: *Page 6-9, Section 6.4.3, SVOCs, last paragraph. The text states that the samples were reextracted out of holding time due to non-compliant surrogate and internal standard recoveries in the initial analysis. The results of the initial analysis were reported. However, the text of this section does not discuss qualification of the data due to the surrogate and internal standard recoveries. Please revise the text accordingly.*

Navy Response: Detailed discussion of the qualification of the data, including the qualification due to surrogate and internal standard recoveries is provided in Appendix C.

PREQB Page-Specific Comment 22: *Page 6-10, Section 6.4.4, SVOCs, last paragraph. Revise the first sentence since there is apparently a typographical error.*

Navy Response: The referenced typographical error has been corrected.

PREQB Page-Specific Comment 23: *Page 6-13, Section 6.4.6, Metals, last paragraph. Please revise the discussion of cobalt in samples 69GW25 and 69GW12 to cadmium.*

Navy Response: The text in the last paragraph of Section 6.5.6 – Test America SDGWMU36419-2, Metals refers to refers to coblalt, as follows:

> Region II requires a detailed comparison of the results between the total and dissolved sample analysis. This comparison is made only when: the dissolved metals concentration is greater than the total concentration, and the dissolved concentration is greater than or equal to five times the MDL. The analyte cobalt met both of these conditions in samples 69GW25 and 69GW12. Therefore, positive results reported for cobalt were qualified as estimated (J/UJ) in samples 69GW25 and 69GW25F (dissolved). The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in 69GW12. Based on Region II validation guidelines the reported results for cobalt were qualified as estimated (J) in this sample.

PREQB Page-Specific Comment 24: *Page 6-14, Section 6.4.7, SVOCs. Please revise the text to address the holding time exceedance and low internal standard recovery for sample ER04.*

Navy Response: The text in Section 6.5.7 has been revised to include a discussion on the extraction holding time exceedance for sample ER04:

> All samples were re-extracted out of holding time due to non-compliant LCS recoveries. The re-extracted samples were not used since the holding time was exceeded, except for ER04RE. Sample ER04 was not used due to low surrogate recoveries. The sample was re-extracted and exhibited complaint surrogate recoveries; therefore the initial analysis was not used in favor of the re-extraction.

PREQB Page-Specific Comment 25: *Page 6-14, Section 6.4.6 and 6.4.7, Data Validation Summary for SWMU36419-2 and SWMU36419-4. A discussion on how does data qualification affect the Data Quality Objectives for the project should be added to both paragraphs.*

Navy Response: The following sectence was added to the end of Section 6.5.6 and 6.5.7 to address the impact on the DQOs:

> Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

PREQB Page-Specific Comment 26: *Section 7.1.1, Terrestrial habitats, page 7-1. Please correct the spelling of several scientific names of plants to read as Randia aculeat**a**, Acacia far**rn**esiana, and Burs**er**a simaruba. Also, in Section 7.1.2 on page 7-3, the correct spelling of black mangrove is Avice**nn**ia germinans.*

Navy Response: Section 7.1.1 and Section 7.1.2 will be revised to include the correct spelling of scientific names for *Randia aculeata*, *Acacia farnesiana*, *Bursera simaruba*, and *Avicennia germinans*

PREQB Page-Specific Comment 27: *Section 7.3.1.2 Transport Pathways, page 7-10. It is acknowledged that no soil samples were collected from the drainage ditches located south and east of SWMU 69. It also is noted that "The presence of ecological chemicals of concern (COCs) in surface soil samples collected nearest the drainage ditch would indicate that transport to drainage ditch surface soil." Because even the soil samples collected nearest to the ditch were 30 to 100 feet from the ditch and may occur on a slope rather than in a low-lying depositional area, they may not be indicative of COC concentrations in the ditch channel and/or forest immediately soils abutting the ditch. Please add text to acknowledge this and to indicate that supplemental soil samples will be collected from depositional areas within/abutting each fork of the ditch and the main stem below their confluence.*

Navy Response: Please see the Navy response to PREQB General Comment 4.

PREQB Page-Specific Comment 28: *Section 7.3.2 Endpoints and Risk Questions, page 7-13 and Table 7-2. Soil screening values such as EcoSSLs were used both to select COPCs and as measurement endpoints to assess potential risks to plants and soil invertebrates from exposures to surface and subsurface soil. Although EcoSSLs are available for several avian feeding guilds, they were not used as screening values to develop a list of COPCs for birds and to calculate preliminary, screening level HQs. Please compare maximum detected chemical concentrations to the avian omnivore, herbivore, and carnivore EcoSSLs as an additional measurement endpoint.*

Navy Response: The Navy disagrees with this comment. Specifically, the Navy believes that a preliminary screening of maximum chemical concentrations in soil to ecological soil screening levels (Eco-SSLs) for avian herbivores, avian ground insectivores, and avian carnivores would represent an unnecessary step since identification of ecological COPCs for additional evaluation in Step 3a of the baseline ecological risk assessment is based solely on the comparison of maximum ingested doses to toxicity reference values. It is noted that, when available, NOAEL values identified and used by the USEPA in the derivation of avian Eco-SSLs were preferentially used as toxicity reference values.

PREQB Page-Specific Comment 29: *Section 7.3.3 Fate and Transport Mechanisms, page 7-15 and Table 7-3. In the 4th paragraph of this section it is stated that chemicals with a log K_{ow} value of 3.0 or less generally "will not bioconcentrate to a significant degree." However, it appears that this criterion was not used consistently in Table 7-3 to identify "Bioaccumulative Chemicals." However, some chemicals with a "recommended" logK_{ow} lower than 3.0 are listed in Table 7-3 as bioaccumulative (e.g., carbon tetrachloride, chlorobenzene, chloroform, styrene, toluene, and trichloroethene), while others that have a "recommended" logK_{ow} greater than 3.0 were not listed as bioaccumulative (e.g., 1,1-Biphenyl). Please clarify and explain the reasons for this inconsistency.*

Navy Response: As stated in the second footnote within Table 7-3, when a range of log K_{ow} values is reported for a given chemical, the upper value within the range was conservatively used to identify bioaccumulative chemicals. Given that the upper value within the range of log K_{ow} values provided for carbon tetrachloride, chlorobenzene, chloroform, styrene, toluene, and trichloroethane exceed 3.0, these six VOCs were conservatively identified as bioaccumulative chemicals in Table 7-3. With regard to 1,1-biphenyl, Table 7-3 incorrectly identifies this SVOC as a non-bioaccumulative chemical. The table will be revised to show that 1,1-biphenyl is considered a bioaccumulative chemical.

PREQB Page-Specific Comment 30: *Section 7.4 Screening-Level Effects Evaluation, page 7-16. As noted in the General Comments, the term "ingestion-based screening value" has been misapplied as a synonym or TRV and should be globally replaced with more accurate terms. To set the stage for these global changes, please revise the last sentence in Section 7.4 to read as: "Media-specific screening values were developed for soil (surface and subsurface) and groundwater, while toxicity reference values (TRVs) were used to calculate potential risks of terrestrial food web (dietary) exposures to upper trophic level terrestrial receptors (birds) from ingested chemical doses."*

Navy Response: Section 7.4 will be revised to replace the term "ingestion-based screening value" with the term "toxicity reference value". This change also will be made throughout the document.

PREQB Page-Specific Comment 31: Section 7.4.1 Media-Specific Screening Values, page 7-16 and Table 7-4**.** Please rename Table 7-4 as "Soil Screening Values *for Plants and Invertebrates*" for greater accuracy and clarity. Please make the following clarifications/corrections in Table 7-4: The correct description of values for Acrylonitrile, Carbon Tetrachloride, trans-1,4-Dichloro-2-butene, and Hexachlorobenzene, as originally cited by Efroymson et al. (1997a), is "Toxicological threshold for *soil*

microorganisms and microbial processes;" duplicate entries appear for cis-1,**3**-Dichloropropene, attributed to CCME 2007, but that source document only provides values for cis and trans 1,**2**-Dichloropropene; the value for Ethylene Dibromide is attributed to CCME 2007, but could not be found among other soil quality guidelines presented in Table 1 of the source document; the source citation of USEPA 1999 for Pentachlorobenzene does not appear in the reference list of the table.

Navy Response: Section 7.4.1.1 and Table 7-4 will be renamed "Soil Screening Values for Terrestrial Plants and Invertebrates". In addition, comment entries for acrylonitrile, carbon tetrachloride, trans-1,4-dichloro-2-butene, and hexachlorobenzene will be revised to indicate that screening values are toxicological thresholds for soil microorganisms and microbial processes. Finally, the source citation for the pentachlorobenzene screening value (i.e., USEPA, 1999) will be added to the list of references contained within the table.

The Navy offers the following points of clarification relative to cis-1,3-dichloropropene and ethylene dibromide. The VOC cis-1,3-Dichloropropene is a chlorinated aliphatic hydrocarbon. Therefore, the CCME (2007) agricultural interim remediation criterion for chlorinated aliphatic hydrocarbons (100 ug/kg; see Table 2 of source document) was selected as the soil screening value for this VOC. It is noted that the duplicate entry for cis-1,3-dichloropropone will be deleted from Table 7-4. With regard to ethylene dibromide, this VOC is a non-chlorinated aliphatic hydrocarbon. Therefore, the CCME (2007) interim remediation criterion for non-chlorinated aliphatic hydrocarbons (300 µg/kg, see Table 2 of source document) was selected as the soil screening value for this VOC. It is noted that the soil screening value presented in Table 7-4 of the Draft CMS Report for ethylene dibromide (100 µg/kg) is incorrect. The table will be revised to show the correct value listed by CCME (2007) for non-chlorinated aliphatic hydrocarbons (300 µg/kg). The surface and subsurface soil risk calculation for terrestrial plants and invertebrates (presented in Tables 7-13 and 7-14 of the Draft CMS Report, respectively) will be revised to reflect the correct ethylene dibromide surface soil screening value.

References cited in the Navy response to PREQB Page-Specific Comment 31:

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: Summary Tables. Updated September 2007. In: Canadian Environmental Quality Guidelines, 1999, CCME, Winnipeg. http://www.ccme.ca/assets/pdf/rev_soil_summary_tbl_7.0_e.pdf.

USEPA. 1999. Screening-Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/D-99/001A.

PREQB Page-Specific Comment 32: *Section 7.4.1.2 Groundwater Screening Values, page 7-18 and Table 7-5. In the bulleted list of dissolved-to-total concentration conversion factors for marine AWQC, please specify that the value for chromium in salt water is for hexavalent chromium. Also, please make the following clarifications/corrections in Table 7-5:* ***(a)*** *the value used for 1,1,**1**,2-Tetrachloroethane should be described as the "Acute LOEL derived from the value for 1,1,**2**,2-Tetrachloroethane, cited by Buchman (1999) using a safety factor of 50;* ***(b)*** *the value for 2-Hexanone should be footnoted as a freshwater value; the Buchman (1999) value for 2,4,5-Trichlorophenol should be cited as "Proposed Marine Criteria Continuous Concentration;"* ***(c)*** *the values for 3,4-Methylphenol, 4,6-Dinitro-2-Methylphenol and 4-Chloro-3-Methylphenol, appear to be incorrectly attributed to USEPA 2003, since the Region 5 ecological screening levels (ESLs) do not include isomers of Methylphenol;* ***(d)*** *the value for 7,12-Dimethylbenz(a)anthracene should be described as a surrogate derived from the value for Dibenz(a,h)anthracene in Buchman (1999);* ***(e)*** *please indicate that the USEPA Region 4 value for Di-n-butyl phthalate is the lowest reported plant value; and* ***(f)*** *note that the value for Naphthalene is the USEPA Region 4* ***marine*** *chronic screening value.*

Navy Response: Section 7.4.1.2 will be revised to indicate that the dissolved-to-total conversion factor shown in the bulleted list for chromium is a conversion factor for hexavalent chromium. Navy responses to Items (a) through (f) are presented below.

(a) The Navy agrees that the value shown in Table 7-5 for 1,1,1-2-tetrachloroethane was derived from the acute LOEL presented in Buchman (1999) for 1,1,2,2-tetrachloroethane. However, use of the 1,1,2,2-tetrachloroethane value as a surrogate value for 1,1,1,2-tetrachloroethane does not follow the approach presented in Section 7.4.1.2 for the selection of groundwater screening values. If this approach is followed, the correct screening value for 1,1,1,2-tetrachloroethane is 200 µg/L. This value represents the minimum acute value listed in the ECOTOX Database System (USEPA, 2007) for 1,1,1,2-tetrachloroethane (96-hour LC_{50} for *Lepomis macrochirus* [bluegill]) with a safety factor of 100). Table 7-5 will be revised to show the correct screening value of 200 µg/L.

(b) The groundwater screening value shown in Table 7-5 for 2-hexanone will be footnoted as a freshwater screening value. With regard to the 2,4,5-trichlorophenol, the Navy does not believe it is necessary to identify the screening value as a "Proposed Marine Criteria Continuous Concentration" since the first footnote in Table 7-5 states that, "*The values shown are marine/estuarine screening values unless otherwise noted*." Because the screening value for 2,4,5-trichlorophenol is not footnoted, it is already inferred that the value is a marine/estuarine screening value. It is noted that groundwater screening values from Buchman (1999) have been updated, as necessary, to reflect values presented in Buchman (2008).

(c) The Navy offers the following points of clarification relative to this comment. USEPA Region 5 (2003) has developed ecological screening levels for 4,6-dinitro-2-methylphenol and 4-chloro-3-methylphenol. The source document lists 4,6-dinitro-2-methylphenol as cresol [4,6-dinitro-o-] and 4-chloro-3-methylphenol as cresol [p-chloro-m-]. The USEPA Region 5 (2003) also lists a ecological screening level for 4-methylphenol (value used as a surrogate for 3,4-methylphenol]. Specifically, the source document lists 4-methylphenol as cresol [p-].

(d) The Navy respectfully disagrees with this comment. All PAH compounds lacking chemical-specific screening values are assigned an acute LOEL of 300 µg/L by Buchman (1999) based on a chemical class. Therefore, the Navy believes that the description of the 7,12-dimethylbenz(a)anthracene screening value included in Table 7-5 (i.e., acute LOEL for chemical class with a safety factor of 50) is appropriate.

(e) The comment entry for di-n-butyl phthalate will be revised to indicate that the screening value is the lowest reported plant value.

(f) The Navy does not believe it is necessary to identify the naphthalene screening value as a "*USEPA Region 4* ***marine*** *chronic screening value*" since the first footnote in Table 7-5 states that, "*The values shown are marine/estuarine screening values unless otherwise noted*." Identical to 2,4,5-trichlorophenol (see Navy response for PREQB Page-Specific Comment No. 32[b] above), because the screening value for naphthalene is not footnoted, it is already inferred that the value is a marine/estuarine screening value.

References cited in the Navy response to PREQB Page-Specific Comment 32:

Buchman, M.F, 2008. NOAA Screening Quick Reference Tables. NOAA OR&R Report 08-1. Office of Response and Restoration, Seattle, WA. 34 pp.

Buchman, M.F. 1999. NOAA Screening Quick Reference Tables. NOAA HAZMAT Report 99-1. Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, Seattle, WA. 12 pp.

USEPA. 2007a. ECOTOX User Guide: Ecotoxicology Database System. Version 4.0. Available at: http:/www.epa.gov/ecotox/.

PREQB Page-Specific Comment 33: *Section 7.4.2 Ingestion Based Screening Values, page 7-19 and Table 7-6. Please rename this table as "Toxicity Reference Values for Birds" and make the following clarifications/corrections regarding the sources and derivation of LOAELs and NOAELs:* ***(a)*** *Values derived from the data compiled in USEPA EcoSSL documents are often incorrectly cited, wrongly suggesting that USEPA was the original source of LOAELs and/or NOAELs actually published by original authors. USEPA should be cited as the original source only for those geometric mean LOAEL or NOAEL calculated from compiled TRV data and used by USEPA for EcoSSL derivation (e.g., NOAELs of 6.71 for nickel and 66.1 for zinc were calculated by USEPA). When an original TRV was chosen from the summary tables of original published TRVs compiled by USEPA, the reference citation should indicate the original author of the study (e.g., NOAEL of 1.63 mg/kgBW/day for lead should be referenced as "Edens and Garlich (1983) as cited in USEPA 2005d");* ***(b)*** *The European starling growth LOAEL (should be 20) and NOAEL (should be 2) values appear to have been used for 7,12-Dimethylbenz(a)anthracene. Also, since USEPA (2007a) did not specify a TRV for this chemical, but the values used in Table 7-6 were derived from the raw data in Appendix 5.2 of this EcoSSL document, the correct raw data reference is "Trust et al. (1994) as cited in Appendix 5.2 of USEPA (2007a)"* ***(c)*** *It appears that NOAELs (or LOAELs) originally published or calculated as geometric means by USEPA were often used inappropriately to infer LOAELs (or NOAELs) using an extrapolation factor of ten. This was done even when a range of NOAELs or LOAELs from the original studies was available and compiled in the EcoSSL documents (e.g., USEPA tabulated published chicken and duck growth LOAELs for cobalt ranging between 7.8 and 148 mg/kgBW/day, as well as 5 different NOAELs for cobalt, from 9 original studies. While use of USEPA's geometric mean NOAEL of 7.61 mg/kgBW/day is appropriate, an extrapolated LOAEL of 76.1 mg/kgBW/day is not. Either one reported LOAEL should be chosen/justified or a geometric mean calculated from all original LOAELs cited by USEPA for use as a TRV in the risk calculation);* ***(d)*** *the Arsenic NOAEL of 2.24 mg/kgBW/day chosen by USEPA was "the lowest NOAEL value for effects on reproduction, growth or survival" from six different Mortality, Growth and Reproduction NOAELs published in 4 studies, not just Mortality Revise Effect/Endpoint as Mortality/Growth/Reproduction. Also, the arsenic LOAEL for Mortality, Growth and Reproduction should not be assumed equal to 22.4 mg/kgBW/day, since the Growth LOAELs cited in Table 5.1 of USEPA (2005b) from the original studies ranged from 1.49 to 17.3 for chickens and mallard ducks. Choose a LOAEL or calculate a geometric mean LOAEL from the LOAELs cited in Table 5.1 of USEPA (2005b).* ***(e)*** *Please clarify the source of the Reproduction/Growth LOAEL for Cadmium of 11.47 mg/kgBW/day.* ***(f)*** *Body weight (0.155 kg) and study duration (5 weeks) originally reported for quail (Coturnix) were inaccurately transposed from USEPA (2005d) for the chicken reproductive TRVs for lead. The correct values for chicken, as reported originally in Edens and Garlich (1983), were 1.81 kg and a 4 week exposure period.* ***(g)*** *The nickel geometric mean NOAEL of 6.71 mg/kgBW/day derived for Reproduction/Growth by USEPA (2007d) in the EcoSSL document was inappropriately used to extrapolate a Reproduction/Growth LOAEL of 67.1 mg/kgBW/day. Rather, the 9 different published Reproduction/Growth LOAELs compiled by USEPA in Table 5.1 of the EcoSSL should be used to calculate a geometric mean LOAEL, or a single LOAEL from Table 5.1 should be chosen and justified for use.* ***(h)*** *Please correct the Test Material entry for cobalt as "Cobalt, Cobalt chloride, and Cobalt Carbonate" to match information presented in the EcoSSL source document.*

Navy Response: Table 7-6 will be renamed as "Toxicity Reference Values for Birds". Responses to Items (a) through (h) are presented below.

(a) The citations referenced are intended to show the source document used to obtain the avian toxicity reference values. The column title will be changed from "reference" to "source document". In addition, references cited within the table that do not represent primary data sources (as reported by the original authors) will be footnoted and identified as secondary data sources. In the case of ecological soil screening level documents, the USEPA will be identified as a primary data sources only for geometric mean values calculated from compiled TRV data and used by USEPA for avian ecological soil screening level derivation (i.e., cadmium, chromium, cobalt, nickel, and zinc). No additional revisions will be made to the citations.

(b) Table 7-6 will be revised to show the correct NOAEL and LOAEL value for 7,12-dimethylbenz(a)anthracene (2.0 mg/kg-BW/day and 20.0 mg/kg-BW/day, respectively). With regard to the citation, please see the Navy response to Item (a) above.

(c) Table 7-6 will be revised by replacing LOAEL values for cadmium, chromium, cobalt, nickel and zinc with LOAEL values derived by calculating the geometric mean of all growth- and reproduction-based LOAEL values listed within the cited Eco-SSL documents that meet the USEPA's minimum data evaluation score. This approach also will be used for arsenic since a LOAEL value was not available from the study chosen by the USEPA as the source of the NOAEL value selected as the ecological soil screening level.

(d) The Navy partially agrees with this comment. As indicated in the Navy response to Item (c) above, the arsenic LOAEL value shown in Table 7-6 will be revised by calculating the geometric mean of all growth- and reproduction-based LOAEL values listed within the cited Eco-SSL document that meet the USEPA's minimum data evaluation score. However, the Navy respectfully disagrees with the portion of the comment that pertains to the effect/endpoint listed for arsenic. The NOAEL value listed in Table 7-6 for arsenic is based on mortality, not growth or reproduction. Therefore, the Navy does not believe it is appropriate to revise the effect/endpoint column to indicate that the NOAEL value is based on mortality, growth, and reproduction.

(e) The LOAEL value listed in Table 7-6 for cadmium was estimated by applying a safety factor of 10 to the NOAEL value. As indicated in the Navy response to Item (c) above, the LOAEL value for cadmium will be revised by calculating the geometric mean of all growth- and reproduction-based LOAEL values listed within the cited Eco-SSL document that meet the USEPA's minimum data evaluation score.

(f) Table 7-6 will be revised to show the correct body weight and study duration entry for lead (i.e., 0.181 kilograms and 4 weeks, respectively).

(g) As indicated in the Navy response to Item (c) above, the LOAEL value for nickel will be revised by calculating the geometric mean of all growth- and reproduction-based LOAEL values listed within the cited Eco-SSL document that meet the USEPA's minimum data evaluation score.

(h) Table 7-6 will be revised to show the correct test material entry for cobalt (i.e., cobalt, cobalt chloride, and cobalt carbonate).

PREQB Page-Specific Comment 34: *Section 7.5.2.2.1 Exposure Point Concentrations, page 7-21 and Tables 7-7 and 7-8. As noted in the General Comments, many of the soil-plant, soil-invertebrate and soil-small mammal BAFs used to calculate chemical concentrations in the diet of birds are too low and were derived from outdated literature sources. Please revise the BAFs in Table 7-7 (terrestrial plants and invertebrates) and Table 7-8 (small mammal prey) using a combination of regression equations and the*

compiled, median BAFs for these avian food items presented in Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs (USEPA, April 2007). A few examples of soil-to-plant BAFs in Table 7-7 that appear too low to estimate plant uptake include: ***(a)*** *BAF of 0.0443 for Pentachlorophenol, for which the EcoSSL guidance reports a median BAF of 5.93;* ***(b)*** *BAF of 0.21 for Acenaphthene versus a median BAF of 2.0 in the EcoSSL guidance;* ***(c)*** *BAF of 0.0908 for Anthracene versus median BAFs ranging from 0.06 to 23 in the EcoSSL guidance;* ***(d)*** *BAF of 0.0114 for Benzo(a)pyrene versus median BAFs ranging from 0.02 to 3.3 in the EcoSSL guidance; (e) Naphthalene BAF of 0.445 versus median BAFs ranging from 5.4 to 12.2 in the EcoSSL guidance; and* ***(f)*** *BAF for Beryllium of 0.01 versus BAFs ranging from 0.033 to 1.625 in Appendix A-2 of the EcoSSL guidance. Because so few actual soil-to-small mammal BAFs were included in Table 7-8, no attempt was made to provide specific comparisons to the more recent BAFs presented in the EcoSSL guidance. Please revise Table 7-8 to include the soil-omnivore BAF median values or regression equations from the EcoSSL guidance to be used to recalculate avian dietary doses derived from invertebrate prey. Please include an explanation of the source and derivation method for each BAF, such as use of a median reported value from published sources, regression equation from the EcoSSL guidance, or "assumed" value.*

Navy Response: As discussed in the Navy response to PREQB General Comment 9, the soil-to-terrestrial plant and soil-to-terrestrial invertebrate BAF values listed in Table 7-7 and the soil-to-small mammal BAFs listed in Table 7-8 of the Draft CMS Report, will be revised, as necessary, to reflect the compiled BAFs and regression equations presented in *Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs* (USEPA, 2007). For example, soil-to-plant BAFs for organic chemicals derived in accordance with the algorithm developed by Travis and Arms (1988) will be replaced by values derived in accordance with the inter-chemical regression equation presented in Figure 5, Panel B of USEPA (2007), the chemical-specific uptake equations present for rinsed plant foliage data presented in Appendix C of USEPA (2007), or maximum BAF values for rinsed plant foliage data presented in Appendix C of USEPA (2007). For conservatism, maximum or 90th percentile soil-to-plant and soil-to-invertebrate BAF values derived from data presented in USEPA (2007) were used in the Step 2 screening-level risk calculation place of the USEPA-recommended median values. It is noted that Tables 7-7 and 7-8 of the Draft CMS Report will become Tables 7-8 and 7-9 within the Revised Draft CMS Report.

Navy responses to Items (a) through (f) are presented below.

(a) The maximum BAF value for the data presented in Appendix F, Table F-1 of USEPA (2007) will be used to estimate the concentration of pentachlorophenol in plant tissue for the Step 2 screening level risk calculation, while the median BAF value contained in Appendix F, Table F-1 of USEPA (2007) will be used to estimate the concentration of pentachlorophenol is plant tissue in the Step 3a risk calculation (maximum BAF = 46.02; median BAF = 5.93).

(b) The chemical-specific bioaccumulation uptake equation derived from measured BAF data and presented in Table 4b of USEPA (2007) will be used to estimate the concentration of acenaphthene in plant tissue for the Step 2 screening level risk calculation and Step 3a risk calculation. The uptake equation is based on the rinsed plant foliage data presented in Appendix C of USEPA (2007).

(c) The chemical-specific bioaccumulation uptake equation derived from measured BAF data and presented in Table 4b of USEPA (2007) will be used to estimate the concentration of anthracene in plant tissue for the Step 2 screening level risk calculation and Step 3a risk calculation. The uptake equation is based on the rinsed plant foliage data presented in Appendix C of USEPA (2007).

(d) The chemical-specific bioaccumulation uptake equation derived from measured BAF data and presented in Table 4b of USEPA (2007) will be used to estimate the concentration of benzo(a)pyrene in plant tissue for the Step 2 screening level risk calculation and Step 3a risk calculation. The uptake equation is based on the rinsed plant foliage data presented in Appendix C of USEPA (2007).

(e) The maximum BAF value for the data presented in Appendix C of USEPA (2007) will be used to estimate the concentration of naphthalene in plant tissue for the Step 2 screening level risk calculation, while the median BAF value contained in Appendix C of USEPA (2007) will be used to estimate the concentration of naphthalene in plant tissue for the Step 3a risk calculation (maximum BAF = 48.0; median BAF = 12.2). The values are based on the rinsed plant foliage data.

(f) The chemical-specific bioaccumulation uptake equation derived be Bechtel Jacobs (1998) from measured BAF data and presented in Table 4b of USEPA (2007) will be used to estimate the concentration of beryllium in plant tissue for the Step 2 screening level risk calculation and Step 3a risk calculation.

References cited in the Navy response to PREQB Page-Specific Comment 9:

Bechtel Jacobs. 1998. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Prepared for U.S. Department of Energy. BJC/OR-133. September 1998.

Travis, C.C. and A.D. Arms. 1988. Bioconcentration of Organics in Beef, Milk, and Vegetation. Environ. Sci. Technol. 22:271-274.

United States Environmental Protection Agency (USEPA). 2007. Attachment 4-1 of Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-55.

PREQB Page-Specific Comment 35: *Section 7.6.1 Selection of Ecological Chemicals of Potential Concern, page 7-24. As noted in the General Comments, comparison to screening values of the MDL rather than the reporting limit (RL) for NDs deviates from the COPC selection approach proposed in the approved CMS Work Plan. Since the RL often is higher than the corresponding MDL for a ND, it will yield a higher, more conservative estimate of potential risk than the MDL, when compared to available screening values for non-detected chemicals.*

Navy Response: Please see the Navy response to PREQB General Comment 2.

PREQB Page-Specific Comment 36: *Section 7.6.2 Screening-Level Risk Calculation for Surface Soil, Subsurface Soil, Groundwater, and Terrestrial Food Web Exposures, page 7-25. For additional clarity as to the content of Tables 7-11, 7-12 and 7-13, please insert the following as the second sentence in this paragraph: These calculations of hazard quotients (HQs) apply only to lower trophic level community exposures of plants and soil invertebrates to terrestrial soil, or of aquatic biota to ground water reaching offshore marine habitats.*

Navy Response: Section 7.6.2 will be revised to include text indicating that the calculation of hazard quotient values presented in Tables 7-11 through 7-13 of the Draft CMS Report apply only to lower

trophic level community exposures. It is noted that the above referenced tables will become Tables 7-12 through 7-14 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 37: *Section 7.6.2.1 Surface Soil, page 7-25. Please modify the first sentence of this section as follows, for greater clarity: "Table 7-11 presents the results of the screening-level risk calculation for plants and soil invertebrates exposed to SWMU 69 surface soil."*

Navy Response: The first sentence in Section 7.6.2.1 will be modified to "Table 7-11 presents the results of the screening-level risk calculation for plant and invertebrate exposures to chemicals in SWMU 69 surface soil". As indicated by the Navy response to PREQB Page-Specific Comment No. 36, Table 7-11 of the Draft CMS Report will become Table 7-12 within the Revised Draft CMS Report. As such, the revised sentence will reference Table 7-12.

PREQB Page-Specific Comment 38: *Section 7.6.2, Tables 7-11 and 7-12. Please revise the title of these tables to convey that they pertain only to soil screening values for plants and invertebrates (e.g., rename Table 7-11 as "Frequency and Range of Surface Soil Data (Maximum Concentrations) Compared to Soil Screening Values for Plants and Invertebrates." Also, these tables cross reference a literature reference for USEPA (1999) as found in Table 7-4, but it is missing from Table 7-4.*

Navy Response: The title of Table 7-11 within the Draft CMS Report will be revised to "Frequency and Range of Surface Soil Data (Maximum Concentrations) Compared to Soil Screening Values for Plants and Invertebrates". The title of Table 7-12 within the Draft CMS Report will be revised to "Frequency and Range of Subsurface Soil Data (Maximum Concentrations) Compared to Soil Screening Values for Plants and Invertebrates". As indicated by the Navy response to PREQB Page-Specific Comment No 36, Tables 7-11 and 7-12 will become Tables 7-12 and 7-13 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 39: *Section 7.6.2, Table 7-16. Please expand the footnote for NE (Not Evaluated) to explain that the low and high MW EcoSSLs were used to evaluate two subtotals for PAHs due to a lack of EcoSSLs or other SVs for individual PAHs. Also, for other COPCs annotated as NE, please add a footnote explanation as to why each was not evaluated (e.g., for 1,4-Dioxane, combine "NE" with footnote #1 to explain it was not evaluated because has a logK_{ow} below 3.0 and is not bioaccumulative). As requested in prior comments, please replace the inappropriate acronym "IBSV" with "TRV" in this table. Finally, please add a footnote to this table to indicate which chemicals were included solely due to a lack of screening values, despite never having been detected.*

Navy Response: Table 7-16 of the Draft CMS Report (Summary of the Screening-Level Risk Calculation) will not be included within the Revised Draft CMS Report. Instead, the section presenting the screening level risk calculation for surface soil, subsurface soil, groundwater, and terrestrial food web exposures (i.e., Section 7.6.2) will be referenced within the text of Section 7.8. It is noted that PREQB Page-Specific Comment 39 references Section 7.6.2 as the location within the Draft CMS Report where Table 7-16 is cited. Table 7-16 is actually cited within Section 7.8 of the Draft CMS Report.

PREQB Page-Specific Comment 40: *Section 7.7 Uncertainties Associated with the SERA, page 7-28. Please add a discussion of the spatial gap in analytical data for soil samples from low-lying, depositional reaches of the drainage ditches and adjacent forested habitats located downgradient of SWMU 69, to the south and east. Please acknowledge the significance of this data gap in the evaluations of (a) potential contaminant migration in surface runoff entering the ditch, and (b) potential risks to the yellow shouldered blackbird that may forage within these forested habitats.*

Navy Response: Please see the Navy's response to PREQB General Comment 4.

PREQB Page-Specific Comment 41: *Section 7.7 Uncertainties Associated with the SERA, Food Web Exposure Modeling, page 7-31***.** *Please discuss uncertainties about the assumed diet of the red-tailed hawk at SWMU 69, to acknowledge that hawks are unlikely to prey solely on rats. Hawks also are likely to prey on smaller birds and perhaps reptiles, such as snakes and lizards, for which COPC uptake and food chain exposures of the hawks were not evaluated.*

Navy Response: Section 7.7 of the Draft CMS Report will be revised to include the following discussion of the uncertainties associated with the assumed diet of the red-tailed hawk:

> "In the SERA, it was assumed that the diet of the red-tailed hawk consisted solely of rodents (i.e., Norway rat). However, red-tailed hawks are opportunistic feeders and prey will vary with regional and seasonal availability. In Puerto Rico's El Yunque rainforest, the following food items were delivered to nestlings: rats (black rat and Norway rat), birds (such as the zenaida dove), lizards (*Anolis* spp.), snakes (such as the Puerto Rican racer [*Alsophis portoricensis*]), and coquis (*Eleutherodactylus* spp.) (Global Raptor Information Network, 2010). Santana and Temple (1988) reported the diet of red-tailed hawks in mountain rain and cloud forests of Puerto Rico consisted primarily of birds, reptiles, and amphibians captured from the tree canopy, while the diet of lowland hawks was comprised mostly of mammals. The diet of lowland hawks reported by Santana and Temple (1988) support the diet assumption used in the SERA. However, if red-tailed hawks at NAPR consume a mixed diet of rats, birds, and reptiles, and bioaccumulation of chemicals in birds and reptiles differ from their bioaccumulation in rats, an assumed diet of 100 percent rats may have resulted in an overestimation or underestimation of potential risks."

References cited in the Navy response to PREQB Page-Specific Comment 41:

Global Raptor information network. 2010. Species Account: Red-Tailed Hawk (*Buteo jamaicensis*). Available at: http://www.globalraptors.org.

Santana, E.C. and S.A. Temple. 1988. Breeding Biology and Diet of Red-Tailed Hawks in Puerto Rico. Biotropica. 20:151-160.

PREQB Page-Specific Comment 42: *Section 7.9 Step 3a of the BERA, page 7-33, and Tables 7-17 and 7-18. Revisions and updates of the BAFs in Tables 7-7 and 7-8, used in the SERA, were requested in the General Comments and Specific Comments on these BAFs. Similarly, the purportedly "less conservative" selections of soil-plant, soil-invertebrate and soil-small mammal BAFs proposed in Tables 7-17 and 7-18 should be reassessed and revised to apply the more recent BAFs and BAF derivation methods (e.g. regression equations) presented in the Attachment 4-1 of the EcoSSL guidance on the use of bioaccumulation models for EcoSSL derivation (USEPA, April 2007).*

Navy Response: The plant and invertebrate BAFs listed in Table 7-17 and the small mammal BAFs listed in Table 7-18 of the Draft CMS Report will be revised, as necessary, to reflect the compiled BAFs and regression equations presented in Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs (USEPA, 2007). It is noted that Tables 7-17 and 7-18 of the Draft CMS Report will become Tables 7-19 and 7-20 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 43: *Section 7.9.1 Refined Risk Evaluation, Table 7-17***.** *Pentachloroethane is incorrectly listed in this table as a semi-volatile organic chemical, but is correctly listed elsewhere as a VOC. As noted in prior comments, the BAFs and BCFs included in this table also*

should be re-evaluated and revised, as needed, based on comparison to those included in Attachment 4-1 of the EcoSSL guidance (USEPA, April 2007).

Navy Response: Pentachloroethane is mistakenly shown in place of pentachlorobenzene within Table 7-17 of the Draft CMS Report. This table will be revised to remove pentachloroethane and show pentachlorobenze. With regard to the BAFs/BCFs listed within this table, please see the Navy Response to PREQB Page-Specific Comment 42. As indicated in this Navy response, the plant and invertebrate BAFs listed in Table 7-17 of the Draft CMS Report and used in Step 3a of the BERA will be revised, as necessary, to reflect the compiled BAFs and regression equations presented in Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs (USEPA, 2007). As was previously discussed, Table 7-17 of the Draft CMS Report will become Table 7-19 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 44: *Section 7.9.1 Refined Risk Evaluation, Table 7-18. Concerns about not having used the best available BAFs and BCFs, voiced in the prior comments, also apply to the content of this table. Please present chemical-specific values used in the food chain exposure models, with a brief explanation of their derivation,*

Navy Response: Please see the Navy response to PREQB Page-Specific Comment 42. As indicated in this response, the soil-to-small mammal BAFs listed in Table 7-18 of the Draft CMS Report and used in Step 3a of the BERA will be revised, as necessary, to reflect the compiled BAFs and regression equations presented in Attachment 4-1 of the Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs (USEPA, 2007). Table 7-18 of the Draft CMS Report also will be revised to include the uptake that was used to derive the small mammal tissue concentrations for those chemicals lacking literature-based BAFs values, as well as a footnote explaining the uptake equation. As was previously discussed, Table 7-18 of the Draft CMS Report will become Table 7-20 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 45: *Section 7.9.1 Refined Risk Evaluation, Table 7-20. For greater clarity, please rename this table so that its title ends with "...Compared to Soil Screening Values for Plants and Invertebrates." Also, please correct/clarify what appear to be errors in the entries for Vanadium:* ***(a)*** *using the 95% UCL of the mean concentration and SSV in the table yields a HQ of 13.67, not 68.35;* ***(b)*** *Assuming the correct SSV is 10 mg/kg, it's source is incorrectly referenced here as Efroymson et al. (1997b), whereas this SSV was attributed to USEPA (2005h) in Table 7-4.*

Navy Response: The title for Table 7-20 of the Draft CMS Report will be revised to "Frequency and Range of Surface Soil Data (95 Percent UCL of the Mean Concentrations) Compared to Soil Screening Values for Terrestrial Plants and Invertebrates".

Responses to Items (a) and (b) are presented below.

(a) The soil screening value for vanadium will be updated within the Revised Draft CMS Report to reflect the safety factor recommended by Wentsel et al. (1996) for converting a chronic lowest observed adverse effect concentration (LOAEC) to a chronic no observed adverse effect concentration (NOAEC). The specific safety factor used will be 5. Based on this safety factor, the vanadium soil screening value is 20 mg/kg, which corresponds to a Step 3a risk estimate of 6.84. Table 7-20 of the Draft CMS Report will be revised show the correct HQ value for vanadium (HQ = 6.84).

(b) Table 7-20 will be revised to show the correct source of the vanadium soil screening value (USEPA, 2005h).

It is noted that Table 7-20 of the Draft CMS Report will become Table 7-21 within the Revised Draft CMS Report.

References cited in the Navy response to PREQB Page-Specific Comment 45:

Wentsel, R.S, T.W. Pa Point, M. Simini, R.T. Checkai, and D. Ludwig. 1996. Tri-Service Procedural Guidelines for Ecological Risk Assessments. Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD. ADA297968.

PREQB Page-Specific Comment 46: *Section 7.9.1 Refined Risk Evaluation, Tables 7-23 and 7-24. For greater clarity, please rename titles of these tables to indicate they pertain only to birds (e.g., Table 7-23 would end with "...Food Web Exposures of Birds: Surface Soil"). Also, if correct, please add a footnote indicating that the HQs are based on the 95% UCL of the mean concentration. Please replace the term Ingestion-based screening value with TRV in the footnote for NA.*

Navy Response: Table 7-23 of the Draft CMS Report will be renamed "Hazard Quotient Values for Avian Dietary Exposures to Chemicals in Surface Soil: Step 3A Risk Calculation. Table 7-24 of the Draft CMS Report will be renamed "Hazard Quotient Values for Avian Dietary Exposures to Chemicals in Subsurface Soil: Step 3A Risk Calculation". In addition to these revisions, the term ingestion-based screening value in the footnotes of each table will be replaced by "toxicity reference value". Finally, a footnote was added to each table that defines the basis of the hazard quotient values (95 percent upper confidence limit of the mean chemical concentrations for surface soil and maximum chemical concentrations for subsurface soil). It is noted that Tables 7-23 and 7-24 of the Draft CMS Report will become Tables 7-25 and 7-26 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 47: *Section 7.9.1 Refined Risk Evaluation, Table 7-25. Selenium has HQs > 1.0 for birds but was omitted as a COPC in subsurface soil for upper trophic level receptors – please add it to the table.*

Navy Response: Based on the use of updated exposure parameters for each avian receptor, including new soil-to-terrestrial plant BAF values, selenium is not identified as an ecological COPC for avian dietary exposures to chemicals in SWMU 69 subsurface soil. As evidenced by Table 7-16 of the Revised Draft CMS Report, the selenium HQ for American robin dietary exposures is equal to 1.00 (i.e., the dietary intake is equal to the NOAEL-based TRV). As such, revisions to Table 7-25 involving the addition of selenium are not necessary. It is noted that Table 7-25 of the Draft CMS Report will become Table 7-27 within the Revised Draft CMS Report.

PREQB Page-Specific Comment 48: *Section 7.9.1.1 Step 3a Risk Evaluation for Surface Soil, page 7-40, paragraph 1. Here the report states: "The analytical data for these downgradient samples give no indication that zinc has migrated from 69SB05, 69SB09, 15-03, and 15-04 with surface soil via surface run-off to drainage ditch surface soil or estuarine wetland surface water or sediment at concentrations greater than what would be expected under background conditions. However, surface soil samples have not been collected at locations downgradient from 69SB14 and 69SB15." This statement hypothesizes that COPCs from the higher elevation source area within SWMU 69 have not migrated in surface water runoff to downgradient habitats, such as the ditch channel and adjacent forest, despite the potential for such contaminants to have accumulated within depositional reaches of the ditch and adjacent forest. The report recommends "that surface soil samples be collected downgradient from these locations to establish a concentration gradient to determine if zinc has migrated to drainage ditch surface soil and*

estuarine wetland surface water and sediment at concentrations greater than background levels." As noted in prior comments, several additional soil samples should be collected from the ditch channels and adjacent forest, but should be analyzed for all relevant COPCs, not just for zinc, to test the contaminant migration hypothesis and assess potential risk from ecological exposures to soils in the ditch and adjacent forest.

Navy Response: Please see the Navy response to PREQB General Comments 4 and 5.

PREQB Page-Specific Comment 49: *Section 7.9.1.1 Step 3a Risk Evaluation for Surface Soil, page 7-40, paragraph 2. The final sentence of this paragraph prematurely concludes that: "there is no indication that lead has migrated from 15E-SS03, 69SB05, 69SB09, and 69SB05 with surface soil via surface run-off to drainage ditch surface soil or estuarine wetland surface water or sediment at concentrations greater than what would be expected under background conditions." As noted above for zinc, this is a hypothesis that must be tested by analyzing additional soil samples from the ditch channel and adjacent depositional areas within the forest. Sample location 69SB05, located nearly 100 feet upgradient from the drainage ditch, is one of several "hot spots" where inorganic COPC concentrations exceed background. However, since this and other locations may occur on a slope, rather than in lower, depositional areas of the ditch/forest habitat, it is conceivable that comparable or even higher COPC concentrations may have accumulated in these unsampled areas. Please revise the discussion to remove this premature inference and acknowledge this uncertainty related to the spatial data gap for the ditches and adjacent forest.*

Navy Response: Please see the Navy response to PREQB General Comments 4 and 5.

PREQB Page-Specific Comment 50: *Section 7.9.1.1 Step 3a Risk Evaluation for Surface Soil, page 7-41. Please add a new sentence in the last paragraph of this section to state that: "However, since many of these COPCs also exceed the lowest of their avian EcoSSLs, they are evaluated separately for terrestrial food chain exposures of birds, below, in Section 7.9.1.4."*

Navy Response: The recommended revisions to the closing paragraph are not deemed necessary since the section referenced by PREQB Page-Specific Comment No 50 is specific to terrestrial plant and invertebrate exposures to chemicals in SWMU 69 surface soil.

PREQB Page-Specific Comment 51: Section 7.9.2 Uncertainties Associated With Step 3a of the BERA, Identification of Ecological COCs ,page 7-48**.** For greater clarity and precision, please modify the first sentence of the bullet to read as: **"**Non-detected chemicals lacking media-specific *screening values and/or avian TRVs* were not evaluated in the refined risk calculation, nor were they identified as ecological COCs."

Navy Response: The first sentence of the third bullet item will be revised by replacing the term "ingestion-based screening values" with "TRVs".

PREQB Page-Specific Comment 52: *Section 7.9.3.2 Subsurface Soil and Section 7.9.3.3 Groundwater, page 7-49. In both sections, please briefly recap how and why these COPCs were eliminated from further evaluation as COCs. The following revision of the one sentence subsurface soil discussion would serve this need: "Based on the refined risk evaluation presented in Section 7.9.1.2, no detected chemicals were identified as ecological COCs for SWMU 69 subsurface soil, despite several HQs exceeding 1.0 for plants and soil invertebrates, because concentrations of these COPCs were below background levels."*

Navy Response: Sections 7.9.3.2 and 7.9.3.3 will be revised to explain why ecological COPCs identified in Step 2 of the SERA were not identified as ecological COCs in Step 3a of the BERA.

PREQB Page-Specific Comment 53: *Section 7.9.3.5 Terrestrial Food Web Exposures: Subsurface Soil, page 7-49. Please recap how and why these COPCs were eliminated from further evaluation as COCs. For example, reiterate why vanadium was dropped despite having a HQ greater than 1.0 for all three bird species in Table 7-24.*

Navy Response: Section 7.9.3.5 will be revised to briefly explain why ecological COPCs identified in Step 2 of the SERA were not identified as ecological COCs in Step 3a of the BERA.

PREQB Page-Specific Comment 54: *Section 7.10.1 Methodology for CAO Development, page 7-49 and Table 7-26. Avian CAOs should be based on the lowest available NOAELs, rather than LOAELs, but it is not clear from this discussion that NOAELs were chosen from Table 7-6 and used to derive the avian CAOs. Please revise the text discussion and footnote Table 7-26 to document which NOAELs were applied from Table 7-6. Also, in the CAO formula, please replace "SV" (ingestion-based screening value) with the more appropriate term "TRV" (toxicity reference value).*

Navy Response: The CAOs developed for terrestrial avian omnivore dietary exposures to ecological COCs in surface soil are based on NOAELs. It is noted Section 7.10 (Methodology for CAO Development) will be deleted from the Revised Final CMS Report and replaced by an evaluation of ecological risks using analytical data collected in accordance with the Final Soil Sampling Strategy for Disturbed Soil Sampling dated June 21, 2010. CAOs will be developed for those chemicals identified as ecological COCs by this risk evaluation and presented within Section 7.12 of the Revised Draft CMS Report.

PREQB Page-Specific Comment 55: *References, page 7-53. The reference for Parker et al. is missing a date, which was cited in the text as 2003.*

Navy Response: The missing date (i.e., 2003) will be added to the Parker et al. reference.

PREQB Page-Specific Comment 56: *Page 8-2, Section 8.3.1.1. Please clarify why this HHRA is referred to as a revised HHRA in this section. There is no indication in previous sections that this HHRA is an update of a previous investigation.*

Navy Response: The HHRA will be revised as follows. The HHRA will be presented in two parts. In Section 8.3 (Revised Original HHRA), the HHRA methodology is described, and soil and groundwater data collected during the 2008 CMS field investigation are re-evaluated: (a) to incorporate updates to screening and toxicity values, exposure assessment methodologies, and exposure parameters used in the original HHRA and (b) to support the decision to limit the analysis of 2010 data to inorganics (based on the lack of organic COCs identified from the 2008 data). In Section 8.4 (2010 Disturbed Soil Sampling Investigation HHRA), soil and sediment data collected as part of the Disturbed Soil Sampling Investigation are evaluated. In order to address potential risks at the SWMU as a whole, the conclusions drawn from the Revised Original HHRA, as well as those from the 2010 Disturbed Soil Sampling Investigation HHRA are collectively summarized in Section 8.5 (Combined Conclusions for 2008 and 2010 Investigations). Based on these revisions the term "revised HHRA" will be changed to "Revised Original HHRA" in Section 8.3.1.1.

PREQB Page-Specific Comment 57: *Page 8-3, Section 8.3.1.2, paragraph 1. Please clarify why EPA Region 3 guidance is referenced as this site is located in EPA Region 2. Also, please indicate where EAP Region 3 guidance procedures were used in identifying COPCs. There is no reference to this guidance in Sections 8.3.1.2.1 and 8.3.1.2.2.*

Navy Response: References to EPA Region 3 guidance will be removed from Section 8.0.

PREQB Page-Specific Comment 58: *Page 8-4, Section 8.3.1.2.1, Blank Concentrations. Please revise the document to reflect the actual data validation methodology used, consistent with the CMS workplan and Region 2 guidelines. The text states that results were considered as positive results only if they exceed 10x the maximum amount detected in the associated blank for common contaminants and 5x the maximum amount detected for the remaining contaminants. The text also states that this methodology was used during data validation prior to selection of the COPCs. However, it should be noted that the validator did not use this methodology for qualifying data due to blank contamination. As per the CMS Work Plan, Region 2 data validation guidelines were followed. In general, if the sample result was detected at a concentration below that detected in the blank, the result was qualified as nondetect (U) at the reported concentration.*

Navy Response: Section 8.3.1.2.1 will be revised to remove the data validation methodology discussion and state the following:

> In conjunction with concentration comparisons to the USEPA Regional SLs, a comparison to concentrations detected in field and laboratory blanks was conducted by a third-party data validator, to ensure that only site-related contaminants are evaluated in the quantitative estimation of human health effects.

PREQB Page-Specific Comment 59: *Page 8-5, Section 8.3.1.2.2, Surface Soil. Trans-1,4-Dichloro-2-butene is identified as a COPC on Table 8.1. Please clarify why this contaminant is not included as a COPC in the text.*

Navy Response: Trans-1,4-Dichloro-2-butene was inadvertently omitted from the COPC discussion. Section 8.3.1.2.2 will be revised to include this chemical as COPC.

PREQB Page-Specific Comment 60: *Page 8-7, Section 8.3.2, paragraph 2. The final USEPA RAGS Part E guidance (2004) states that it "incorporates and updates principles of the EPA interim report, Dermal Exposure Assessment: Principles and Applications." Therefore, the 1992 Dermal Exposure Assessment guidance should not be used as a reference. Please remove this reference from the text and update the HHRA, if necessary, to ensure consistency with the final RAGS Part E guidance.*

Navy Response: The 1992 Dermal Exposure Assessment guidance will be removed from the HHRA.

PREQB Page-Specific Comment 61: *Page 8-8, Section 8.3.2.1, paragraph 2. Excavation of soils may or may not occur and future industrial worker exposure to combined surface and subsurface soil may not occur. Therefore, for the industrial worker, two datasets should be evaluated, one comprised of surface soil and one comprised of surface and subsurface soil, or only evaluate the dataset (surface or combined surface and subsurface soil) that has the higher contaminant concentrations. The same dataset should also be used to evaluate a future trespasser as a trespasser may be exposed to the same combined surface and subsurface soils as a future commercial/industrial worker. Also, the depth of soils to which construction worker exposure may occur should be based on construction practices, not the maximum depth that soil samples were collected. Please discuss the basis for assuming excavation activities typically reach a depth of 9 to 11 feet bgs in Puerto Rico.*

Navy Response: The soil exposure pathway evaluation in the SWMU 69 HHRA will be revised as follows. COPCs will be selected from both surface soil (0 to 1 foot bgs) and total soil (0 to 11 feet bgs). Note that analytical results from subsurface soil samples collected from the 9 to 11 feet bgs interval will be included in the total soil data set used in the HHRA because 10 feet bgs is included in this interval. EPCs will be calculated for the surface soil and total soil COPCs, and the higher of the two EPCs for each COPC will be used in the risk calculations to produce a conservative risk estimate. For COPCs having

less than four detected concentrations or less than eight samples in the dataset, the maximum detected concentration will be used as the EPC for that data grouping. Section 8.0 text and associated tables, figures, and appendices will be revised accordingly.

The depth of soil to which construction worker exposure may occur is based on construction practices at NAPR rather than the maximum depth soil samples were collected. This will be reflected in Sections 8.2 and 8.3.2.1. It should be noted that the maximum depth of 10 feet bgs to which human exposure is evaluated at NAPR was agreed upon in the January 9, 2002 conference call between the Navy, USEPA, and PREQB.

PREQB Page-Specific Comment 62: *Page 8-8, Section 8.3.2.1, paragraph 3. The use of vapor intrusion screening criteria to evaluate direct inhalation exposure to volatile contaminants in groundwater by construction workers is inappropriate. The vapor intrusion screening criteria were developed to assess vapors volatilizing from groundwater through the vadose zone into a building, not volatilizing directly from water into a trench. The Regional SL calculator can be used to calculate a screening level using only the inhalation component (zeroing out all other exposure parameter inputs for ingestion), adjusting the exposure frequency, exposure duration and exposure time to reflect construction worker exposure scenario values. Using the inhalation during showering component of this calculator more closely models the inhalation of volatiles in a trench than the vapor intrusion screening criteria. Please revise the HHRA accordingly.*

Navy Response: Section 8.3.2.1 will be revised to discuss that the volatile compounds in groundwater were compared to both Regional Screening Levels (RSLs) and vapor intrusion screening criteria to determine if volatiles in groundwater should be evaluated directly and/or indirectly.

PREQB Page-Specific Comment 63: *Page 8-11, Section 8.3.2.5, paragraph 3. Please provide further information on the basis for the inhalation rates selected for the adult and adolescent trespasser, as there are many different inhalation rates presented in the reference.*

Navy Response: The HHRA will be revised to remove the inhalation rates for all receptors because of the application of USEPA's 2009 Supplemental Guidance for Inhalation Risk Assessment (RAGS Part F).

PREQB Page-Specific Comment 64: *Page 8-12, Section 8.3.2.5, paragraph 4. Please obtain dermal factors from the supporting tables for the regional SLs. Please revise the HHRA accordingly. This comment applies elsewhere in the text where Region 3 dermal values are referenced.*

Navy Response: The HHRA will be revised to obtain dermal factors from the RSL tables where available. Additionally, references to Region 3 dermal values will be removed from the HHRA.

PREQB Page-Specific Comment 65: *Page 8-12, Section 8.3.2.5, paragraph 6. Please provide further information on what activity pattern was selected from the reference to represent the respiration rate for this receptor.*

Navy Response: Please refer to response to PREQB Page-Specific Comment 63.

PREQB Page-Specific Comment 66: *Page 8-13, Section 8.3.2.5, paragraph 9. For consistency with other risk assessments conducted in Puerto Rico, please use the ingestion rate of 330 mg/day and an adherence factor of 0.3 mg/cm^2 presented in the Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) for the construction worker.*

Navy Response: The ingestion rate and adherence factor for the future construction worker will be revised to 330 mg/day and 0.3 mg/cm^2, respectively, as per the December 2002 SSL Guidance and as agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB.

PREQB Page-Specific Comment 67: *Page 8-13, Section 8.3.2.5, paragraph 10. This paragraph appears inconsistent with Section 8.3.2.1, paragraph 3, which states that it is not necessary to evaluate direct and indirect inhalation of volatiles from groundwater. This paragraph indicates that inhalation of volatiles will be evaluated. Please clarify this apparent discrepancy.*

Navy Response: Section 8.3.2.5, Future Adult Industrial/Commercial Workers, will be revised to state that inhalation of volatiles was not quantitatively evaluated.

PREQB Page-Specific Comment 68: *Page 8-17, Section 8.3.4.3, paragraph 2. The lead model used to calculate the screening criteria, the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) model, assumes an average lead concentration as an input to the model. Therefore, a discussion of the average (arithmetic and 95% UCL of the mean) lead concentration at the site would be beneficial in this section.*

Navy Response: As future residential land use will conservatively be evaluated for SWMU 69, (refer to Navy Response to EPA General Comment 3), the IEUBK model will be used to evaluate lead concentrations detected in the soil at SWMU 69, and the average lead concentration in soil will be included in Section 8.3.4.3.

PREQB Page-Specific Comment 69: *Pages 8-17 to 8-20, Section 8.3.5. Please revise this section to provide a discussion of the level of uncertainty (low, medium or high) that each source of uncertainty imparts to this risk assessment.*

Navy Response: Note that in the revised HHRA, the uncertainties section will become Section 8.3.6. As such, Section 8.3.6 will be revised as indicated in the comment.

PREQB Page-Specific Comment 70: *Page 9-1, Section 9.1, paragraph 2. According to Figure 9-1 sampling point 69SB11 doe not exceed for cadmium as it is mentioned at the text. Table 9-1 does not include point 69SB14 as having concentrations above the final CAO, instead 69SB15 is repeated. Appropriate corrections should be made at the text, tables and figures were necessary.*

Navy Response: In support of the conversion of the airfield to a commercial facility by the Puerto Rico Ports Authority (PRPA), soil that had been previously characterized as part of SWMU 69 was disturbed by a PRPA contractor thereby resulting in a significant alteration of the physical conditions of the site as well as a potential redistribution of the contaminants of concern (COCs). Section 9.0 (including tables and figures) will be revised to reflect the additional surface and subsurface soil sampling investigation conducted from August 3 to 6, 2010.

PREQB Page-Specific Comment 71: Section 9.1 Surface Soil, page 9-2. *The closing statement in the second paragraph represents a premature and inadequately supported conclusion: "Soil samples collected closer to the drainage ditch did not exhibit exceedances of the CAOs indicating limited contaminant migration south of the site toward the drainage ditch." Because even the samples collected nearest to the ditch are located 50 to 100 feet from the ditch and may be located on a slope rather than in the lowest-lying, depositional areas of the drainage ditch channel and adjacent forest habitat, this hypothetical statement must be verified by sampling and analyzing soils from depositional areas within the ditch and adjacent forest. Please acknowledge this current data gap and rephrase this sentence as a hypothesis to be tested by supplemental sampling and analysis.*

Navy Response: Please refer to PREQB Page-Specific Comment 70. In addition, the additional soil sampling investigation also included sediment samples collected from the southern and eastern drainage ditches associated with SWMU 69.

PREQB Page-Specific Comment 72: *Sections 9.1 Surface Soil and 9.2 Subsurface Soil, pages 9-1 to 9-2 and Figures 9-1 and 9-2. Please estimate, tabulate and discuss the residual surface and subsurface soil concentrations (95% UCL of mean) and residual HQs for plants and invertebrates, and the American robin that would be attained if the spatial extent of soil removal needed to attain the proposed CAOs in the "hot spots" shown in Figures 9-1 and 9-2 were to proceed.*

Navy Response: Vanadium is the sole Chemical of Concern in soils. The proposed remedial action for surface soil (Figure 9-1) and subsurface soil (Figures 9-2 and 9-3) is removal of soil exceeding the CAO (the upper limit of the mean background concentration of 367 mg/kg) for vanadium and would result in residual soil contamination at or below background concentrations. To evaluate post-remediation contamination, the following samples (which were collected from areas to be remediated) were removed from the dataset: Surface soil (0-1 ft bgs) 69SB122-00, 69SB127-00, 69SB128-00, 69SB129-00, 69SB130-00, 69SB132-00, 69SB133-00, 69SB140-00, and 69SB144-00; subsurface soil (1-2 ft bgs) 69SB122-01, 69SB127-01, 69SB128-01, 69SB129-01, 69SB130-01, 69SB132-01, 69SB133-01, 69SB140-01, and 69SB144-01; and subsurface soil (2-3 ft bgs) 69SB122-02, 69SB129-02, 69SB130-02, and 69SB140-02. The 95 percent UCL of vanadium in airfield background soils is 201.4 mg/kg; the post-remediation 95 percent UCL of vanadium in surface and subsurface soil at SWMU 69 would be 135.7 mg/kg and 201.0 mg/kg, respectively. Corresponding post-remediation HQs for terrestrial plants and invertebrates would be 6.79 in surface soil and 10.05 in subsurface soil (compared to 10.07 under background conditions). Post-remediation HQs for the American robin would be 6.34 in surface soil and 9.4 in subsurface soil (compared to 9.42 under background conditions). UCLs and HQs are summarized in the following table.

	Surface Soil Vanadium 95% UCL (mg/kg)	SS HQ for Terrestrial Plants/ Invertebrates	Subsurface Soil Vanadium 95% UCL (mg/kg)	SB HQ for Terrestrial Plants/ Invertebrates	Surface Soil HQ for American Robin	Subsurface Soil HQ for American Robin
Pre-Remediation	171.8	8.59	237	11.85	8.03	11.08
Airfield Background	201.4	10.07	201.4	10.07	9.42	9.42
Post-Remediation	135.7	6.79	201	10.05	6.34	9.4

95% Upper Confidence Limit (UCL) calculated with ProUCL Version 4.00.05 (USEPA, 2010)
HQ = Hazard Quotient
mg/kg = milligrams per kilogram
SB = Subsurface Soil
SS = Surface Soil
Hazard Quotients for the American robin are based on comparisons to No Observed Effects Levels (NOAELs).

PREQB Page-Specific Comment 73: *Page 11-3, Section 11.1.1. Please clarify that contaminant removal verification is synonymous with confirmatory sampling or include confirmatory sampling in the FSAP.*

Navy Response: Contaminant removal verification is synonymous with confirmatory sampling.

PREQB Page-Specific Comment 74: *Page 11-2, Section 11.1, last paragraph. Confirmatory sampling should be intended to verify effectiveness of the corrective measures implementation. Sampling the*

bottom of the excavation area is recommended. It should be included at the Site-Specific Field Sampling and Analysis Plan that will be prepared and submitted for review.

Navy Response: As discussed in Section 10.1- Description of Remedy and Section 11.1 – Conceptual Design, bottom of excavation confirmatory sampling is proposed at the two foot below ground surface for Areas 1, 3 and 5. However, since the excavation depth for all areas is limited to a maximum depth of three feet below ground surface because of a lack of a complete exposure pathway for ecological receptors below this depth, confirmation samples from the three foot bottom of excavation depth are not required.

PREQB Page-Specific Comment 75: *Tables 6-1, 6-2, 6-3, and 6-4. As discussed under General Comments #1 and 2, please revise these tables to reflect the laboratory's reporting limits and not MDLs for nondetect results. It should be noted that the ECP Phase II data presented in Tables 6-5 and 6-6 reported nondetect results down to the reporting limit, not MDL.*

Navy Response: Please refer to the Navy Response to PREQB General Comment #2.

PREQB Page-Specific Comment 76: *Appendix A, Field Log Book Notes. Section 3.2 (page 3-4) of the CMS Work Plan provides criteria for successful well development as follows:*

- *Clarity of water based on visual determination*
- *A maximum time period (typically two hours for shallow wells)*
- *A maximum borehole volume (typically three to five borehole volumes plus the amount of any water added during the drilling or installation process)*
- *Stability of pH, specific conductance, and temperature measurements (typically less than 10% change between three successive measurements)*
- *Clarity based on turbidity measurements (typically less than 20 NTUs)*

Based on these criteria, it is unclear why the following monitoring wells were not developed for a longer period of time.

69GW11: the final turbidity was 60 NTUs after 36 minutes of development.
69GW12: the final 3 conductivity measurements were not within ±10% and the final turbidity was 41 NTUs after 41 minutes of development.
69GW08: the final 3 conductivity measurements were not within ±10% and the final turbidity was 89 NTUs after 56 minutes of development.
69GW07: the final turbidity was 68 NTUs after 35 minutes of development.
69GW25: the final turbidity was 51 NTUs after 27 minutes of development.

Navy Response: The Final CMS Work Plan for SWMU 69 (Baker, 2007) indicates that the wells will be developed until the water runs relatively clear, although the Work Plan points out that not all wells will clear with continued development. Further, the Work Plan indicated that typical limits placed on development may include any one or a combination of the requirements listed in this comment. However, the Work Plan does not require meeting any or all of these requirements to consider a well developed.

Well 69GW11 is considered developed because more than five borehole volumes of water were removed from the well and pH, temperature, dissolved oxygen and oxidation reduction potential were stable. Well 69GW12 is considered developed because more than five borehole volumes of water were removed from the well; dissolved oxygen, pH and temperature also were stabilized for this well. Well 69GW08 is considered developed because more than five volumes of water were removed from the well and four of

the water quality parameters (pH, dissolved oxygen, temperature and oxidation reduction potential) were stabilized. Well 69GW07 is considered developed because more than five well volumes of water were removed from the well and temperature and pH were stabilized. Well 69GW25 is considered developed because more temperature, conductivity, pH and oxidation reduction potential were stable.

Reference

Baker. 2007. Final Corrective Measures Study Work Plan for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 6, 2007.

PREQB Page-Specific Comment 77: *Appendix A, Field Log Book Notes. Please explain why sample 69GW25 was collected prior to stabilization of ORP. As per Region 2 low flow sampling procedures which are cited as being followed in Section 4.2 of this report, three consecutive ORP readings must be within ±10 mV.*

Navy Response: Groundwater sample 69GW25 was collected after stabilization of ORP. The relative percent difference between the last three consecutive ORP measurements is 9 mV, which is within the ±10mV criteria.

PREQB Page-Specific Comment 78: *Appendix A, Field Log Book Notes. Section 3.2 of the CMS Work Plan states that the cement/bentonite grout of the monitoring wells will be allowed to cure for a minimum of 24 hours prior to well development. Based on the field notes provided in Appendix A, it appears that well development was performed prior to the minimum 24-hour waiting period. Please clarify why this occurred.*

Navy Response: In a limited number of cases (69SB07 and 69SB08), well development was performed prior to the minimum 24 hour waiting period as stated in the approved Work Plan because of an oversight by the field team. This is not expected to significantly adversely impact the groundwater samples; in fact, water quality parameter measurements for both of these wells stabilized within established criteria indicating good communication with aquifer and representativeness of the groundwater sample.

PREQB Page-Specific Comment 79: *Appendix A, Chain-of-Custody Forms. The chain-of-custody forms associated with groundwater samples 69GW26 and 69GW27 were not provided in this Appendix.*

Navy Response: The chain-of-custody form for groundwater samples 69GW26 and 69GW27 has been added to Appendix A.

PREQB Page-Specific Comment 80: *Appendix B, Laboratory Analytical Results. As discussed under General Comments #1 and 2, please revise these tables to reflect the laboratory's reporting limits and not MDLs for nondetect results. It should be noted that the ECP Phase II data presented in this Appendix reported nondetect results down to the reporting limit, not MDL.*

Navy Response: TestAmerica Savannah's process for performing MDL studies is outlined in laboratory SOP SA-QA-007: *Determination and Verification of Detection and Reporting Limits.* This process is performed in accordance with the 40CFR Part 136 Appendix B procedure and includes determining a statistical MDL value using the standard deviation of results from the analysis of a minimum of 7 replicates spiked near the reporting limit. The laboratory has also adopted an MDL verification procedure such that this statistical MDL value is verified via an MDL verification sample and the long term evaluation of method blanks. This verification procedure ensures the laboratory's MDL values are reasonable, consistently recovered, and at least 3 times the background noise. The laboratory's MDL study, MDL verification data, and SOPs are available for review upon request.

The convention for evaluating non-detect values to the MDL is a common industry-wide laboratory practice. This convention is consistent with that outlined in the Department of Defense Quality Systems Manual (DOD QSM) and several other state requirements, including the Florida Department of Environmental Protection, FLDEP, who issues the laboratory's NELAC certification upon which our Puerto Rico certification is based.

Based on the above, no revisions to the text or tables are proposed. This issue is currently awaiting resolution pending the outcome of the Response to Comment Letter for the Draft Phase I RFI for SWMU 60 (Former Landfill at the Marina) dated September 25, 2009. Once this issue is resolved, the final response will be applied to this document. The Navy position is that no revisions to the text or tables are proposed.

FINAL CORRECTIVE MEASURES STUDY REPORT - SWMU 69

For NAVAL ACTIVITY PUERTO RICO
EPA I.D. No. PR2170027203
CEIBA, PUERTO RICO

Prepared for:

Department of the Navy
NAVFAC SOUTHEAST
North Charleston, South Carolina

Prepared by:

Baker

Michael Baker Jr., Inc.
Moon Township, PA

Contract No. N62470-10-D-3000
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IQC for A/E Services for Multi-Media Environmental Compliance Engineering Support

FINAL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69

NAVAL ACTIVITY PUERTO RICO
EPA I.D. NO. PR2170027203
CEIBA, PUERTO RICO

APRIL 26, 2013

Prepared for:

DEPARTMENT OF THE NAVY
NAVFAC SOUTHEAST
North Charleston, SC

Under:

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DELIVERY ORDER JM01

Prepared by:

MICHAEL BAKER JR., INC.
Moon Township, Pennsylvania

I certify under penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that this document and its attachments were prepared either by me personally or under my direction or supervision in a manner designed to ensure that qualified and knowledgeable personnel properly gather and present the information contained therein. I further certify, based on my personal knowledge or on my inquiry of those individuals immediately responsible for obtaining the information, that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowingly and willfully submitting a materially false statement.

Signature _____

Name:_____

Title:_____

Date:_____

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ATTACHMENTS

Attachment 1 – UST 794 Site Characterization Sample Locations

LIST OF ACRONYMS AND ABBREVIATIONS

ABS	Dermal Absorption
ADAF	Age-Dependent Adjustment Factors
AET	Apparent Effects Threshold
AF	Adherence Factor
AFWTF	Atlantic Fleet Weapons Training Facility
ALM	Adult Lead Model
APA	Aerial Photography Analysis
AST	Above-ground Storage Tank
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
AUF_j	Area Use Factor for receptor j
BAF	Bioaccumulation Factors
Baker	Michael Baker Jr., Inc.
BB&L	Blasland, Bouck & Lee, Inc.
BCF	Bioconcentration Factors
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BRAC	Base Realignment and Closure
BTAG	Biological Technical Assistance Group
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BW	Body Weight
BW_j	Body weight of receptor j
BW_r	Body weight of receptor species
BW_t	Body weight of test species
CADD	Computer Aided Design and Drafting
Cal EPA	California Environmental Protection Agency
CAOs	Corrective Action Objectives
CCC	Continuous Criteria Concentrations
CCME	Canadian Council of Ministers of the Environment
CDI	Chronic Daily Intake
CDI_i	Chronic Daily Intake of contaminant i
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
cm^2	Square centimeters
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
CNO	Chief of Naval Operations
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CRQL	Contract Required Quantitation Limit
CSF	Cancer Slope Factor
CSF_i	Cancer Slope Factor for compound i
CT	Central Tendency
CY	Cubic Yards

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

DAD	Dermally Absorbed Dose
DAD_i	Dermally Absorbed Dose of contaminant i
DDT	Dichlorodiphenyltrichloroethane
DI	Deionized
DI_{xj}	Dietary intake of chemical x by receptor j
DMMP	Dredged Material Management Program
DO	Delivery Order
DoN	Department of the Navy
DPT	Direct Push Technology
DRO	Diesel-Range Organics
DGPS	Differential Global Positioning System
E2SS3	Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen
E2US3	Estuarine, Intertidal, Unconsolidated Shore, Mud
E2US4	Estuarine, Intertidal, Unconsolidated Shore, Organic
EC	Exposure Concentration
EC_i	Exposure Concentration for contaminant i
EC_{50}	Median Effective Concentration
ECOSAR	Ecological Structure Activity Relationships
ECO-SSL	Ecological Soil Screening Level
ECP	Environmental Condition of Property
ED	Exposure Duration
EF	Exposure Frequency
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
EqP	Equilibrium Partitioning
ERA	Ecological Risk Assessment
ER-L	Effects Range-Low
ER-M	Effects Range-Medium
ESCP	Erosion and Sediment Control Plan
ET	Exposure Time
F	Fahrenheit
FCVs	Final Chronic Values
FC_{xi}	Maximum concentration of chemical x in food item i
FID	Flame Ionization Detector
FIR	Food Ingestion Rate
FIR_j	Food Ingestion Rate for receptor j
FOD	Frequency of Detection
FSAP	Field Sampling and Analysis Plan
GIS	Geographic Information System
GPS	Global Positioning System
GRO	Gasoline-Range Organics
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

HM	Hazardous Material
HMW	High Molecular Weight
HQ	Hazard Quotient
HSA	Hollow-Stem Auger
IAS	Initial Assessment Study
IC_{50}	Median Inhibition Concentration
ICM	Interim Corrective Measure
ICSAB	Interference Check Sample Solution AB
IDW	Investigation-Derived Waste
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Incremental Lifetime Cancer Risk
IR	Ingestion Rate
IRIS	Integrated Risk Information System
ISQG	Interim Freshwater Sediment Quality Guideline
IUR	Inhalation Unit Risk
K_d	Adsorption Coefficient
kg	kilogram
kg/day	kilogram per day
K_{oc}	Organic Carbon Partition Coefficient
K_{ow}	Octanol-Water Partition Coefficient
K_p	Permeability Constant
LANTDIV	Naval Facilities Engineering Command, Atlantic Division
LC_{50}	Median Lethal Concentration
LCS	Laboratory Control Sample
LD_{50}	Median Lethal Dose
L/day	Liters per day
LEL	Lowest Effect Level
LLC	Limited Liability Corporation
LLPAH	Low-level Polynuclear Aromatic Hydrocarbon
LMW	Low Molecular Weight
LOAEC	Lowest Observed Adverse Effect Concentration
LOAELs	Lowest Observed Adverse Effects Levels
LOEC	Lowest Observed Effect Concentration
LOEL	Lowest Observable Effects Levels
MATC	Maximum Acceptable Toxicant Concentration
MC	Macro-Cores®
MDL	Method Detection Limit
mg	Milligram
mg/cm^2	Milligrams per Square Centimeter
MGD	Million Gallons per Day
mg/day	Milligrams per Day
mg/kg	Milligrams per Kilogram
mg/kg/day	Milligram per Kilogram per Day
mg/kg-BW/day	milligrams of chemical per kilogram body weight per day
m^3/hr	Cubic meters per hour

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

MHSPE	Ministry of Housing, Spatial Planning and Environment
MTBE	Methyl-Tert-Butyl Ether
MRL	Method Reporting Limit
MMOA	Mutagenic Mode of Action
MSDS	Material Safety Data Sheet
MS/MSD	Matrix Spike/Matrix Spike Duplicate
$\mu g/m^3$	Micrograms per Cubic Meter
µg/dl	Micrograms per Deciliter
µg/L	Micrograms per Liter
NAD	North American Datum
NAPR	Naval Activity Puerto Rico
NAVFAC	Naval Facilities Engineering Command Atlantic Division
NAWQC	National Ambient Water Quality Criteria
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facility Engineering Service Center
NFPA	National Fire Protection Act
NOAA	National Oceanic and Atmospheric Administration
NOAEC	No Observed Adverse Effect Concentration
NOAELs	No Observed Adverse Effects Levels
$NOAEL_r$	NOAEL for the receptor species
$NOAEL_t$	NOAEL for the test species
NOEC	No Observed Effects Concentration
NOEL	No Observed Effects Level
NPL	National Priorities List
NSRR	Naval Station Roosevelt Roads
NTU	Nephelometric Turbidity Unit
OECD	Organization for Economic Co-Operation and Development
ORNL	Oak Ridge National Laboratory
OVA	Organic Vapor Analyzer
PAH	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDF_i	Proportion of diet composed of food item i
PDS	Proportion of diet composed of soil
PEC	Probable Effect Concentration
PEF	Particulate Emission Factor
PEL	Probable Effect Level
PEM1	Palustrine Emergent Persistent
PI	Photo Identified
PID	Photoionization Detector
PMO	Program Management Office
POL	Petroleum, Oils and Lubricant
PPRTVs	Provisional Peer Reviewed Toxicity Values
ppt	Parts Per Thousand
PRDNR	Puerto Rico Department of Natural Resources

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

PREQB	Puerto Rico Environmental Quality Board
PRPA	Puerto Rico Ports Authority
PRWQS	Puerto Rico Water Quality Standards
PRWQSR	Puerto Rico Water Quality Standards Regulation
PSI	Physical Site Inspection
PSQG	Provincial Sediment Quality Guideline
PVC	Polyvinyl Chloride
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfC_i	Reference Concentration for contaminant i
RfD	Reference Dose
RfD_i	Reference Dose of contaminant i
RL	Reporting Limit
RME	Reasonable Maximum Exposure
RRF	Relative Response Factor
RSL	Regional Screening Levels
RTK	Real-time Kinematic
SAR	Structure Activity Relationships
SC_x	Maximum concentration of chemical x in soil
SDG	Sample Delivery Group
SE	Southeast
SEL	Severe Effect Level
SERA	Screening Level Ecological Risk Assessment
SF	Square Feet
SID	Screening Information Database
SL	Screening Level
SQAG	Sediment Quality Assessment Guideline
SQG	Sediment Quality Guideline
SQUIRTs	Screening Quick Reference Tables
SSLs	Soil to Groundwater Screening Levels
STSC	Superfund Health Risk Technical Support Center
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TEC	Threshold Effect Concentration
TEL	Threshold Effect Level
TGO™	Trimble Geomatics Office
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Values
TRV_x	NOAEL-based TRV for chemical x
UCL	Upper Confidence Limit
ULM	Upper Limit of the Means
UNEP	United Nations Environmental Program
USACE	United States Army Corp of Engineers

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
VDEQ	Virginia Department of Environmental Quality
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
%D	Percent Difference
%R	Percent Recovery

1.0 INTRODUCTION

This document presents the results of the Corrective Measures Study (CMS) investigation conducted for Solid Waste Management Unit (SWMU) 69 (Aircraft Parking Area) at Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico, as well as an evaluation of corrective measures to mitigate potential human health and ecological risks. This report has been prepared by Michael Baker Jr., Inc. (Baker), for the Navy Base Realignment and Closure (BRAC) Program Management Office (PMO) Southeast (SE) office under contract with the Naval Facilities Engineering Command (NAVFAC), SE (Contract Number N62470-07-D-0502, Delivery Order [DO] 0002).

The United States Environmental Protection Agency (USEPA) issued a Resource Conservation and Recovery Act (RCRA) § 7003 Administrative Order on Consent (Environmental Protection Agency [EPA] Docket No. RCRA-02-2007-7301) (USEPA, 2007), which identified SWMU 69 (formerly referred to as Environmental Condition of Property (ECP) Site 15) as having documented releases of solid and/or hazardous waste and hazardous constituents. The Administrative Order required preparation of an acceptable work plan to complete site characterization and completion of a CMS to determine the final remedy for the SWMU. The Final CMS Work Plan for SWMU 69 (Baker, 2007) was approved by the USEPA on April 10, 2008. The CMS investigation was conducted in April through June 2008 using the approved work plan.

The Navy submitted a Draft CMS Report on September 12, 2008 (Baker, 2008a). However, in a letter dated December 3, 2008 (Baker, 2008b), the Navy retracted the Draft CMS due to changed site conditions. During the summer of 2008, in support of the conversion of the airfield to a commercial facility by the Puerto Rico Ports Authority (PRPA), soil that had previously been characterized as part of 2008 CMS field investigation was disturbed by a PRPA contractor. Specifically, a PRPA contractor excavated a trench (approximately 12 inches in width and approximately 24 inches in depth) between August 6 and August 8, 2008 for the installation of 2-inch polyvinyl chloride (PVC) conduits for most of the taxiway lighting system. The trench was offset approximately 10 feet from the edge of the concrete or asphalt pavement at the southern portion of the expanded apron. Observations made during a site visit conducted on October 2, 2008 included the following: (Baker 2008b):

- Vegetation (manicured grass of unknown species composition) present along the eastern and southern sides of the concrete apron during CMS field sampling activities were disturbed or lacking.

- In some locations, surface soil, ranging from one inch to approximately 12 inches, was scraped away and not replaced.

- Some of the scraped soil was pushed down slope away from the apron towards a drainage ditch that parallels the southern edge of the apron.

- Scraped soil piles were present at various locations within the SWMU.

These activities resulted in a significant alteration of the physical conditions at the SWMU, as well as a potential redistribution of the chemicals of concern (COCs) identified within the 2008 Draft CMS Report (Baker, 2008a). In response to the observations made during the October 2, 2008 site visit, the Navy submitted a Draft Sampling Strategy for Disturbed Soil, SWMU 69 – Aircraft Parking Area on April 20, 2010 (Baker, 2010a). A Final Sampling Strategy, addressing

USEPA and Puerto Rico Environmental Quality Board (PREQB) comments, was submitted on June 21, 2010 (Baker, 2010).
This Revised Draft CMS Report includes the following:

- A discussion of sampling activities and analytical results associated with the 2008 CMS field investigation and 2010 and disturbed soil field investigation.

- Responses to USEPA and PREQB comments dated January 15, 2009 on the Draft CMS Report (document retracted on December 3, 2008).

This Revised Draft CMS Report also includes revisions based on Navy responses to USEPA and PREQB comments on the Draft CMS Report.

1.1 Purpose of Report

This report has been prepared to complete the characterization of SWMU 69 and serves as the basis for the selection of corrective measures to protect human health and the environment at SWMU 69. This report presents the environmental data, evaluates potential human health and ecological risks, develops COCs and corrective action objectives (CAOs), and develops corrective measures to mitigate identified risks.

1.2 Objectives

The overall objective of this report is to meet the requirement for conducting a CMS at SWMU 69, as specified in the Administrative Order on Consent (USEPA, 2007). The specific objectives addressed in this report include:

- Completion of characterization and delineation of site contaminants

- Identification of specific COCs and their extent at SWMU 69

- Identification of cleanup goals or CAOs for each media/COC

- Evaluation of potential corrective measures that could be implemented at SWMU 69 to meet the CAOs

- Recommendation of a preferred corrective action scenario for this SWMU.

1.3 Organization of the CMS Investigation Report

This CMS Report is organized into 11 sections. Sections 1 and 2 present the purpose and objectives of the CMS Report and provide a brief summary of the background of NAPR and the history and previous investigations at SWMU 69. Section 3 discusses the climatology, topography, and regional geology, hydrology, and hydrogeology for NAPR. Section 4 provides a description of the 2008 CMS investigation field work activities including soil and groundwater sampling, quality assurance/quality control (QA/QC) procedures, and other investigation considerations. Section 5 presents and discusses the physical results of the CMS investigation including the site geology/hydrogeology and other current conditions observed during the investigation. Section 6 presents the results of the chemical analysis performed on the environmental media samples and QA/QC samples collected during the CMS investigation. Analytical results from previous investigations are also included in this section for purposes of

developing a comprehensive view of site contamination. Section 7 discusses the ecological risk assessment (ERA) and development of CAOs based on protection of potential ecological receptors. Similarly, Section 8 provides an evaluation of human health risks, including a baseline human health risk assessment (HHRA) and develops CAOs based on protection of potential human receptors. A comprehensive set of COCs for ecological and human health protection, and a spatial depiction of the extent of contamination associated with these COCs, is provided in Section 9. Section 10 provides justification for a recommended corrective action. Finally, Section 11 discusses the technical approach to implementing the corrective measure at SWMU 69.

1.4 References

Baker, 2007. Final Corrective Measures Study Work Plan for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 6, 2007.

Baker, 2008a. Draft Corrective Measures Study Report for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. September 12, 2008.

Baker, 2008b. Retraction of Draft Corrective Measures Study Report for SWMU 56 and Draft Corrective Measures Study Report for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 3, 2008.

Baker, 2010a. Draft Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area. Naval Activity Puerto Rico, Ceiba, Puerto Rico. April 20, 2010.

Baker, 2010b. Final Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area. Naval Activity Puerto Rico, Ceiba, Puerto Rico. June 21, 2010.

USEPA, 2007. RCRA § 7003 Administrative Order on Consent. In the Matter of: United States The Department of the Navy, Naval Activity Puerto Rico formerly Naval Station Roosevelt Roads, Puerto Rico. Environmental Protection Agency, EPA Docket No. RCRA-02-2007-7301. January 29, 2007.

2.0 BACKGROUND

This section discusses the history and description of NAPR and SWMU 69. This section also includes a summary of the results of previous investigations conducted at SWMU 69.

2.1 NAPR Description and History

NAPR occupies over 8,800 acres on the northern side of the east coast of Puerto Rico along Vieques Passage with Vieques Island lying to the east about 10 miles off the harbor entrance (see Figure 2-1). NAPR also occupies the immediately adjacent islands of Piñeros and Cabeza de Perro, as presented on Figure 2-2. The northern entrance to NAPR is about 35 miles east along the coast road (Route 3) from San Juan. The property consists of 3,938 acres of upland (developable) property and 4,955 acres of environmentally sensitive areas including wetlands, mangrove, and wildlife habitat. The closest large town is Fajardo (population approximately 37,000), which is about 5 miles north of NAPR off Route 3. Ceiba (population approximately 17,000) adjoins the west boundary of NAPR (see Figure 2-1).

The facility was commissioned in 1943 as a Naval Operations Base and re-designated as a Naval Station in 1957. Naval Station Roosevelt Roads (NSRR) operated as a Naval Station from 1957 until March 31, 2004. NSRR was one of the largest naval facilities in the world with more than 100 miles of paved roads, approximately 1,300 buildings, a large scale airfield (Offsite Field), a deep water port, and over 30 tenant commands. NSRR played a major role in providing communication support to the Atlantic and Caribbean areas and also served as a major training site for fleet exercises.

Section 8132 of fiscal year 2004 Defense Appropriations Act, signed into law on September 30, 2003, directed that NSRR be disestablished within six months, and that the real estate disposal/transfer be carried out in accordance with procedures contained in the BRAC Act of 1990. This legislation required that the base closure be conducted in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended by the Community Environmental Response Facilitation Act (CERFA). NSRR has undergone operational closure as of March 31, 2004 and has been designated as Naval Activity Puerto Rico. The mission of NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal of the property. NAPR will continue until the real estate disposal/transfer is completed.

In anticipation of operational closure of NSRR, the Naval Facilities Engineering Command, Atlantic Division (LANTDIV) prepared Phase I/Phase II ECP Reports to document the environmental condition of NSRR. The Draft Phase I Environmental Condition of Property Report dated March 31, 2004 (LANTDIV, 2004) identified new sites at NAPR based on the results of a review of records, an analysis of historic aerial photographs, physical site inspections, and interviews with persons familiar with past and current operations and activities. The new ECP sites had not been previously identified or investigated under existing environmental program areas. A Phase II ECP field investigation was performed in 2004 to conduct environmental sampling to determine if a release/disposal actually occurred at any of the Phase I ECP sites recommended for further evaluation in the Phase I ECP and, if so, whether any potential risk to human health was present. The Final Phase II ECP Report recommended additional sampling (to be undertaken as part of the RCRA Program) at several sites to permit a more detailed assessment (NAVFAC Atlantic, 2005).

The USEPA issued a RCRA 7003 Administrative Order (EPA Docket No. RCRA-02-2007-7301) (USEPA, January 29, 2007), which identifies SWMU 69 (formerly referred to as ECP Site 15) as having documented releases of solid and/or hazardous waste and hazardous constituents and requires an acceptable work plan to complete site characterization and a CMS to determine the final remedy. Following a public comment period, the Consent Order became effective on January 29, 2007.

Ownership of the Air Field parcel (Offsite Airfield) was transferred from the United States Navy to the PRPA on February 7, 2008. The Ports Authority has developed the airfield into a regional airport. However, in accordance with the Administrative Order, the Covenant Deferral Request, and the Quitclaim Deed of transfer, the US Navy maintains responsibility for the investigation and cleanup of SWMU 69.

2.2 SWMU 69 Description and History

SWMU 69 - the Aircraft Parking Area (also known as ECP Site 15) is located in what was the northern portion of NAPR, on the western end of the Offsite Airfield on the northern aircraft parking area, as shown on Figure 2-2. SWMU 69 consists of a portion of the northern aircraft parking apron (approximately 7 acres) and an expanded concrete apron area (approximately 10 acres) also used for aircraft parking. The site layout is shown on Figure 2-3. Also, as shown on Figure 2-3, a drainage ditch parallels the southern edge of the parking apron from west to east with a short branch that runs parallel to the eastern edge of the expanded concrete apron. An estimated 17 acres of the concrete parking apron (including the approximately 10-acre expansion) is sloped to drain towards the southeastern corner of the expanded concrete apron area and into the drainage ditch. Surface water flow in the drainage ditch along the southern border of SWMU 69 is to the southeast past the Day Tank 2437, where it commingles with runoff from the day tank fuel storage area, the Aircraft Hydrant Refueling System, and taxiway.

The aerial photography analysis (APA), presented within the Phase I ECP Report (LANTDIV, 2004), identified this area as photo identified (PI) Site 21, due to the observation of extensive stains on and just off of the apron from 1977-1985. During the APA, as presented in the ECP Report (LANTDIV, 2004) the Navy conducted an extensive analysis of aerial photography, covering the period of 1936 through 1999 from multiple sources (as discussed in the Phase I ECP report). In addition to records review, the Navy used the aerial photographs to identify anomalies (e.g., large spills/stains, ground scars, debris piles, pits, possible disposal areas, etc.) that were not identified in previous investigations. The polygon features shown on Figures 2-3 and 2-4 represent areas of disturbance from the year in which the aerial photograph showed anomalies and were derived as follows:

- 1961 Polygon Feature – Three horizontal, above ground storage tanks (ASTs) were identified just off the aircraft parking area (see Figure 2-4); staining was identified on the concrete apron
- 1964 Polygon Feature – Three ASTs remained just off the aircraft parking area; staining was identified on the apron and extended off its southern edge; standing liquid was also visible off the southern edge of the apron
- 1977 Polygon Feature – Staining was identified on the apron and extended off its southern edge
- 1985 Polygon Feature – Staining was identified on the apron
- 1995 Polygon Feature – Staining was identified on the apron

The three ASTs identified on the aerial photographs were removed sometime between January 1964 and March 1965. No other information pertaining to the ASTs was readily available. The Phase I ECP records review identified the area as part of the aircraft apron, where numerous aircraft were parked throughout its usage period. The physical site inspection of SWMU 69 revealed that most of the area identified as PI Site 21 is now covered by the expanded concrete apron, including the area where the ASTs were located. The expanded concrete apron area is acting as a cap over the potentially contaminated soil areas; no stains or stressed vegetation were observed at the edges of the expanded concrete apron. Interviews identified the area as an aircraft apron and stated that numerous past spills of petroleum, oils, and lubricant (POL) and hazardous materials occurred at the site, and that light aircraft maintenance was also conducted in this area.

Visual evidence of staining on the surface of the southern portion of the expanded aircraft apron was observed during the Phase II ECP investigation performed in 2004 (NAVFAC Atlantic, 2005) (see Photograph A-1 in Appendix A). However, there were no signs of stains in the vegetated areas, nor was stressed vegetation observed in any areas of this site. In addition, five groundwater monitoring wells were observed south of the extended aircraft apron, in the southwestern portion of the site (Photograph A-2). These wells were installed as part of the site characterization investigation for underground storage tank (UST) 794 (Blasland, Bouck & Lee, Inc. [BB&L], 1994). The UST had a capacity of 550 gallons and was used to store diesel fuel for air compressors located in Building 794. The UST was removed in 1993. No other information regarding the dates of use for the UST was readily available.

The 2004 Phase II ECP investigation conducted at this site indicated that soil was impacted by past operations in the area. These impacts are discussed further in Section 2.3.

2.3 Previous Investigations

Previous investigations have been conducted at SWMU 69, including the Phase I ECP and the Phase II ECP investigation. Additionally, an UST site characterization was performed for UST 974, adjacent to the southern border of SWMU 69. The results of the Phase I ECP investigation are discussed in Section 2.2. The results of the other investigations are summarized in the following paragraphs.

A Site Characterization of UST 794 was performed in June and July 1994 by BB&L subsequent to the excavation of the UST in April 1993 (BB&L, 1994). Building 794 housed air compressors for use at the airfield, and the aforementioned UST was used to store diesel fuel for the air compressors. Ten soil borings were advanced as part of the site characterization for soil and groundwater collection. The former Building 794 and associated UST are shown on Figure 2-3. Soil boring and monitoring well locations are shown on Figure 3-1 of the BB&L report, as presented in Attachment 1 of this CMS Report. Subsurface soil samples were collected for field screening using an organic vapor analyzer (OVA). Select samples underwent field screening for total petroleum hydrocarbon (TPH) vapors and/or benzene, toluene, ethylbenzene, and xylenes (BTEX). Twenty samples were submitted for fixed base laboratory analysis for BTEX and TPH. BTEX were not detected, while TPH was detected above the PREQB limit of 100 mg/kg in soil collected at one boring location (794-SB1: 460 mg/kg in soil collected 4 to 6 feet below ground surface [bgs] and 360 mg/kg in soil collected 8 to 10 feet bgs) (BB&L, 1994). Groundwater (borehole) samples were collected from each soil boring and were field analyzed for BTEX and TPH. All field screening results were below detection limits. Five soil borings were converted to monitoring wells, each with a screen interval of 10 to 20 feet bgs. At the time of the well installation, the depth to water across the site was approximately 14 feet bgs (BB&L, 1994). Groundwater was collected from each well and submitted for laboratory analysis of BTEX, methyl-tert-butyl ether (MTBE), and TPH; three samples were also analyzed for polynuclear

aromatic hydrocarbons (PAHs), total naphthalenes, and lead. No groundwater concentrations of benzene, BTEX, MTBE, TPH, PAHs, total napthalenes, or lead exceeded method detection limits or PREQB target levels for UST sites. The site characterization report concluded that subsurface soil contamination was present at the site but that the groundwater was not impacted by the release of fuel compounds.

Visual evidence of staining on the concrete surface of the southern portion of the expanded aircraft apron was observed during the Phase II ECP investigation performed in 2004 (NAVFAC Atlantic, 2005). However, there were no signs of stains in the vegetated areas, nor was stressed vegetation noted in any areas of this site.

During the ECP investigation, a total of five soil borings were advanced around the southern and eastern perimeters of the expanded aircraft apron. As shown on Figure 2-3, four soil borings were established south of the expanded aircraft apron, while one soil boring was located at the corner of the expanded aircraft apron and the original aircraft parking area. One surface soil and one subsurface soil sample was collected from each soil boring location and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals contained in Appendix IX to 40 CRF Part 264, as well as TPH diesel range organics (DRO) and gasoline range organics (GRO). All five soil borings were drilled to a depth of 5 feet bgs. Approximately 1.3- to 3.0-feet of fill material (mainly sand and gravel) was observed. Residual clay was observed immediately below the fill material. No bedrock or groundwater was encountered.

Dibenzo(a,h)anthracene and benzo(a)pyrene were detected in surface soil at concentrations greater than their EPA Region III residential risk-based concentrations (RBCs). However detected concentrations were less than their industrial RBC levels. DRO was detected in two samples at concentrations in excess of the PREQB criteria of 100 mg/kg. Several metals, including arsenic, barium, cadmium, chromium, and vanadium, exceeded their EPA Region III Residential RBCs; however, only arsenic marginally exceeded its Industrial RBC. Lead exceeded its residential screening level of 400 milligrams per kilogram (mg/kg). This metal was not detected at concentrations exceeding the industrial screening level of 800 mg/kg. Among the metals that exceeded screening levels, arsenic, barium, cadmium, and lead also exceeded twice the average detected background concentrations established for surface soil at NAPR. Both vanadium and chromium were present in fairly high concentrations compared to their Residential RBC.

Concentrations of organic compounds and metals in the subsurface soil samples were typically less than the surface soil samples, with the exception of vanadium. In all subsurface soil samples, concentrations of vanadium exceeded both the Residential and Industrial RBCs.

The analytical findings of the ECP showed that in general, the contamination at this site was primarily related to fuel compounds, in particular PAHs and DRO. The DRO concentration detected in surface soil collected at two locations established along the southeastern edge of the expanded apron were 300 mg/kg at15E-03 and 170 mg/kg at 15E-04. Barium, lead, and zinc concentrations were also relatively higher at these locations. The presence of DRO was not verified by the Flame Ionization Detector (FID)/Photoionization Detector (PID) screening during the investigation, indicating that a recent release has not occurred. It was not determined as to whether the TPH DRO detected during the ECP investigation was a result of the Building 794 UST release or a release associated with the Aircraft Parking Area. No groundwater samples were obtained at this site during the ECP investigation, but based on the reduction in concentrations from the surface soil to the subsurface soil collected during the investigation, it was tentatively concluded that groundwater had not been impacted.

The ECP data showed that the surface soil near the expanded apron was impacted. Therefore, the final ECP report recommended continued RCRA corrective measures activities, which was the basis for incorporating SWMU 69 into the USEPA § 7003 Administrative Order and ultimately for conducting this CMS investigation.

The SWMU 69 CMS field investigation was conducted from April through June, 2008. On September 12, 2008, the Navy submitted the Draft CMS Report (Baker, 2008a), which evaluated the analytical data for organics (Appendix IX VOCs and SVOCs) and inorganics (Appendix IX metals) in surface soil and subsurface soil, as well as Appendix IX VOCs, SVOCs, and total and dissolved metals in groundwater.

However, during the summer of 2008, in support of the conversion of the airfield to a commercial facility by the PRPA, soil that had been previously characterized as part of SWMU 69 was disturbed by a PRPA contractor thereby resulting in a significant alteration of the physical conditions of the site as well as a potential redistribution of the COCs. Soil to a depth of approximately 24 inches bgs was believed to have been disturbed. With a significant alteration of the physical conditions, as well as a potential redistribution of the COCs, Baker (in a letter dated December 3, 2008 [Baker, 2008b]) requested that the EPA retract the Draft Corrective Measures Study Report for SWMU 69. As a result of soil disturbance and the need to re-characterize the site, the Navy submitted a Draft Sampling Strategy for Disturbed Soil, SWMU 69 – Aircraft Parking Area on April 20, 2010. The sampling strategy also included sampling of sediment in the southern and eastern drainage ditches, and the soil piles that were created during grading operations.

2.4 References

Blasland, Bouck & Lee, Inc. (BB&L), 1994. Site Characterization Site 794. Roosevelt Roads Naval Station, Ceiba, Puerto Rico. October 1994.

LANTDIV, 2004. Phase I Environmental Condition of Property Report, U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Prepared for Commander, Navy Region Southeast (CNRSE), U.S. Navy, by Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. March 31, 2004.

Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic), 2005. Final Phase I/II Environmental Condition of Property, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia.

USEPA, 2007. RCRA § 7003 Administrative Order on Consent. In the Matter of: United States The Department of the Navy, Naval Activity Puerto Rico formerly Naval Station Roosevelt Roads, Puerto Rico. Environmental Protection Agency, EPA Docket No. RCRA-02-2007-7301. January 29, 2007.

Baker, 2008a. Draft Corrective Measures Study Report for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. September 12, 2008.

Baker, 2008b. Retraction of Draft Corrective Measures Study Report for SWMU 56 and Draft Corrective Measures Study Report for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 3, 2008.

3.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

The physical setting of NAPR was documented in the 1984 Initial Assessment Study (IAS) (Naval Energy and Environmental Support Activity [NEESA], 1984). This information is summarized in the paragraphs that follow.

3.1 Climatology

The climate associated with NAPR is characterized as tropical; warm and humid, with frequent showers occurring throughout the year. A major factor affecting the weather is the pattern of trade winds associated with the Bermuda High, the center of which is in the vicinity of 30° North, 30° West. The prevailing wind direction reflects the easterly trade winds. The area receives a surface flow varying between the northeast to the southeast about 75 percent of the year, and as much as 95 percent of the time in July when the easterly winds are strongest. The differential heating of the land and sea during the day tends to give a more northerly component to the flow on the northern side of the island and a more southerly component on the southern side. During the night, a land breeze causes a prevailing southeasterly flow in the north and a prevailing northeasterly flow over the southern coast. The mean annual wind velocity is 5.5 knots, with a minimum in November and a maximum in August. Gales associated with westward moving disturbances in the trade winds or hurricanes passing either north or south of the area have the highest probability of occurrence from June through October.

Uniform temperatures prevail with small diurnal ranges as a result of insular exposure and the relatively small land areas. The warmest months are August and September, while the coolest are January and February. Mean annual maximum temperatures range from 82.0° Fahrenheit (F) in January to 88.2° F in August, while mean annual minimum temperatures range from 64.0° F in January to 73.2° F in June. The highest maximum temperature recorded was 95.0° F, while the lowest minimum was 59.0° F. Rain usually occurs at least nine days in every month, with an average of 60 inches per year; however, a dry winter season occurs from December through April. About 22 thunderstorm-days occur per year, with maximum frequencies of three days per month from May through October.

In late summer, the mean sky cover begins a steady decrease from a monthly maximum average of 6.5-tenths coverage in September to a minimum monthly average of 4.4-tenths coverage in February. From March through August, the monthly average cloud cover increases steadily from 4.5- to 6.0- tenths coverage during the period. Over the open sea, a maximum of clouds (usually broken stratocumulus) occurs during early morning, with the skies clearing or becoming scattered with cumulus by afternoon. Completely clear or overcast skies are rare during daylight hours, while clear skies frequently occur at night.

The hurricane season is from mid-June through mid-September. During severe hurricanes, maximum winds exceed 95 knots. An average of two tropical storms per year occurs in the study area, one of which usually reaches hurricane intensity.

3.2 Topography

The regional area of NAPR consists of an interrupted, narrow coastal plain with small valleys extending from the Sierra de Luquillo range, which has been severely eroded by streams into valleys several hundreds of feet deep. Slopes of up to 60° are common.

In the immediate area of NAPR, elevations range from sea level to approximately 295 feet. Immediately to the north of the NAPR boundary, the hills rise abruptly to heights of 800 to 1,050 feet above sea level, with the tallest peak located within 2 kilometers of the NAPR boundary. There is a series of three hilly areas on NAPR, two of which separate the southern airfield area from the Port/Industrial, Housing, and Personnel Support areas. The third set of hills is in the Bundy area. These ridgelines not only separate sections of NAPR, but also dictate the degree of allowable development. The ridgeline south of the airfield provides an excellent barrier, which effectively decreases the aircraft-generated noise reaching the Unaccompanied Enlisted Personnel Housing areas to an acceptable level. Relief is low along the shoreline and lagoons and mangrove swamps are common.

3.3 Geology, Hydrology, and Hydrogeology

Subsections 3.3.1 through 3.3.4 present descriptions of the geologic, hydrologic, and hydrogeologic conditions across NAPR. These are generally applicable, but may or may not be specifically-applicable, to the SWMU 69 area. In 2004, Baker conducted a series of Phase II ECP investigations across NAPR (NAVFAC Atlantic, 2005). Subsection 3.3.4 discusses hydrogeologic information collected from SWMU 69 during the Phase II ECP in the context of regional hydrogeology.

3.3.1 Soils

The soil associations found at NAPR are predominantly of two types typical of humid areas, namely the Swamps-Marshes Association and the Mabi-Rio-Arriba-Cayagua Association, as well as the Descalabrado-Guayama Association, which is typical of dry areas. In addition, isolated areas of the Caguabo-Mucara-Naranjito Association, the Coloso-Toa-Bajura Association, and the Jacana Amelia-Fraternidad Association are found at NAPR.

The Swamps-Marshes and Mabi-Rio-Arriba-Cayagua associations cover over one half of NAPR's surface area and are equally distributed. Primarily the Descalabrado-Guayama and Caguabo-Mucara-Naranjito associations cover the remaining area.

The Swamps-Marshes Association consists of deep, very poorly drained soils. This association is found in level or nearly level areas that are slightly above sea level, but are wet, and when the tide is high, are covered or affected by saltwater or brackish water. The soils are sandy or clayey, and contain organic materials from decaying mangrove trees. Coral, shells, and marl at varying depths underlie them. The high concentration of salt inhibits the growth of all vegetation except mangrove trees and in small-scattered patches, other salt-tolerant plants.

The Mabi-Rio-Arriba-Cayagua Association consists generally of deep, somewhat poorly drained and moderately well drained, nearly level to moderately steep soils found on foot and side slopes, terraces, and alluvial fans. Soils of this association at NAPR are basically clayey and are more than 80 inches thick.

The Descalabrado-Guayama Association generally consists of shallow, well drained, strongly sloping to very steep soils on volcanic uplands. Soils of this association are found primarily in the hilly areas located directly inland and adjacent to the soils of the Swamps-Marshes Association.

The Caguabo-Mucara-Naranjito Association consists generally of shallow and moderately deep, well drained, sloping to very steep soils on volcanic uplands. This association consists of soils that formed in residual material weathered from volcanic rocks. This association is represented at

NAPR by soils of the Sabana series, which are found on the side slopes and the hilly terrain west of Langley Drive in the Fort Bundy area. These soils are suited for pasture and woodland. Steep slopes, susceptibility to erosion, and depth to bedrock are the main limitations for farming and for recreation and urban areas.

The Coloso-Toa-Bajura Association consists of deep, moderately well drained to poorly drained, nearly level soils found on floodplains. This soil association extends along the western boundary of NAPR and around the airfield. The soils of this association formed in fine-textured and moderately fine-textured sediment of mixed origin on floodplains. The Coloso soils are deep and somewhat poorly drained; the Toa soils are deep and moderately well drained; and the Bajura soils and Maunabo soils are deep and poorly drained. The Reilly soils, also part of this association, are shallow sand and gravel and are excessively drained; they lie adjacent to streams. The minor soils are Talante, Vivi, Fortuna, Vega Alta, and Vega Baja. The Talante, Vivi, Fortuna, and Vega Baja soils are found on floodplains, while the Vega Alta soils occupy slightly higher positions on terraces.

The Jacana-Amelia-Fraternidad Association consists generally of moderately deep and deep, well drained and moderately well drained, nearly level to strongly sloping soils on terraces, alluvial fans, and foot slopes. This association is represented at NAPR by soils of the Jacana series, which consist of moderately deep, well-drained soils found on the foot slopes and low rolling hills along Langley Drive and just east of the airfield. These soils formed in fine-textured sediment and residuum derived from basic volcanic rocks.

3.3.2 Regional Geology

The underlying geology of NAPR area is predominantly volcanic (composed of lava and tuff), as well as sedimentary (rocks derived from discontinuous beds of limestone). These rocks all range in age from early Cretaceous to middle Eocene. The volcanic rocks and interbedded limestone have been complexly faulted, folded, metamorphosed, and variously intruded by dioritic rocks. This complex geological structuring occurred sometime after the deposition of the limestone during the middle Tertiary, when Puerto Rico was separated from the other major Antillean Islands by block faulting and was arched, uplifted, and tilted to the northeast. Culebra, Vieques, and the Virgin Islands are part of the Puerto Rican block; they are separated from the main island simply because of the drowning that resulted from the tilting.

In addition to the predominant volcanic and sedimentary rock, unconsolidated alluvial and older deposits from the Quaternary period underlie the northwestern and western sectors of the base.

The primary geologic formations on and near NAPR are various beach deposits, alluvium, quartz diorite and granodiorite, quartz keratophyre, the Daguao Formation, and the Figuera Lava. The Peña Pobre fault zone traverses NAPR.

3.3.3 Regional Hydrology

The surface waters that flow across the northeastern plain of Puerto Rico, where NAPR is located, originate on the eastern slopes of the Sierra De Luquillo Mountains. Surface runoff is channeled into various rivers and streams that eventually flow into the Caribbean Sea. The Daguao River and Quebrada Seca Stream (a tributary to Rio Daguao) collect surface waters from the hills immediately north of NAPR and, in periods of heavy rain, flooding on NAPR occurs. The Daguao-Quebrada Seca watershed comprises an area of approximately 7.6 square miles (4,900 acres), and the river falls some 700 feet from its source to sea level. Increased

development in the town of Ceiba, especially in areas adjacent to NAPR's northern boundary, has significantly increased the surface runoff reaching NAPR, causing ponding and erosion in the Boxer Drive area. Boxer Drive, for a major portion of its length, is subject to surface water flooding, as are Hangar 200 and AIMD Hangar 379 and adjacent apron areas. This condition has been alleviated by the construction of a new highway (Route 3) immediately outside the fence and the realignment of Boxer Drive both with attendant storm water management features.

In the low-lying shore areas, seawater flooding results from storms, wind, and abnormally high tides. The tidal ranges in the NAPR area are rather small, with a maximum spring range of less than three feet. The tides are semidiurnal and have a usual range of about one-foot in the main harbor of NAPR.

The quality of surface waters is variable, reflecting the drainage area through which the water flows. Generally, surface waters have high turbidities and bio-organics (naturally occurring organics, such as decay products of vegetable and animal matter) due to the periodic heavy rains that can easily erode soils from steep slopes, exposed areas and disturbed streambeds. Water from alluvial aquifers along the coast of NAPR is of a calcium bicarbonate type, and has high concentrations of iron and manganese. The source of these minerals is unknown, but they may be derived from buried swamp or lagoon deposits.

A seawater-freshwater interface is present in the aquifers throughout the coastal areas of Puerto Rico, usually within a short distance inland of the coastline.

The NAPR potable water treatment plant receives raw water from the Rio Blanco through a 27-inch reinforced concrete pipe that replaced the old, open channel. The intake is located at the foot of the El Yunque rain forest. This buried raw water line traverses a distance of 14 miles from the intake to the NAPR boundary. A raw water reservoir is located at the water treatment plant and has a 45 million gallon capacity. Additionally, there are two fire protection storage reservoirs with a total capacity of 520,000 gallons.

NAPR has been served for over 30 years by the present treatment facility. The plant (Building 88) has a capacity of 4.0 million gallons per day (MGD). Water flows by gravity into a 45 million-gallon raw water storage basin from which the plant draws its supply at a rate of 1.3 MGD on average. Treatment consists of pre-chlorination, coagulation sedimentation, filtration, and post-chlorination.

3.3.4 Regional Hydrogeology

Little information exists concerning the hydrogeology of NAPR. The only known potential sources of groundwater lie in lenticular beds of clay, sand and gravel, and rock fragments, which occur at a depth of less than 30 meters. No wells have been developed on site from these layers. Some wells had been developed upgradient of NAPR in Ceiba, some three kilometers from base headquarters, but were abandoned due to high levels of salinity.

In 2004, Baker conducted a Phase II ECP investigation involving 20 sites throughout NAPR (NAVFAC Atlantic, 2005). Some consistent stratigraphic trends were observed during the ECP. The site hydrogeology can be better understood in the context of NAPR regional geology. For the sake of simplicity, the NAPR regional geology can be divided into three regions:

- Upland areas
- Near-shore flat lands
- Inland flat lands

The upland areas of NAPR includes the hills encompassing the Tow Way Fuel Farm and hospital areas, the hills encompassing the area behind the Exchange, the former Atlantic Fleet Weapons Training Facility (AFWTF) Command, and Fort Bundy area. These upland areas are underlain by bedrock (predominately Gabbro) and exhibit varying degrees of weathering. Typically, the bedrock is overlain be a relatively thin residual soil (i.e., residuum). Residuum is unconsolidated soil, originating from weathered-in-place bedrock. This residuum generally consists of sand, silt, and clay.

The near-shore areas include the mangrove swamp areas as well as the shores of Ensenada Honda and Puerca Bay. The near-shore areas are typically underlain by marine sand layers (with coral and shell fragments), silt and clay layers, and occasional peat layers. In some near-shore areas, particularly by the harbor and Camp Moscrip in the southeastern portion of the base, fill material overlays the marine layers. The fill consists of rock fragments, debris (e.g., brick), sand, silt, and clay.

The inland flat land area generally encompasses the airfield and golf course areas. The inland flat land area is typically underlain by relatively thick residuum. The residuum generally consists predominately of clay. Although the total thickness has not been ascertained, more than eight feet of residuum were encountered in soil boring 69SB25, installed during the 2008 CMS Investigation. Fill material overlays the residuum in some areas, particularly the airfield, and generally consists of sand and gravel with lesser amounts of silt and clay.

SWMU 69 (ECP Site 15) is located in the inland flat lands, in the airfield area. During the ECP investigation, approximately 1.3- to 3.0-feet of fill material (mainly sand and gravel) was observed. Residual clay was observed immediately below the fill material. The borings were not advanced beyond 5-feet bgs, and no bedrock or groundwater was encountered. Additional details regarding the site-specific geology and hydrogeology for SWMU 69 are presented in Section 5.0 of this CMS report.

3.4 References

Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic), 2005. Final Phase I/II Environmental Condition of Property, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia.

Naval Energy and Environmental Support Activity (NEESA), 1984. Initial Assessment Study of Naval Station Roosevelt Roads, Puerto Rico. NEESA 13-051.

4.0 CMS INVESTIGATION ACTIVITIES

This section summarizes the CMS investigation field work, laboratory analysis, and data validation activities that were conducted as part of the CMS. Three field investigations have been conducted at SWMU 69: 2004 Phase II ECP field investigation, 2008 CMS investigation, and 2010 Disturbed Soil Sampling Investigation. The Phase II ECP investigation was conducted in 2004. A description of the Phase II ECP field investigation and associated analytical results were previously presented in the Final Phase I/II Environmental Condition of Property (NAVFAC Atlantic, 2005), and in Section 2.3 of this report. The 2008 CMS Investigation sampling event was conducted from April through June 2008, while the 2010 Disturbed Soil Sampling Investigation was conducted in August and November 2010. The field work for both the 2008 and 2010 investigations was conducted in accordance with the approved Final Corrective Measures Study Work Plan for SWMU 69 (Baker, 2007), and is summarized in the following paragraphs:

2008 CMS Investigation

The SWMU 69 CMS field activities conducted from April through June, 2008 consisted of:

- The collection of surface soil samples from 25 locations, of which, five were from soil borings where subsurface soil samples were also collected. Each surface soil sample was analyzed for Appendix IX VOCs, SVOCs (including low level PAHs [LLPAHs]), and total metals.

- The advancement of a total of seven soil borings with the collection of subsurface soil samples from five of the seven boring locations. Each subsurface soil was analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and total metals.

- The installation of monitoring wells at each of the seven soil boring locations.

- The collection of groundwater samples from each of the seven groundwater monitoring wells. Each groundwater sample was analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and total and dissolved metals.

- Other field activities conducted in support of the CMS investigation at SWMU 69, including utility clearance, groundwater elevation measurement, surveying, management of investigation derived wastes, and QA/QC sampling.

A more detailed discussion of the surface and subsurface soil sampling activities is provided in Section 4.1. Section 4.2 discusses the monitoring well installation and groundwater sampling activities, while Section 4.3 discusses the collection of groundwater level measurements.

The surface soil, subsurface soil, and groundwater samples collected at the SWMU were analyzed at a fixed-base laboratory by Test America located in Savannah, Georgia and the analytical data were validated by an independent third party; DataQual Environmental Services, LLC., of St. Louis, Missouri. A summary matrix identifying the primary environmental samples collected and the analyses conducted on each sample is shown in Table 4-1. Field duplicates and matrix spike/matrix spike duplicate (MS/MSD) samples and the analyses conducted on these samples are also shown in Table 4-1. Other QA/QC samples collected in the field (i.e., trip blanks, field blanks, and equipment rinsates) and the analyses conducted on these samples are shown in Table

4-2. The analytical parameter lists and the contract required quantitation limits are shown in Table 4-3. Field notes containing descriptions of the site activities, field logs, soil boring and well construction records and chain-of-custody records are presented in Appendix A. Analytical results are presented in Appendix B. Data Validation report summaries are provided in Appendix C.

2010 Disturbed Soil Sampling Investigation

As discussed in Section 1.0, the conversion of the airfield to a commercial facility by the PRPA resulted in significant disturbances to soil at SWMU 69. Therefore, analytical results for surface and shallow subsurface soil collected during the 2008 CMS investigation are no longer representative of the current site conditions. The maximum depth of soil disturbance was approximately 2 feet bgs. Therefore, surface soil (0 to 1 foot bgs) and subsurface soil (1 to 3 feet bgs) were collected as described in the Final Sampling Strategy for Disturbed Soil Sampling (Baker, 2010). It is noted that subsurface soil was collected from 1 to 3 feet bgs since the depth of soil disturbance by the PRPA contractor was an estimation. It is further noted that subsurface soil samples collected from depths greater than 3 feet bgs during the 2008 CMS field investigation, as well as groundwater, is still considered representative of SWMU conditions and were used in the ecological and human health risk assessments presented in Sections 7.0 and 8.0, respectively. As part of the sampling strategy, sediment collection activities were proposed within the southern and eastern drainage ditches to account for potential migration of chemicals adhered to soil particles with storm water run-off. Finally, the sampling strategy proposed the collection and analysis of soil from the scraped soil piles observed during the October 2, 2008 site visit. Note that the scraped soil piles are minor features that are remnants of the trenching/backfilling operation and a lack of final grading and not "stockpiles" of soil for disposal.

The disturbed soil field investigation was scheduled to begin on July 20, 2010. However, due to heavy rains and flooding, the investigation was postponed. It should also be noted that as a result of the weather conditions, only "essential personnel" were permitted at NAPR. The disturbed soil sampling was rescheduled and conducted on August 3 - 6, 2010 and consisted of:

- The collection of 52 surface soil and 104 subsurface soil samples. All samples were analyzed for Appendix IX metals.

- The collection of 14 sediment samples from the adjacent drainage ditches. All sediment samples were submitted for laboratory analysis for Appendix IX metals. It should be noted that the proposed sediment samples were not collected from August 3 – 6, 2010, due to the amount rainfall present in the drainage ditch (which at the time was thought to be uncharacteristic). Sediment samples were later collected on November 5, 2010. Additional information regarding sediment sample collection is described in Section 4.4.

- Other field activities were also conducted in support of the 2010 Disturbed Soil Sampling Investigation including surveying, and QA/QC sampling.

The investigation was generally conducted in accordance with the Final CMS Work Plan for SWMU 69 (Baker, December 2007), and the Final Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area (Baker, 2010). It is noted that the soil piles created during 2008 disturbance at the site were not located during the 2010 investigation. Therefore, sampling and analysis of soil piles was not conducted. Also, following sample collection, each

borehole was backfilled with the remaining soil to the extent practicable, in order to minimize the burden of waste disposal. The surface of the borehole was then patched with bentonite grout. As a result, no IDW samples were collected during the 2010 investigation.

The surface soil, subsurface soil, and sediment samples collected from the site were analyzed at a fixed-base laboratory by Test America located in Savannah, Georgia and the data was validated by an independent third party; DataQual Environmental Services, LLC., of St. Louis, Missouri. A summary matrix showing the primary environmental samples collected and the analyses conducted on each sample is shown in Table 4-1. Field duplicates and matrix spike/matrix spike duplicate samples and the analyses conducted on these samples are also shown in Table 4-1. QA/QC samples (trip blanks, field blanks, and equipment rinsates) collected and the analyses conducted on these samples are shown in Table 4-2. The analytical parameter lists and the contract required quantitation limits are shown in Table 4-3. Field notes containing descriptions of the site activities, field logs, soil boring and well construction records, and chain-of-custody records are presented in Appendix A. Analytical results are presented in Appendix B. Data Validation report summaries are provided in Appendix C.

4.1 Surface and Subsurface Soil Sampling

2008 CMS Investigation

Surface soil samples were collected along the southern and eastern edges of the expanded concrete apron area. Samples along the southern edge of the expanded concrete apron were collected in two lines to track potential contaminant movement from the apron area to the nearby drainage ditch. The first line of samples (69SB04, 60SB05, 69SB07, 69SB09, 69SB11, 69SB14, 69SB15, 69SB16, 69SB18, 69SB21, 69SB23 and 69SB24) was collected adjacent to the southern edge of the expanded concrete apron area. The second line of surface soil samples (69SB06, 69SB08, 69SB10, 69SB12, 69SB13, 69SB17, 69SB19, 69SB20 and 69SB22) were collected approximately 50 feet from the edge of the apron area, near the drainage ditch. Three surface soil samples from locations 69SB01, 69SB02, and 69SB03 were collected from the eastern edge of the expanded concrete apron area. A surface soil sample was also collected from soil boring/monitoring well location 69SB27, south of the drainage ditch and approximately 200 feet south of the edge of the expanded concrete apron area. Sample locations are depicted on Figures 4-1 and 4-2.

Surface soil samples were collected from 20 locations using stainless steel spoons and from five locations (69SB07, 69SB08, 69SB11, 69SB12, and 69SB27) using Macro-Cores® during boring advancement. The surface soil samples were collected from a depth of 0 to 1 foot bgs after removing the vegetation from the topsoil/root zones. Soil at each depth interval was transferred to disposable aluminum pie pans, and homogenized using disposable stainless steel spoons before being apportioned into sample containers. The samples were transferred directly into pre-labeled sample jars and placed on ice. Surface soil samples were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals. Surface soil samples for VOCs were not homogenized, rather they were collected using TerraCore kits. . The Terra Core kits included one disposal syringe, one dry weight container, two-40 milliliter (ml) VOA vials (with stir bar) including 5 ml of sodium bisulfate solution, and one-40 ml VOA vial (with stir bar) including 5 ml of methanol solution. Table 4-1 provides a summary of the surface soil samples collected at SWMU 69.

Subsurface soil samples were collected from soil borings 69SB07, 69SB08, 69SB11, 69SB12, and 69SB27 located near the southeastern edge between the apron and drainage ditch. These soil borings were installed to provide data to evaluate the horizontal and vertical extent of contamination in the vicinity of the ECP samples (15E-03 and 15E-04) where elevated

concentrations of DRO and metals were found during the ECP investigation. Soil boring 69SB27 was advanced for installation of a monitoring well, and soil samples were not intended to be collected from this location; however, based on field observations of elevated PID readings, surface and subsurface soil samples were also collected. Additionally, soil borings 69SB25 and 69SB26 were advanced for installation of monitoring wells. Although soil samples were not collected, the lithology was classified in the field. Sample locations for these two borings are depicted on Figures 4-1 and 4-2.

Soil borings were advanced using a direct push technology (DPT) method and samples were collected using 4-foot Macro-Cores®. The DPT rig (Geoprobe 66DT rig operated by JFA Geological and Environmental Scientists) with augering capability was also used for installation of monitoring wells as noted above. Soil boring logs are presented in Appendix A. Subsurface soil samples were collected from pre-established depth intervals of 1 to 3 foot bgs and 9 to 11 foot bgs from four locations as per the approved Work Plan (69SB07-01, 69SB07-05, 69SB08-01, 69SB08-05, 69SB11-01, 69SB11-05, 69SB12-01 and 69SB12-05). Alternate sample intervals were not selected because PID measurements and visual/olfactory screening did not indicate contamination in the borings. The exception was for location 69SB27 where subsurface soil samples were collected from intervals with elevated PID measurements (samples 69SB27-01 and 69SB27-05 which, coincidentally corresponded to the 1 to 3 and 9 to 11 foot depth intervals). Ultimately, this resulted in the collection of a total of 11 subsurface soil samples (including a field duplicate 69SB08-05D). The samples were transferred directly into pre-labeled sample jars and placed on ice. Subsurface soil samples were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals, similar to the surface soil samples, and as summarized on Table 4-1. Subsurface soil sample collection for VOCs included the use of Terra Core kits. The Terra Core kits included one disposal syringe, one dry weight container, two-40 milliliter (ml) VOA vials (with stir bar) including 5 ml of sodium bisulfate solution, and one-40 ml VOA vial (with stir bar) including 5 ml of methanol solution. VOC samples were collected immediately after the sample liner was cut and screened with the PID.

2010 Disturbed Soil Sampling Investigation

Soil borings were advanced using a track-mounted DPT rig (Geoprobe 6610 DT rig operated by GeoEnviroTech, Inc., of San Juan, Puerto Rico). Samples were collected using a 4-foot Geoprobe Macro-Core® (MC) sampler and disposable, clear acetate liners.

Surface soil (0 to 1 foot bgs) and subsurface soil (1 to 2 feet and 2 to 3 feet bgs) were collected adjacent to the southern expanded apron in two rows on a 50-foot by 50-foot grid pattern at 52 grid locations (SB-101 through SB-152) as depicted on Figures 4-1 and 4-2. The sample locations for this sampling event were located within the soil disturbance area (resulting from the excavation of the trench for the electric buried line) to the drainage ditch south of the expanded concrete apron (refer to Figures 4-1 through 4-3). Although surface soil samples 69SB01, 69SB02, and 69SB03 (2008 investigation) were located within the disturbed area adjacent to the eastern end of the expanded apron, these three locations were not re-sampled since contamination was not present and they were outside of the area proposed for excavation in the CMS prior to disturbance of the site. In addition, boring 69SB27 (2008 investigation) was not re-sampled since it was located south of the expanded concrete apron area on the other side of the drainage ditch and was outside of the disturbed area. The field team did not observe staining, presence of debris, or soil piles (created as a result of re-grading activities by the PRPA contractor in 2008). Each grid cell was individually evaluated in the field to determine the most appropriate sample location. This resulted in the collection of one biased sample from each grid cell. This evaluation included accessibility for the drill rig, safety, and general topography. The

field team did not observe contaminated surface soil (i.e., staining) or the presence of debris when selecting the sample locations. Each sample was collected using DPT, which simultaneously yielded both the surface soil (0 to 1 foot bgs) and subsurface soil (1 to 2 and 2 to 3 foot bgs) samples. The soil at each depth interval was taken from the Macro-Cores®, transferred to disposable aluminum pie pans, and homogenized using disposable stainless steel spoons before being apportioned into sample containers. The samples were transferred directly into pre-labeled sample jars and placed on ice. Surface and subsurface soil samples were analyzed for Appendix IX metals, as summarized on Table 4-1. Soil boring logs are presented in Appendix A.

4.2 Monitoring Well Installation and Groundwater Sampling

In 2008, permanent monitoring wells were installed at seven locations outside the southern and eastern edges of the expanded apron. Four monitoring wells were installed between the expanded apron area and the ditch (in the vicinity of the previously discussed ECP samples 15E-03 and 15E-04) at locations 69SB07, 69SB08, 69SB11, and 69SB12 as shown on Figures 4-1 and 4-2.

These four wells were installed to evaluate whether contamination had migrated to the groundwater and the potential extent of such contamination. Two additional monitoring wells were installed at locations 69SB26 and 69SB27 further away from the southern edge of the expanded concrete apron area, on the other side of the drainage ditch. A monitoring well was also installed at location 69SB25 further away from the eastern edge of the expanded concrete apron area. These wells were installed at the locations shown on Figures 4-1 and 4-2, to provide water levels for estimating the direction of groundwater flow and to define the outer extent of any groundwater contamination.

All monitoring wells were installed using DPT with augering capability, as mentioned above in Section 4.1; similarly, soil sampling was conducted as discussed previously.

The wells were constructed of 1-inch or 2-inch ID, Schedule 40 Polyvinyl Chloride (PVC), with flush joint threads. Each well was provided with 10-foot long well screens and installed to straddle the water table. The well screen and bottom cap were set at the bottom of the borehole. The screen was connected to a threaded, flush-joint riser. The annular space around the well screen was backfilled with a well-graded, fine to medium sand as the augers were withdrawn from the borehole. The sand was extended to approximately two feet above the top of the screened interval. An approximately two-foot thick sodium bentonite seal was placed above the sand pack. The bentonite was hydrated with potable water. The annular space above the bentonite seal was backfilled with cement/bentonite grout to prevent surface water from infiltrating into the screened groundwater monitoring zone. An expandable, water tight locking cap or slip-cap with a vent hole was placed at the top of the casing.

All of the monitoring wells were installed with two-foot “stickup” risers to provide visibility because of the vegetation present in these areas. Steel protective casings were placed over the risers and surrounded by concrete pads. The pads were approximately 2 feet by 2 feet (length x width) and 6 inches in thickness (with 2 inches set into the ground outside the casing), and extending 2 feet bgs inside the annular space around the well. For monitoring wells 69SB07, 69SB08, 69SB11 and 69SB12, steel bollards were installed around the concrete pads at the well locations as additional protection and painted a bright color yellow to aid in visibility. The remaining monitoring wells 69SB25, 69SB26 and 69SB27 were not provided with steel bollards (at the time of the investigation, these wells were considered temporary). All wells were equipped with a locking cap installed on the PVC riser or protective steel casing.

Each new monitoring well was developed using overpumping as described in the work plan, after allowing suitable time for the cement/bentonite grout to cure (typically a minimum of 24 hours was allowed). The purpose of well development was to restore the permeability of the formation which may have been reduced by the drilling operations and to remove fine-grained materials that may have entered/accumulated in the well or filter pack. The wells were developed until the discharged water ran relatively clear of fine-grained materials. A record of the well development is provided in the field notes in Appendix A.

Groundwater samples were collected using the USEPA Region II low-flow sampling technique as presented in the work plan. Field parameters of pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential were obtained with the YSI 556 MPS (multi-probe system with flow cell) during sampling, while turbidity was measured using the LaMotte 2020 meter. The groundwater samples were placed into appropriate laboratory supplied containers. The groundwater samples were filtered in the field for the dissolved metals analyses. Field notes summarizing the groundwater parameters collected during well development, purging, and sample collection are provided in Appendix A.
Seven groundwater samples and one duplicate sample were collected for analysis of Appendix IX VOCs, SVOCs (including LLPAHs), and total and dissolved metals, as outlined on Table 4-1.

4.3 Groundwater Level Measurements

The depth to the groundwater surface in the seven monitoring wells at SWMU 69 was measured on May 7, 2008 and again on July 22, 2008. Water levels were measured from the top of PVC riser, and the elevations of the water levels were calculated from the surveyed elevation of the top of riser. The elevations of the tops of risers were surveyed on May 6, 2008 following the methods described in Section 4.6. The water level measurements and elevations are discussed further in Section 5.0.

4.4 Sediment Sampling

As a result of soil disturbance by the PRPA contractor in 2008, as well as surface runoff from the adjacent expanded apron during precipitation events, there is potential for chemical migration with surface soil migration into the drainage ditches. Therefore, the proposed sampling strategy (Baker, June 2010) included sampling of sediment in the southern and eastern drainage ditches.

As noted in previous sections, the disturbed soil sampling event (and sediment sample collection from the adjacent freshwater drainage ditches) was scheduled to begin July 20, 2010. However, due to heavy rains and flooding, only "essential personnel" were permitted at NAPR, limiting the field team from accessing field sampling supplies and equipment stored at Building 1205. As a result, the investigation was postponed. However, the field team was able to access SWMU 69 for a cursory field reconnaissance and note the significant amount of surface runoff (due to excess rainfall) from the aircraft parking area and expanded concrete apron. No other surface water features or sources of influence (culverts or inlets, etc.) were found to contribute to the amount of water in the ditches during the reconnaissance. Therefore, it was assumed that surface water runoff (during precipitation events) from the adjacent parking area/concrete apron directly influences the amount of water present in the ditches.

During the 2008 investigation, water was not present in the ditches, nor were there signs of prolonged soil saturation to conclude the presence of hydric soils. Also, there were no hydrophytes (i.e., plants adapted to grow in water) observed in the ditch (see photo A-6 in Appendix A). White lead tree (*Leucaena leucocephala),* and guinea grass *(Urochloa maxima)*

were noted as the dominant herbaceous and small woody vegetative types that were observed as being similar to those in many other upland areas in and around the airfield. The wetland indicator status for white lead tree is Facultative, or "FAC". FAC plants have a similar likelihood (33-67%) of occurring in both wetlands and non-wetlands. The wetland indicator status for guinea grass is a Facultative Upland, or "FACU-". FACU- plants occur sometimes (1-33%) in wetlands, but occur more often (67%-99%) in non-wetlands. Note that the "-" sign following an indicator status means that the species generally has a lesser estimated probability of occurring in wetlands than species having the general indicator status (i.e., FACU).

The SWMU 69 Draft Sampling Strategy for Disturbed Soil included soil/sediment sample collection for the associated drainage ditches. However, in order to accurately assess the drainage ditches, sample collection was delayed to verify if the water in the ditches would dissipate and revert to conditions similar to those observed in 2008.

The disturbed soil sampling investigation was conducted on August 3 to 6, 2010 and involved the collection of 52 surface soil and 104 subsurface soil samples. The field team noted that a significant amount of water remained in the ditches. However, this was still believed to be uncharacteristic, given the previous field observations made in 2008 (i.e., no water in the ditch). Therefore, the proposed soil/sediment samples were not collected.

On November 5, 2010, a final ditch evaluation was made. The field team noted that water was still present in the drainage ditches, along with signs of soil saturation and the presence of hydric soils. 14 sediment samples (including two duplicate samples – 69SD01D and 69SD02D) were collected as shown on Figures 4-1 and 4-2. All sediment samples were collected using disposable stainless steel spoons. Once collected, each sediment sample was transferred to disposable aluminum pie pans and homogenized before being transferred into labeled sample containers. All sediment samples were analyzed for Appendix IX metals.

Vegetation was noted within the ditch and also along the adjacent riparian areas during sediment sample collection:

No established vegetation was noted within the ditch for sediment samples 69SD06, 69SD07, 69SD08, 69SD10, 69SD11, 69SD12, 69SD13, and 69SD14. However, dominant riparian (areas immediately adjacent to the ditch) vegetation included white lead tree, guinea grass, ocean blue morning glory *(Ipomoea indica)*, and bay biscayne creeping-oxeye (*Sphagneticola trilobata*). The wetland indicator status for white lead tree, ocean blue morning glory, and bay biscayne creeping-oxeye is FAC, while the indicator status for guinea grass is FACU-.

Dominant vegetation within the ditch was noted at sediment samples 69SD01, 69SD02, 69SD03, 69SD04, 69SD05, and 69SD09, and included white lead tree, guinea grass, ocean blue morning glory *(Ipomoea indica)*, and bay biscayne creeping-oxeye (*Sphagneticola trilobata*). Although not considered dominant species, southern cattail (*Typha domingensis*) and knotted spikerush (*Eleocharis interstincta*) were noted in the vicinity of 69SD09. The wetland indicator status for knotted spikerush and southern cattail is obligate ("OBL"). Obligate species occur almost always (99% of the time) in wetlands under natural conditions, but may also occur rarely (<1%) in non-wetlands. The wetland indicator status for white lead tree, ocean blue morning glory, and bay biscayne creeping-oxeye is FAC, while the indicator status for guinea grass is FACU-.

Sediment sample collection notes, including the vegetative species identified during sample collection are provided in Appendix A.

Although no samples were proposed downgradient and beyond the SWMU 69 boundary, the ditch was checked for obvious obstructions that would impact drainage from the ditches associated with SWMU 69. However, no obstructions were noted.

The regional rainfall amounts that accumulated in July 2010 were excessive. The highest 24-hour precipitation total across Puerto Rico for the month of July was 9.03", which fell in Ceiba, Puerto Rico (that 24-hour total was recorded from 8 am July 19th, to 8 am July 20th). Overall, 2010 has been recorded as the wettest year on record, with the San Juan, Puerto Rico area receiving 89.51 inches of precipitation (NOAA, 2010). Although accumulated rainfall amounts in 2010 were excessive; the water present in the ditches for the extended period of time could be due to the following circumstances:

- Lack of routine ditch maintenance;
- Established vegetation that has been impeding flow and allowing water to remain in the ditches over time. A comparison of aerial images (Figures 4-1 and 4-2) show the difference in vegetative growth in the ditches at SWMU 69. The ditch depicted on Figure 4-1 (2006 aerial image) has been maintained, with sparse amounts of vegetation remaining. By comparison, the 2010 aerial image on Figure 4-2 shows persistent vegetation, and little maintenance associated with the ditches. The maintenance in 2006 can be attributed to the field observations made during the 2008 CMS investigation (i.e., no water in the ditch);
- Blockage in the storm sewer system at the airfield.

4.5 Investigation Derived Waste

Disposable sampling tools were used for soil and groundwater sampling to the extent practicable, in order to minimize the generation of liquid investigation-derived waste (IDW) from decontamination. Wastewater from decontamination of the drill rig before and after entering the site were containerized, characterized, and disposed of appropriately.

4.6 Utility Clearance

All proposed boring locations were first checked for the presence of subsurface utilities. A facility map showing all utilities was obtained and the boring locations verified for absence of utilities. The sampling locations were field-located using a survey-grade Global Positioning System (GPS) and the absence of subsurface utilities was field verified. Buried electrical power lines were noted in the vicinity of the site; however, no interferences with the proposed drilling locations were expected.

4.7 Surveying

Prior to entering the field for the 2008 and 2010 sampling events, an electronic "shape file" (which included all proposed sample locations) was uploaded to the GPS data collector. Once in the field, the GPS unit was used to navigate to each sample location. Each sample location was flagged and identified in the field. A detailed discussion of the 2008 and 2010 survey activities are explained below.

2008 CMS Field Investigation

In 2008, after the monitoring wells were installed, their coordinates were more accurately surveyed using Real-Time Kinematic (RTK) GPS methods. RTK GPS surveying employs a GPS base station and a GPS rover that reads satellite carrier phase signals. An elevation was obtained from the top of PVC riser for water level elevation calculations, and a spot ground surface elevation was also obtained. All survey data was downloaded and processed using Trimble Geomatics Office™ (TGO), which is a software application tool used to convert survey data collected in the field into electronic files for use in office application software such as Auto Computer Aided Design and Drafting (CADD).

2010 Disturbed Soil Sampling Investigation

PJDC, Inc. conducted a site survey at SWMU 69 on August 4, 6, and 9, 2010. After the soil borings were advanced, their coordinates were more accurately surveyed using conventional survey methods. Conventional surveying was selected specifically because of the accuracy of data they provide:

+/- 0.01 Vertical
+/- 0.05 Horizontal

Each soil boring advanced at SWMU 69 was surveyed. All survey data was submitted to Baker for use in office application software such as Auto CADD. Coordinates were obtained and input into a CADD/Geographic Information System (GIS) to produce the maps used in this CMS report. The sediment samples were not surveyed using conventional methods. However, the samples were field-located by Baker using the GPS unit as previously described.

4.8 QA/QC Sampling

The following QA/QC samples were collected during the SWMU 69 investigation:

- Field Duplicates
- MS/MSDs
- Trip blanks
- Equipment rinsate blanks
- Field blanks

Tables 4-1 and 4-2 provide a summary of the QA/QC samples collected and their associated laboratory analysis.

4.8.1 Field Duplicates

Field duplicates were collected at the rate of 10 percent of primary environmental samples in accordance with the work plan. Discussed below are the field duplicate samples collected for the 2008 CMS Investigation and the 2010 Disturbed Soil Sampling Investigation.

2008 CMS Field Investigation

Three field duplicate surface soil samples (69SB01-00D, 69SB11-00D, and 69SB21-00D) were collected corresponding to 25 surface soil samples. One field duplicate subsurface soil sample

(69SB08-05D) was collected, corresponding to ten subsurface soil samples. One field duplicate groundwater sample (69GW11D) was collected corresponding to seven groundwater samples. Field duplicates were analyzed for the same parameters as the primary environmental samples, and the results were used to evaluate the field sampling methodology.

2010 Disturbed Soil Sampling Investigation

Six field duplicate surface soil samples (69SB101-00D, 69SB111-00D, 69SB121-00D, 69SB131-00D, 69SB141-00D, and 69SB151-00D) were collected corresponding to 52 surface soil samples. Ten field duplicate subsurface soil samples (69SB104-01D, 69SB107-02D, 69SB114-01D, 69SB117-02D, 69SB124-01D, 69SB127-02D, 69SB134-01D, 69SB137-02D, 69SB144-01D, and 69SB147-02D) were collected, corresponding to 104 subsurface soil samples. Two field duplicate sediment samples (69SD01D and 69SD02D) were collected corresponding to 14 sediment samples. Field duplicates were analyzed for the same parameters as the primary environmental samples and the results were used to evaluate the field sampling methodology.

4.8.2 Trip Blanks

2008 CMS Field Investigation

One trip blank sample was included in each cooler containing samples from the site intended for VOC analysis. A total of six trip blanks (69TB01, 69TB02, 56TB03, 56TB04, QATB01, and 74TB12) accompanied samples from this site. These trip blanks were analyzed for Appendix IX VOCs to evaluate whether cross contamination occurred during shipping of samples.

2010 Disturbed Soil Sampling Investigation

The Disturbed Soil Sampling Investigation only included Appendix IX metals analysis; therefore, no trip blank samples were collected.

4.8.3 Matrix Spike/Matrix Spike Duplicates

2008 CMS Field Investigation

Matrix spike/matrix spike duplicates were collected at the rate of approximately 5 percent of primary environmental samples from soil and groundwater. Two sets of MS/MSDs (69SB01-00MS/MSD and 69SB21-00MS/MSD) were collected corresponding to 25 surface soil samples and one MS/MS (69SB08-05MS/MSD) was collected corresponding to 10 subsurface soil samples. One MS/MSD (69GW11MS/MSD) was collected corresponding to seven groundwater samples. The MS/MSD samples were analyzed for the same parameters as the primary environmental samples and the results were used to evaluate the effect of each type of matrix on the analytical method.

2010 Disturbed Soil Sampling Investigation

Matrix spike/matrix spike duplicates were collected at the rate of approximately 5 percent of primary environmental samples from soil and sediment. Three sets of MS/MSDs (69SB101-00MS/MSD, 69SB121-00MS/MSD, and 69SB141-00MS/MSD) were collected corresponding to 52 surface soil samples and five MS/MSD (69SB107-02MS/MSD, 69SB114-01MS/MSD, 69SB127-02MS/MSD, 69SB134-01MS/MSD, and 69SB147-02MS/MSD) samples were collected corresponding to 104 subsurface soil samples. One MS/MSD (69SD02MS/MSD) was

collected corresponding to 14 sediment samples. The MS/MSD samples were analyzed for the same parameters as the primary environmental samples, and the results were used to evaluate the effect of each type of matrix on the analytical method.

4.8.4 Field Blanks

2008 CMS Field Investigation

One field blank sample (FB01) was collected from laboratory-grade deionized water used as the source water for the equipment rinsate samples. No store bought distilled water was purchased during this investigation, so an additional field blank for store bought distilled water was not necessary. The field blank sample was analyzed for Appendix IX VOCs, SVOCs (including low-level PAHs), and metals, to determine whether the water used for generating the equipment rinsates was free of chemicals at levels of concern for the site.

2010 Disturbed Soil Sampling Investigation

Two field blank samples (69FB01 and 69FB-SD) were collected from laboratory-grade deionized water used as the source water for the equipment rinsate samples. No store bought distilled water was purchased during this investigation, so an additional field blank for store bought distilled water was not necessary. The field blank sample was analyzed for Appendix IX metals, to determine whether the water used for generating the equipment rinsates was free of chemicals at levels of concern for the site.

4.8.5 Equipment Rinsates

2008 CMS Field Investigation

Equipment rinsate samples were collected from the disposable sampling tools and analyzed for the same parameters as the corresponding primary environmental samples. ER03 was collected from a Macro Core liner used for soil sample collection. ER04 and ER05 were collected from tubing that was used for groundwater sampling on two different days. All equipment rinsate samples were analyzed for Appendix IX VOCs, SVOCs, and metals.

2010 Disturbed Soil Sampling Investigation

Equipment rinsate samples were collected from the disposable sampling tools and analyzed for the same parameters as the corresponding primary environmental samples. 69ER01 was collected from a Macro Core liner used for soil sample collection. 69ER02 was collected from a stainless steel spoon and 69ER03 was collected from an aluminum pie pan, each used to assist in soil sample collection. All equipment rinsate samples were analyzed for Appendix IX metals. One additional equipment rinsate sample (69ER-SD) was collected on November 5, 2010 from an unused stainless steel spoon used for sediment sample collection.

4.9 Laboratory Analysis

Fixed-base laboratory analysis was conducted by Test America, Savannah, Georgia. The list of parameters under the analytical program and the Contract Required Quantitation Limits (CRQLs) are provided in Table 4-3.

The data was certified by a Puerto Rico certified chemist. The PR certificate is provided in Appendix C.

4.10 Data Validation

All fixed-base laboratory data was validated by Data Qual Environmental Services, LLC., of St. Louis, Missouri, an independent third party. The USEPA Region II Data Validation Standard Operating Procedures were followed. Validation reports are provided for each Sample Delivery Group (SDG) in Appendix C.

4.11 References

Baker, June 2010. Final Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area. Naval Activity Puerto Rico, Ceiba, Puerto Rico. June 21, 2010.

Baker, December 2007. Final Corrective Measures Study Work Plan for SWMU 69. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 6, 2007.

National Oceanic Atmospheric Administration (NOAA), 2010. Flood Event for Puerto Rico and the U.S. Virgin Islands.
http://www.srh.noaa.gov/images/sju/hydrology/FloodEvents/2010/July2010flood.pdf

Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic), 2005. Final Phase I/II Environmental Condition of Property, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia.

5.0 PHYSICAL RESULTS

The following sections provide a brief discussion of the site conditions at SWMU 69 at the time of the CMS field investigation. The site geology and hydrogeology, as ascertained from the soil boring program and other available information also is described in this section.

5.1 Current Conditions

As shown on Figure 2-3, SWMU 69 consists of approximately 7 acres of the aircraft parking area, approximately 10 acres of the expanded concrete apron area adjacent to the parking area and the soil and drainage ditch south and east of the apron expansion area. At the time of the 2008 CMS investigation, and because of the Base closure, the area encompassed by SWMU 69 was vacant and had not been used for several years. No debris or staining was noted on the concrete apron, and the drainage ditch south of the site was overgrown with brush and tall grass. Figure 7-3 can be referenced for wetland resources located in the vicinity of SWMU 69, and also for a complete overview of the SWMU 69 (and portion of the airfield) drainage ditch system.

Ownership of the airfield parcel (Offsite Airfield) was transferred from the United States Navy to the Puerto Rico Ports Authority on February 7, 2008, and although the Ports Authority has since developed the airfield into a regional airport (Jose Aponte De La Torre Regional Airport).

However, during the summer of 2008, in support of the conversion of the airfield to a commercial facility by the PRPA, soil that had been previously characterized as part of SWMU 69 was disturbed by a PRPA contractor thereby resulting in a significant alteration of the physical conditions of the site as well as a potential redistribution of the COCs. Soil to a depth of approximately 24 inches bgs was believed to have been disturbed. As a result of soil disturbance and the need to re-characterize the site, the Navy submitted a Draft Sampling Strategy for Disturbed Soil, SWMU 69 – Aircraft Parking Area on April 20, 2010. The sampling strategy also included sampling of sediment in the southern and eastern drainage ditches. Detailed topographic mapping is not available for this SWMU. However, based on visual observation of the site during the field activities, it is evident that the aircraft parking area and the concrete apron expansion areas slope to the southeast and that surface water/rainfall runoff is routed to the drainage ditch south and east of the site. During the 2008 CMS Investigation, water was not present in the ditch during the time of the investigation, nor were there signs of prolonged soil saturation to conclude the presence of hydric soils. Also, there were no hydrophytes (i.e., plants adapted to grow in water) observed in the ditch. The dominant herbaceous and small woody vegetative types that were observed are similar to those in many other upland areas in and around the airfield. Those species included white lead tree and guinea grass.

The SWMU 69 Draft Sampling Strategy for Disturbed Soil included soil/sediment sample collection from the associated drainage ditches. Sample collection was scheduled to begin July 20, 2010. However, the field investigation was postponed due to heavy rains and flooding, which resulted in a significant amount of water was present in the SWMU 69 drainage ditches. Sample collection was delayed to verify if the water in the ditches would dissipate and revert to conditions similar to those observed in 2008. On November 5, 2010, a final ditch evaluation was made to determine the proper sample media (i.e., soil or sediment). The field team noted water still present in the drainage ditches, along with signs of soil saturation and the presence of hydric soils. Downgradient areas beyond the SWMU 69 boundary were checked for obstructions that would impact drainage associated with SWMU 69. However, no obstructions were noted.

Based on Figure 7-2, SWMU 69 area is described as "Urban". However, dominant tree/shrub, and herbaceous vegetation documented during the 2010 disturbed soil sampling investigation included white lead tree, guinea grass, ocean blue morning glory , knotted spikerush (*Eleocharis interstincta*), southern cattail (*Typha domingensis),* and bay biscayne oxeye (*spahagneticola trilobata*). Knotted spikerush and southern cattail, are considered obligate (i.e., plants that almost always [99% of the time] occur in wetlands). However, these two species were only noted in the vicinity of sediment sample location 9SD09.

As discussed in section 4.4, the amount of water and prolonged saturation in the SWMU 69 ditches can be associated with the lack of routine ditch maintenance, which has resulted in the overgrowth of vegetation that has been impeding flow and allowing water to remain in the ditches over time. With a lack of routine maintenance and persistence of vegetation, the riparian (banks) associated with SWMU 69 have transitioned from an urban environment, to more of a coastal scrub forest terrestrial habitat type..

Photographs of the site showing 2008 and 2010 site conditions are provided in Appendix A.

5.2 Geology/Hydrogeology

5.2.1 Geology

SWMU 69 is located within the inland flat land area as previously described and stated in Section 3.3.4. A total of seven borings were advanced during the 2008 CMS field effort and seven groundwater monitoring wells were installed at these boring locations (see Figure 4-1 and 4-2). Boring logs for each borehole are presented in Appendix A. A thin layer, generally only a few inches, of topsoil was observed at each boring and this was followed by a layer of lean clay. In some cases a gravelly zone was encountered between the topsoil and lean clay. The gravel and lean clay zones are interpreted as native deposits, while everything above the lean clay and gravel is interpreted as non-native or fill material. Borings 69SB11 and 69SB12 were the only two borings out of seven which encountered a sand and gravel zone at approximately 12 feet below ground surface. This zone may represent an historic water drainage deposition. A geologic cross section was drawn depicting the geologic conditions and water levels relative to well placement and topography from wells 69SB26 to 69SB25. The cross-section A-A' shows the sand and gravel in the area representative of borings 69SB11 and 69SB12. Below the native materials sandy clay is being interpreted as weathered bedrock. A geologic cross section location map is presented as Figure 5-1 and Geologic Cross Section A-A' is shown on Figure 5-2.

5.2.2 Hydrogeology

Groundwater yields at SWMU 69 were observed to be generally good and were estimated between 1 and 2 gallons per minute. Fill material is estimated to be between 6 and 12 feet bgs at SWMU 69. The fill materials are variable in grain size and receive a lot of surface water runoff from the parking pad as it flows toward the drainage ditch. The water table was found near the fill/native soil interface at most wells and ranged from approximately 6 to 10 feet bgs (8 feet bgs on average). Groundwater was difficult to detect during direct push sampling in the borings containing predominately clay rich materials. Groundwater production was more obvious in the natural sand and gravel zones observed in wells 69SB11 and 69SB12.

5.2.3 Aquifer Characterization Testing

Slug tests were performed during the 2008 CMS field investigation at five of the seven newly installed monitoring wells (69SB07, 69SB08, 69SB11, 69SB12 and 69SB25) following completion of well installation, development and groundwater sampling. The purpose of the slug tests was to estimate the hydraulic conductivity of the saturated zone in the immediate vicinity of the monitoring well by measuring the aquifer response to a change in static conditions induced by introduction or removal of a slug of known volume from the well. A 1.5-inch diameter slug (approximately 1.5-inches in diameter by 3 foot long) was used.

Each test was initiated by measuring the static water level in the well and total well depth; these values were recorded in the field notes. A pressure transducer attached to a computerized data logger was then installed in the well and the water levels allowed to re-equilibrate. The slug was introduced into the well and the change in the water level over time was measured for the falling head portion of the slug test. Measurements continued until water levels stabilized at which point the slug was removed from the well and the change in water level was again measured until the water levels stabilized for the rising head portion of the test.

In general, it is better to evaluate unconfined aquifer slug test data using rising head versus falling head (especially when there is a quick response) because the PVC slug does not "smack" the water surface. Therefore, there is less sloshing of the water and masking the groundwater level recovery to equilibrium. In the case of 69SB25, field evaluation of the data indicated a slower recovery and a good data set retrieved and therefore, a rising head test was not performed at this location and the falling head data set was used for evaluation.

The electronic water level measurements were processed using Microsoft Excel and AQTESOLV® for Windows®, version 3.5. The Bouwer and Rice method (Bouwer and Rice, 1976 and 1989) for analyzing slug test data in unconfined aquifers was selected as the solution method. A saturated thickness of 30 feet was used, based on observations made during drilling. The aquifer was assumed to be isotropic and therefore an anisotropy ratio of 1 was used. A boring radius of 0.344 ft and a casing radius of 0.083 ft were used as inputs for all well tests at SWMU 69 for calculating hydraulic conductivity. The remaining input parameters used for calculating hydraulic conductivity, in addition to the time and water level measurements, included initial displacement, total well penetration depth, static water column height and screen length. These parameters varied by well location based on well construction and water level. A summary of the input parameters used for calculating the hydraulic conductivity and the graphical analysis is provided in Appendix A.

The hydraulic conductivity values calculated from the slug test data from each well are summarized on Table 5-1. The average hydraulic conductivity for SWMU 69 was separated showing an average for wells 69SB07, 69SB08, and 69SB25 of 2.22 feet/day for the fractured clay, and an average for wells 69SB11 and 69SB12 of 78.46 feet/day for the sand and gravel.

5.2.4 Groundwater Flow Direction and Velocity

Groundwater levels were measured in each monitoring well using an electronic water level meter to the nearest 0.01 foot. Measurements were taken immediately prior to collecting groundwater samples, prior to conducting the slug tests, on May 07, 2008 and again on July 22, 2008. Water level measurements May 7, 2008 and calculated groundwater elevations are presented on Table 5-2. Groundwater elevation contours are provided on Figure 5-3 for the immediate vicinity of SWMU 69. The localized groundwater flow direction at SWMU 69 is generally towards the east

with an average gradient of 0.005. A regional groundwater flow direction map is presented on Figure 5-4. This figure was generated using groundwater depth measurements collected on July 22, 2008 from numerous wells within the airfield area associated with SWMUs 56, 69, and 74. Regionally, the groundwater flow direction of the airfield is to the southeast toward the wetlands/mangroves in that direction. By multiplying the average hydraulic conductivity obtained from the slug tests with the hydraulic gradient calculated from the localized contours, and then dividing by an effective porosity, an average groundwater flow velocity is calculated as 0.04 feet/day for the fractured clay and 1.12 feet/day for the sand and gravel. These results are based on an effective porosity of 30 percent for the fractured clay and 35 percent for the sand and gravel. The calculated groundwater flow velocities values do not take into account flow retardation factors or contaminant physical properties, but gives a general potential contaminant transport rate.

5.3 References

Bouwer, H., 1989. The Bouwer and Rice Slug Test--An Update, Ground Water, vol. 27, no. 3, pp. 304-309.

Bouwer, H. and R.C. Rice, 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

6.0 ANALYTICAL RESULTS

As discussed in Section 1.0, the conversion of the airfield to a commercial facility by the PRPA resulted in significant disturbances to soil at SWMU 69 (which occurred after the 2008 CMS investigation). Therefore, analytical results for surface and shallow subsurface soil collected during the 2008 CMS investigation are no longer representative of the current site conditions. These activities resulted in a significant alteration of the physical conditions at the SWMU, as well as a potential redistribution of the chemicals of concern (COCs) identified within the 2008 Draft CMS Report (Baker, 2008a). A Disturbed Soil Sampling Investigation was conducted in 2010 to re-characterize the site. A discussion of the analytical results from that investigation is discussed below, while a discussion of the analytical results for 2008 soil data have been incorporated into Appendix B. Note that subsurface soil samples collected from depths greater than 3 feet bgs during the 2008 CMS field investigation, as well as groundwater is still considered representative of SWMU conditions and were used in the ecological and human health risk assessments presented in Sections 7.0 and 8.0, respectively.

This section discusses the results of the laboratory chemical analysis of groundwater samples collected from SWMU 69 during the April to June 2008 CMS investigation, and the soil and sediment samples collected during the 2010 Disturbed Soil Sampling Investigation. 2008 subsurface soil data (greater than 3 feet bgs) are also presented in this section. The laboratory analytical data went through a formal validation process. Complete validated data tables for the 2008 and 2010 CMS investigations are included in Appendix B; in addition, relevant portions of the data validation reports for the 2008 and 2010 CMS investigation for SMWU 69 are provided in Appendix C; a summary discussion of the necessary laboratory level data adjustments to the 2008 and 2010 data is presented in Section 6.4.

6.1 Surface Soils

2010 Disturbed Soil Sampling

Fifty-two surface soil samples (69SB101-00 through 69SB152-00) and six duplicate samples (69SB101-00D, 69SB111-00D, 69SB121-00D, 69SB131-00D, 69SB141-00D, and 69SB151-00D) were collected and analyzed during 2010 Disturbed Soil Sampling investigation at SWMU 69. All of the surface soil samples were analyzed for Appendix IX metals. The detected analytical results for the 2010 surface soil data set are provided in Table 6-6, while the complete data set is provided in Appendix B.

Fifteen metals were detected in the surface soil samples including:

- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium

- Vanadium
- Zinc

Of these fifteen metals, nine were detected in one or more samples at concentrations in excess of the NAPR Airfield background screening value, as shown on Table 6-6. Arsenic exceeded the background screening value (2.34 mg/kg [milligrams per kilogram]) in 28 of 52 samples (and four duplicate samples) with concentrations above background ranging from 2.4 mg/kg in sample 69SB134-00 to 6.2 mg/kg in duplicate sample 61SB101-00D. Barium (470 J mg/kg) only exceeded the background screening value (231 mg/kg) in sample 69SB126-00. Cadmium exceeded the Airfield background screening value (0.65 mg/kg) in 11 of 52 samples (and duplicate samples 69121-00D and 69131-00D) with concentrations above background ranging from 0.67 mg/kg (69SB121-00 and 69SB131-00) to 5.3 mg/kg in sample 69SB115-00. Cobalt exceeded the Airfield background screening value (53.6 mg/kg) in sample 69SB125-00 at a concentration of 64 mg/kg. Lead was detected above the Airfield background screening value (27.9 mg/kg) in 3 of 52 samples, with concentrations of lead above background ranging from 32.0 mg/kg in sample 69SB131-00D to 71 mg/kg in sample 69SB122-00. The Airfield background screening value for mercury (0.11 mg/kg) was exceeded in six samples. The concentrations of mercury detected above background ranged from 0.12 mg/kg in sample 69SB128-00 to 0.18 mg/kg in samples 69SB125-00 and 69SB130-00. Selenium was detected slightly above background (1.85 mg/kg) in two samples, 69125-00 (2.0 mg/kg) and 69126-00 (2.1 mg/kg). Vanadium was detected above background (367 mg/kg) in three samples, 69128-00 (410 mg/kg) and 69132-00 (550 mg/kg), and 69133-00 (370 mg/kg). In sample 69SB115-00, zinc exceeded the Airfield background screening value (112 mg/kg) at a concentration of 200 mg/kg.

Additionally, of the fifteen metals detected in the surface soil samples, several metals (arsenic, barium, cadmium, cobalt, copper, lead, mercury, selenium, thallium, and vanadium) were detected at concentrations exceeding the respective USEPA Soil to Groundwater Screening Values (SSLs) (USEPA, 2011) using the most conservative assumption of a dilution attenuation factor (DAF) of 1. All but copper and thallium also exceeded the NAPR airfield background screening value at one or more locations. Zinc did not exceed its SSL in any sample but did exceed background in one sample. It is noted that, while soil data are compared to SSLs for completeness, groundwater data were collected and evaluated at the SWMU (refer to Section 6.4). Furthermore, the soil and groundwater data were quantitatively evaluated in ecological and human health risk assessments (Sections 7.0 and 8.0, respectively).

6.2 Subsurface Soil

2008 CMS Investigation

Five subsurface soil samples and one duplicate sample were collected and analyzed during the 2008 CMS investigation at SWMU 69. All of the subsurface soil samples were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals. The detected results for the 2008 subsurface soil data set (greater than 3 feet bgs) are provided in Table 6-1, while the complete data set is provided in Appendix B.

Five VOCs were detected in the subsurface soil data set including 2-chloro-1,3-butadiene, 2-hexanone, 4-methyl-2-pentanone, acetone and carbon disulfide. Acetone was detected in two samples and in the duplicate sample with concentrations ranging from 7 J ug/kg in sample 69SB07-05 to 16 J ug/kg in sample 69SB08-05D. The acetone result was rejected for subsurface soil sample 69SB27-05 because the initial and continuing calibration exhibited low relative response factors; non-detected values were rejected. 2-Chloro-1,3-butadiene was detected in one

of the five subsurface soil samples. 2-hexanone and 4-methyl-2-pentanone were each detected in the duplicate sample, 69SB08-05D. For the ECP Phase II investigation, only one VOC, acetone was detected in the subsurface soil at a concentration that did not exceed the screening criteria used for that investigation, as shown on Table 6-5.

One SVOC, bis(2-ethylhexyl)phthalate was detected in one subsurface soil sample, 69SB07-05 at a relatively low concentration (i.e., near the detection limit), as shown on Table 6-1. Two SVOCs, bis(2-ethylhexyl)phthalate and benzo(g,h,i)perylene were detected in the subsurface soil samples collected during the ECP Phase II investigation at low concentrations (i.e., below the method practical quantitation limit), as shown on Table 6-5.

Fourteen metals were detected in the subsurface soil samples collected during the 2008 CMS investigation, including:

- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Vanadium
- Zinc

Of these fourteen metals, two were detected in one or more samples at concentrations in excess of the NAPR airfield background screening value, as shown on Table 6-1. Copper exceeded the NAPR airfield screening value in sample 69SB27-05 and the duplicate sample 69SB08-05; while vanadium exceeded the NAPR airfield screening value in samples 69SB07-05, 69SB27-05 and the duplicate sample 69SB08-05.

2010 Disturbed Soil Sampling

104 subsurface soil samples and 10 duplicate samples were collected and analyzed during 2010 Disturbed Soil Sampling investigation at SWMU 69. All of the subsurface soil samples were analyzed for Appendix IX metals. The detected analytical results for the 2010 subsurface soil data set are provided in Table 6-7, while the complete data set is provided in Appendix B.

Fifteen metals were detected in the subsurface soil samples including:

- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium

- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc

Of these fifteen metals, six were detected in one or more samples at concentrations in excess of the NAPR airfield background screening value, as shown on Table 6-7. Arsenic exceeded the NAPR Airfield background screening value (2.34 mg/kg) in 19 samples (and one duplicate sample 69SB114-01D). Concentrations above background ranged from 2.4 mg/kg (69SB125-02 and 69SB129-02) to 5.9 mg/kg in sample 61SB139-01. Barium exceeded the Airfield background screening value (231 mg/kg) in sample 69SB124-01 at a concentration 240 mg/kg. Duplicate samples 69SB124-01D (250 mg/kg) and 69SB134-01D (270 mg/kg) also exceeded the barium background screening value. Copper exceeded the Airfield background screening value (223 mg/kg) in sample 69SB150-02 at a concentration of 280 mg/kg. The Airfield background screening value for mercury (0.10 mg/kg) was slightly exceeded in 12 samples. The concentrations of mercury detected above background ranged from 0.11 mg/kg (samples 69SB106-01, 69SB121-01, 69SB121-02, 69SB136-02, and 69SB141-01) to 0.18 mg/kg in sample 69SB110-01. Selenium was detected slightly above background (1.85 mg/kg) in three samples, 69101-01 (1.9 mg/kg), 69129-02 (2.2 mg/kg), and 69130-02 (1.9 mg/kg). Vanadium was detected above background (367 mg/kg) in 10 samples (and one duplicate sample 69SB144-01D). The concentrations of vanadium detected above background ranged from 370 mg/kg in sample 69SB140-02 to 580 mg/kg in samples 69SB127-01 and 69SB130-02.

Additionally, of the fifteen metals detected in the subsurface soil samples, several metals (arsenic, barium, cobalt, copper, mercury, thallium, and vanadium) were detected at concentrations exceeding the respective USEPA Soil to Groundwater SSLs using the most conservative assumption of a DAF of 1 (USEPA, 2011). Arsenic, barium, mercury, and vanadium also exceeded the NAPR airfield background screening value at various locations. It is noted that, while soil data are compared to SSLs for completeness, groundwater data were collected and evaluated at the SWMU (refer to Section 6.4). Furthermore, the soil and groundwater data were quantitatively evaluated in ecological and human health risk assessments (Sections 7.0 and 8.0, respectively).

6.3 Sediment

On November 5, 2010, 14 sediment samples (69SD01 through 69SD14) and two duplicate samples (69SD01D and 69SD02D) were collected and analyzed during the 2010 Disturbed Soil Sampling investigation at SWMU 69. All of the sediment samples were analyzed for Appendix IX metals. The detected analytical results for the 2010 sediment data set are provided in Table 6-8, while the complete data set is provided in Appendix B.

Fifteen metals were detected in the sediment samples including:

- Arsenic
- Barium

- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc

Of these fifteen metals, eight were detected in one or more samples at concentrations in excess of the NAPR basewide background screening value, as shown on Table 6-8. Arsenic exceeded the NAPR basewide background screening value (2.83 mg/kg) in six of 14 samples with concentrations ranging from 3.0 mg/kg in sample 69SD08 to 4.8 mg/kg in sample 69SD09. Cadmium exceeded the NAPR basewide background screening value (0.217 mg/kg) in all 14 samples (including duplicate samples), with concentrations ranging from 0.38 mg/kg in sample 69SD04 to 24 mg/kg in sample 69SD07. Chromium exceeded the NAPR basewide background screening value (63.4 mg/kg) for sediment samples 69SD06 (99 mg/kg) and 69SD07 (72 mg/kg). The NAPR basewide background screening value for copper is 160 mg/kg. The concentration for sediment sample 69SD07 is shown as an exceedance on Table 6-8 as 160 mg/kg. No other sediment sample concentrations met or exceeded the airfield background screening value. Lead exceeded the NAPR basewide background screening value (19.4 mg/kg) in nine of 14 samples with concentrations ranging from 21 mg/kg in sample 69SD13 to 680 mg/kg in sample 69SD07. Nickel exceeded the NAPR basewide background screening value (18.1 mg/kg) in samples 69SD06 (34 mg/kg) and 69SD07 (27 mg/kg). In three samples, 69SD05 (350 mg/kg), 69SD09 (370 mg/kg), and 69SD14 (350 mg/kg), vanadium exceeded the NAPR basewide background screening value of 241 mg/kg. Zinc exceeded the NAPR basewide background screening value (148 mg/kg) in samples 69SD06 (450 mg/kg), 69SD07 (490 mg/kg), and 69SD08 (220 mg/kg)

6.4 Groundwater

Seven groundwater samples (69GW07, 60GW08, 69GW11, 69GW12, 69GW25, 69GW26 and 69GW27) and one duplicate sample (69GW11D) were collected and analyzed during the 2008 CMS investigation at SWMU 69. All of the groundwater samples were analyzed for Appendix IX VOCs, SVOCs, total metals and dissolved metals. The detected results for the groundwater data set are provided in Table 6-2. The complete data set is provided in Appendix B.

Three VOCs were detected in the groundwater samples including 2-hexanone, acetone and chloromethane. Chloromethane was detected in groundwater sample 69GW25 at 1.5 J ug/L, 2-hexanone was detected in groundwater sample 69GW26 at 1.1 J ug/L, and acetone was detected in groundwater sample 67GW27 at 15 J ug/L. All detections of VOCs in the groundwater samples are considered low (i.e., near detection limits).

Six SVOCs were detected in the groundwater samples including 3&4 methylphenol, acenaphthene, bis(2-ethylhexyl)phthalate, dibenzofuran, fluorene and phenanthrene. Bis(2-ethylhexyl)phthalate was detected in sample 69GW25 at 0.6 J ug/L. Fluorene and phenanthrene

were detected in sample 69GW26 at concentrations of 0.083 J and 0.28 ug/L, respectively. 3 & 4 Methylphenol, acenaphthene and dibenzofuran were detected in sample 69GW27 at concentrations of 2.1, 0.11 J and 0.36 J ug/L, respectively. All of the detections of SVOCs are considered low (i.e., near detection limits).

Seven total metals were detected in the groundwater samples, including:

- Arsenic
- Barium
- Cadmium
- Cobalt
- Nickel
- Vanadium
- Zinc

None of these total metals were detected at concentrations in excess of the NAPR basewide background screening value for groundwater.

Seven dissolved metals were detected in the groundwater samples, including:

- Arsenic
- Barium
- Cadmium
- Cobalt
- Nickel
- Vanadium
- Zinc

Barium exceeded the NAPR background screening value in two samples, 69GW11 (540 ug/L) and 69GW12 (570 J ug/L) and the duplicate sample 69GW11D (530 ug/L). The remaining detections of dissolved metals did not exceed their respective NAPR basewide background screening values.

Additionally, concentrations of organic and metals detected in groundwater were compared to Puerto Rico Water Quality Standards (PRWQS) (PREQB, 2010). As shown in Table 6-2, there were no chemical concentrations detected in groundwater that exceeded the applicable PRWQS for class SG waters (PREQB, 2010).

6.5 Laboratory Data Validation Summary

A discussion of the compounds detected in the Field QA/QC samples is presented in Sections 6.5.1 and 6.5.9. A summary of the data validation findings, as they relate to each sample delivery group (SDG), are discussed in Sections 6.5.2 through 6.5.23 below. Data validation reports are included in Appendix C. In addition, the Puerto Rican Chemist Certifications for each Test America SDG are also presented in Appendix C.

6.5.1 Summary of Detected Compounds in Field QA/QC Samples

Field generated QA/QC samples for the field efforts consisted of a field blank, equipment rinsates, trip blanks, and environmental duplicates. The blanks were analyzed for all fractions requested in this investigation. Table 6-3 presents the detected compounds found in the field blank, equipment rinsates, and trip blanks.

One field blank sample was collected; FB01 representing laboratory grade deionized water. Detections in the field blank included: two VOCs (2-Butanone and 1,4-Dichlorobenzene); three SVOCs (acetophenone, diethyl phthalate and di-n-butyl phthalate; and two metals (copper and lead). Six trip blanks were collected. Chloromethane was detected in two of the trip blanks, no other VOCs were detected.

Three equipment rinsate samples were collected as indicated on Table 4-2. One VOC (1,4-Dichlorobenzene); three SVOCs (acetophenone, diethyl phthalate and di-n-butyl phthalate); and one metal (copper) was detected in ER03 from a macro core liner. Toluene, acetophenone, and di-n-butyl phthalate were detected in ER04 and ER05 from the groundwater sampling tubing. There were no detections of metals in ER04 or ER05.

6.5.2 Test America SDG SWMU36289-3

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. VOC compounds that were rejected include acetone, acrolein, isobutyl alcohol, and 3-chloro-1-propene. Other VOC compounds, as listed in the data validation narrative included in Appendix C were qualified as non-detected (UJ). Due to the high %D values in the continuing calibrations, some compounds were qualified as estimated (J).

Blank contamination was noted in the method and QC blank (FB01) associated with samples in this batch. Please note that the laboratory reported to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for acetone and 2-butanone (U) were added to the data due to method blank/QC blank contamination.

SVOCs

Sample 69SB07-01RE extraction holding time was exceeded; therefore, all results were qualified as estimated J/UJ.

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. A summary of these non-compliances and affected samples are listed in the data validation narrative included as

Appendix C. Due to high %D values, in the continuing calibrations, 4-nitroquinoline-1-oxide and hexachlorophene results were rejected.
Blank contamination was noted in the method blank associated with samples in this batch. As stated above, the laboratory reported to the MDL for this project and positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for bis(2-ethylhexyl)phthalate (U) were added to the data due to method blank contamination.

A matrix spike and matrix spike duplicate was submitted for sample 69SB08-05. The MS exhibited 2% recovery and the MSD exhibited 3% recovery for 2,4-dinitrophenol. The compound was qualified as estimated (J/UJ) in sample 69SB08-05.

The field duplicate pair of samples 69SB11-00 and 69SB11-00D exhibited non-comparable results for benzo(a)pyrene, bis(2-ethylhexyl)phthalate, butly benzyl phthalate, dibenz(a,h)anthracene, indeo(1,2,3-cd)pyrene and benzo(a)anthracene. These results for these compounds were qualified as estimated (J/UJ).

Sample 69B07-01 was re-extracted due to non-compliant surrogate and internal standard recoveries. The re-extraction exhibited compliant results and therefore was used instead of the analysis.

Metals

The ICSAB standard exhibited a non-compliant recovery below the QC limit for the analyte cadmium. Based on the Region II guidelines all positive and non-detect results for cadmium in the field samples was qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project, therefore the blank flagging actions were modified to take this into consideration. Antimony and silver were qualified with a U (non-detected) for results greater than the MDL up to the reporting limit.

The field duplicate pair of samples 69SB08-05 and 69SB08-05D exhibited non-comparable results for chromium, cobalt, copper and vanadium based on Region II guidelines. The field duplicate pair of samples 69SB11-00 and 69-SB11-00D exhibited non-comparable results for arsenic based on Region II guidelines. The reported positive results for these analytes were qualified estimated (J) in the respective field duplicate pairs only.

Data Validation Summary for SWMU36289-3

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 4/29/08/ and samples were received at the laboratory on 4/30/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.3 Test America SDG SWMU36360-3

This SDG is relevant to the analytical findings associated with the surface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah,

Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. VOC compounds that were rejected include acetone, acrolein, acetonitrile, isobutyl alcohol, and propionitrile. Other VOC compounds, as listed in the data validation narrative included in Appendix C were qualified as non-detected (UJ) or estimated (J) due to the high %D values in the continuing calibrations.

Blank contamination was noted in the method and QC blank (FB01) associated with samples in this batch. Please note that the laboratory reported to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for acetone, 2-butanone, and isobutyl alcohol were added to the data due to method blank/QC blank contamination.

SVOCs

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. A summary of these non-compliances and affected samples are listed in the data validation narrative included as Appendix C. Due to high %D values, in the continuing calibrations, 4-nitroquinoline-1-oxide and hexachlorophene results were rejected. Other compounds were qualified as estimated (J/UJ) as shown in the data validation narrative included in Appendix C.

Blank contamination was noted in the method blank associated with samples in this batch. As stated above, the laboratory reported to the MDL for this project and positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for bis(2-ethylhexyl)phthalate (U) were added to the data due to method blank contamination.

Two matrix spike pairs were submitted with this data package. One matrix spike and matrix spike duplicate exhibited below 10% recoveries for two compounds; therefore the results for these compounds in the native samples were qualified as estimated. Another matrix spike pair exhibited high recoveries for four compounds that exhibited positive results in the native sample; the results were qualified as estimated (J). Compounds that were qualified include 2,4,-dimehtylphenol, 4,6-dinitro-2-methyphenol, hexachlorocyclopentadiene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouroanthene and benzo(g,h,i)perylene.

The field duplicate pair of samples 69SB01-00 and 69SB01-00D exhibited non-comparable results for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene and pyrene. These results for these compounds were qualified as estimated (J).

All samples were re-extracted out of holding time due to non-compliant surrogate and internal standard recoveries in the initial analysis. The re-extracted samples were not used due to similar results and exceeded holding times.

Metals

The ICSAB standard exhibited a non-compliant recovery below the QC limit for the analyte cadmium. Based on the Region II guidelines all positive and non-detect results for cadmium in the field samples was qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project, therefore the blank flagging actions were modified to take this into consideration. Antimony was qualified with a U (non-detected) for results greater than the MDL up to the reporting limit.

The matrix spikes of sample 69SB21-00 exhibited non-compliant %R for antimony for that required qualification in the field samples, samples were qualified as J/UJ. The serial dilution for the same sample exhibited non compliant %D for chromium and vanadium that required samples to be estimated as J/UJ.

The field duplicate pair of samples 69SB01-00 and 69SB01-00D exhibited non-comparable results for lead based on Region II guidelines. The field duplicate pair of samples 69SB21-00 and 69-SB21-00D exhibited non-comparable results for copper, lead and vanadium based on Region II guidelines. The reported positive results for these analytes were qualified estimated (J) in the respective field duplicate pairs only.

Data Validation Summary for SWMU36360-3

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 4/29/08 and 4/29/08 and samples were received at the laboratory on 4/30/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Two soil samples (69SB09-00 and 69SB02-00) contained 50-90% water that resulted in qualifying the data results as estimated (J/UJ), for VOCs, SVOCs and metals. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.4 Test America SDG SWMU36360-4

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. VOC compounds that were rejected in this SDG include acetone, acrolein, acetonitrile, isobutyl alcohol, and propionitrile. Other VOC compounds, as listed in the data validation narrative included in Appendix C were qualified as non-detected (UJ). Due to the high %D values in the continuing calibrations, some compounds were qualified as estimated (J).

Blank contamination was noted in the method and QC blank (FB01) associated with samples in this batch. Please note that the laboratory reported to the MDL for this project. Therefore, the

blank flagging actions were modified to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for acetone and 2-butanone (U) were added to the data due to method blank/QC blank contamination.

SVOCs

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, sulfotepp, 4-nitroaniline, and 3,3-dichlorobenzidine were qualified as estimated (J/UJ); 4-nitroquinoline-1-oxide results were rejected.

Blank contamination was noted in the method blank associated with samples in this batch. As stated above, the laboratory reported to the MDL for this project and positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for bis(2-ethylhexyl)phthalate (U) were added to the data due to method blank contamination.

All samples exhibited non-compliant surrogate recoveries that resulted in qualifying all results as estimated. The samples were re-extracted and exhibited compliant surrogate recoveries. However, the samples were re-extracted 17-18 days out of extraction holding time and therefore were not used in favor of the original analysis.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for cadmium. Based on Region II guidelines all positive and non-detect results for cadmium was qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project, therefore the blank flagging actions were modified to take this into consideration. Antimony was qualified with a U (non-detected) for results greater than the MDL up to the reporting limit. Lead was qualified as estimated (J) for results greater than the blank level (0.38 ug/L) and up to 10 times the blank level.

The associated matrix spike (sample 69SB21-00 from SDG SWMU36360-3) exhibited non-compliant %Rs for one analyte for which qualifications were required. Positive and non-detected results for antimony were flagged as estimated J/UJ in the samples.

Data Validation Summary for SWMU36360-4

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 4/29/08-5/1/08 and samples were received at the laboratory on May 1 and 2, 2008. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.5 Test America SDG SWMU36360-5

This SDG is relevant to the analytical findings associated with the groundwater sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The calibration standards exhibited RRF and %D that were non-complaint and resulted in qualifying non-detected results for isobutyl alcohol as rejected (R) and results for other VOCs as non-detected estimated (UJ), as shown in the data validation narrative as part of Appendix C.

All sample vials for sample 69TB02 were received at the laboratory with headspace. According to Region II guidelines when all the vials for a sample have air bubbles or the VOC vial analyzed had air bubbles, all positive results are qualified as estimated (J) and non-detected results are rejected (R). All results for 69TB02 were non-detected and were rejected.

SVOCs

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, hexachlorophene and 4-nitroquinoline-1-oxide were rejected. Other compounds were qualified as estimated (UJ), details are provides in Appendix C.

Blank contamination was noted in the method blank and QC blanks (ER04 and FB01) associated with samples in this batch. Please note that the laboratory reported to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for di-n-butylphthalate and (U) were added to the data due to method blank/QC blank contamination.

All samples were re-extracted due to non-compliant LCS and Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries. The re-extracted LCS and MS/MSD exhibited compliant recoveries; therefore the re-extracted sample batch was used.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium and silver. Based on Region II guidelines all positive and non-detect results for cadmium and silver in the total metals samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project. Arsenic, chromium, cobalt, and copper were qualified if results were greater than the MDL up to the RL with a U qualifier (not-detected).

The MS/MSD pair of sample 69GW11 exhibited non-compliant recoveries for the analyte mercury that were below the QC limits. All results for mercury in the total metals samples were qualified as estimated J/UJ.

The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in one of the samples. Based on Region II validation guidelines, the reported results for cobalt required rejection in the samples. However, both results were flagged non-detect (U) due to blank contamination so the disparity in the results is likely due to this blank contamination. Therefore, the results were not rejected.

Data Validation Summary for SWMU36360-5

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 4/30/08-5/1/08 and samples were received at the laboratory on 5/2/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.6 Test America SDG SWMU36419-2

This SDG is relevant to the analytical findings associated with the groundwater sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, Limited Liability Corporation (LLC), located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The calibration standards exhibited a relative response factor (RRF) and percent difference (%D) that were non-complaint and resulted in qualifying pentachloroethane and vinyl acetate as estimated (UJ).

SVOCs

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, hexachlorophene and 4-nitroquinoline-1-oxide were rejected (R). Other compounds were qualified as estimated (UJ), details are provides in Appendix C.

Blank contamination was noted in the method and quality control (QC) blanks (ER04 and FB01) associated with samples in this batch. Please note that the laboratory reported to the method detection limit (MDL) for this project. Therefore, the blank flagging actions were modified to take this into consideration. Positive results greater than the MDL but less than the contract required quantitation limit (CRQL) are qualified as U at the reported concentrations when affected by blank contamination. Qualifications for di-n-butylphthalate (UJ) were added to the data.

The laboratory control sample (LCS) exhibited low recovery (four percent) for hexachlorocyclopentadiene; all samples were qualified as UJ for this compound.

Metals

The Interference Check Sample Solution AB (ICSAB) standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium (79 percent) and silver (74-77 percent). Based on Region II guidelines all positive and non-detect results for cadmium and silver in the total metals samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in this sample deliver group (SDG). The laboratory reported non-detects results to the method detection limit (MDL) for this project. Total tin and copper were qualified if results were greater than the MDL up to the reporting limit (RL) with a U qualifier (not-detected). Additionally, the serial dilution (from sample 56GW03 in SDG 36429-1) analyzed for the dissolved metals exhibited a non-compliant %D for cobalt. All results for cobalt in the dissolved metals samples were qualified as estimated (J).

Region II requires a detailed comparison of the results between the total and dissolved sample analysis. This comparison is made only when: the dissolved metals concentration is greater than the total concentration, and the dissolved concentration is greater than or equal to five times the MDL. The analyte cobalt met both of these conditions in samples 69GW25 and 69GW12. Therefore, positive results reported for cobalt were qualified as estimated (J/UJ) in samples 69GW25 and 69GW25F (dissolved). The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in 69GW12. Based on Region II validation guidelines the reported results for cobalt were qualified as estimated (J) in this sample.

Data Validation Summary for SWMU36419-2

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 5/1/08 and samples were received at the laboratory on 5/5/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements. All VOC and SVOC samples were received at the laboratory at an elevated temperature on 10.6 degrees Celsius. The metals samples were received at an elevated temperature of 12.8 degrees Celsius. In accordance with Region II guidelines, stating that samples received above 10 degrees Celsius are to be qualified as estimated (J/UJ), therefore qualifications were added to the data. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.7 Test America SDG SWMU36419-4

This SDG is relevant to the analytical findings associated with the QA/QC sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The calibration standards exhibited a RRF and %D that were non-complaint and resulted in qualifying pentachloroethane, vinyl acetate, chloromethane, and bromomethane as estimated (UJ).

SVOCs

All samples were received at the laboratory at an elevated temperature of 11.8 degrees Celsius. In accordance with Region II guidelines, all samples received above 10 degrees Celsius are qualified as estimated (J/UJ).

All samples were re-extracted out of holding time due to non-compliant LCS recoveries. The re-extracted samples were not used since the holding time was exceeded, except for ER04RE. Sample ER04 was not used due to low surrogate recoveries. The sample was re-extracted and exhibited complaint surrogate recoveries; therefore the initial analysis was not used in favor of the re-extraction.

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, hexachlorophene and 4-nitroquinoline-1-oxide were rejected (R). In addition, indeo(1,2,3-cd)pyrene, di-n-octylphthalate, dibenz(a,h)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene and benzo(k)fluoranthene. Other compounds were qualified as estimated (UJ), details are provides in Appendix C.

The laboratory control sample (LCS) exhibited low recovery (four percent) for hexachlorocyclopentadiene; all samples were qualified as J/UJ for this compound.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium and silver. Based on Region II guidelines all positive and non-detect results for cadmium and silver in the metals samples were qualified as estimated J/UJ.

Data Validation Summary for SWMU36419-4

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 4/28/08-5/2/08 and samples were received at the laboratory on 5/5/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements. All VOC, SVOC, DRO/GRO, and metals samples were received at the laboratory at an elevated temperature of 11.8 degrees Celsius. In accordance with Region II guidelines, stating that samples received above 10 degrees Celsius are to be qualified as estimated (J/UJ), therefore qualifications were added to the data. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.8 Test America SDG SWMU36426-7

This SDG is relevant to the analytical findings associated with the groundwater sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

VOCs

The calibration standards exhibited RRF and %D that were non-complaint and resulted in qualifying non-detected results for acrolein as rejected (R) and dichlorodifluoromethane, bromomethane, vinyl acetate, trans-1,3-dichloropropene, acrylonitrile and pentachloroethane as estimated (UJ).

SVOCs

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, hexachlorophene and 4-nitroquinoline-1-oxide were rejected. Other compounds were qualified as estimated (UJ), details are provides in Appendix C.

Blank contamination was noted in the method and QC blanks (ER05 and FB01) associated with samples in this batch. Please note that the laboratory reported to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U (not detected) at the reported concentrations when affected by blank contamination. Qualifications for di-n-butylphthalate and bis(2-ethylhexyl)phthalate (U) were added to the data due to method blank/QC blank contamination.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium (78 percent) and silver (74-77 percent). Based on Region II guidelines all positive and non-detect results for cadmium and silver in the total metals samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project. Total cobalt and copper were qualified if results were greater than the MDL up to the RL with a U qualifier (not-detected). Additionally, the serial dilution (from sample 56GW03 from SDG 36429-1) analyzed for the dissolved metals exhibited a non-compliant %D for cobalt. All results for cobalt in the dissolved metals samples were qualified as estimated (J).

The serial dilution of sample 56GW03 (from SDG SWMU36419-1) analyzed for the dissolved metals exhibited a non-compliant %D for cobalt. All results for cobalt in the dissolved metals samples were qualified as estimated J/UJ.

The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in one of the samples. Based on Region II validation guidelines the reported results for cobalt were qualified as estimated in the sample.

Data Validation Summary for SWMU36426-7

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 5/3/08 and samples were received at the laboratory on 5/6/08. All sample preparation and analysis was performed within Region II and/or method holding time

requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

2010 Disturbed Soil Sampling

6.5.9 Summary of Detected Compounds in Field QA/QC Samples

Field generated QA/QC samples for the field effort consisted of field blanks, equipment rinsates, and environmental duplicates. The blanks were analyzed for all fractions requested in this investigation. Table 6-9 presents the detected compounds found in the field blanks and equipment rinsates.

Two field blank samples were collected; 69FB01 and 69FB-SD, each representing laboratory grade deionized water. Detections in 69FB01 included copper and zinc. There were no detections in 69FB-SD.

Four equipment rinsate samples were collected as indicated on Table 4-2. Copper and tin were detected in 69ER01 from a macro core liner; zinc was detected in 69ER02 from a stainless steel spoon; copper and zinc were detected in 69ER03 from an aluminum pie pan; and copper was detected in 69ER-SD from a stainless steel spoon.

6.5.10 Test America SDG SWMU68060189-1

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Blank contamination was noted and qualification was required in this SDG. For samples 69SB102-00, 69SB103-00, and 69SB106-00, cadmium was qualified at the reporting limit with a non-detect (U) qualifier. For all samples greater than the method detection limit, but less than the reporting limit, zinc was qualified at the reporting limit with a non-detect (U) qualifier.

The matrix spike pair sample of 69SB101-00 exhibited non-compliant %Rs for three analytes that required qualification/rejection in the field samples. Positive and non-detects for barium were flagged as estimated (J/UJ) in the samples. Chromium was flagged with an estimated (J) and vanadium was flagged as rejected (R).

The field duplicate pairs of samples 69SB101-00 and 69SB101-00D exhibited non-compliant field duplicate reproducibility for the analytes barium and chromium based on Region II guidelines. The 69SB104-01 and 69SB104-01D sample exhibited non-compliant field duplicate reproducibility for the analytes barium, cobalt, copper, zinc, and lead based on Region II guidelines. The reported positive results for the analytes with the exception of lead, were qualified estimated (J) in the respective field duplicate pairs. Lead was qualified as rejected (R).

Data Validation Summary for SWMU 68060189-1

The SDG was received complete and intact. Resubmissions were not required. Clarification was required from the laboratory regarding internal standards and a response was provided.

According to the chain of custody records, sampling was performed on 8/3/10 and samples were received at the laboratory on 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.11 Test America SDG SWMU68060189-10

For SDG#68060189-1, 20 samples for vanadium analysis were rejected due to the matrix spike pair analysis that exhibited non-compliant %Rs (346/291). As a result, vanadium was reanalyzed.

Validation conclusions are as follows:

Vanadium

Samples 69SB101-00 and 69SB101-00D exhibited non-compliant field duplicate reproducibility for vanadium based on Region II guidelines. The reported positive results were qualified as estimated (J).

Data Validation Summary for SWMU 68060189-10

According to the chain of custody records, sampling was performed on 8/3/10 and samples were received at the laboratory on 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Extraction was performed on the 175th day.

6.5.12 Test America SDG SWMU68060189-2

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

The matrix spike pair sample 69SB107-00 exhibited a non-compliant %Rs for one analyte, antimony, requiring qualification in the field samples. Positive and non-detects for antimony were flagged as estimated (J/UJ).

The serial dilution sample 69SB107-02 (from SDG SWMU68060189-2) exhibited a non-compliant %D for vanadium. All positive and non-detect results were qualified as estimated (J/UJ).

The field duplicate pair samples 69SB107-02 and 69SB104-02D exhibited non-compliant field duplicate reproducibility for the analytes arsenic and copper based on Region II guidelines. The analytes were flagged as estimated (J). The field duplicate pair samples 69SB111-00 and 69SB111-00D exhibited non-compliant field duplicate reproducibility for the analytes arsenic and lead based on Region II guidelines. Arsenic was flagged as estimated (J) and lead was flagged as rejected (R).

Data Validation Summary for SWMU68060189-2

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to the chain of custody records, sampling was performed on 8/3/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.13 Test America SDG SWMU68060189-3

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

The matrix spike pair sample 69SB114-01 exhibited non-compliant %Rs for three analytes: copper, lead, and zinc requiring qualification/rejections in the field samples. Copper and lead were flagged as estimated (J) and zinc was flagged as rejected (R).

The serial dilution of sample 69SB114-01 (from SDG SWMU68060189-3) exhibited a non-compliant %D for the analyte vanadium. All positive and non-detect results were qualified as estimated (J/UJ).

One field duplicate pair sample 69SB114-01 and 69SB114-01D exhibited non-compliant field duplicate reproducibility for barium, cobalt, copper, lead, nickel, vanadium, and zinc based on Region II guidelines. All analytes were flagged as estimated (J).

Data Validation Summary for SWMU68060189-3

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to chain of custody records, sampling was performed on 8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objects for this SDG.

6.5.14 Test America SDG SWMU68060189-11

For SDG#68060189-3, 20 samples for zinc analysis were rejected due to the matrix spike pair analysis that exhibited non-compliant %Rs (368/226). As a result, zinc was reanalyzed.

Zinc conclusions are as follows:

Zinc

Samples 69SB114-01 and 69SB114-01D exhibited non-compliant field duplicate reproducibility for vanadium based on Region II guidelines. The reported positive results were qualified as estimated (J).

Data Validation Summary for SWMU 68060189-11

According to the chain of custody records, sampling was performed on 8/4/10 and samples were received at the laboratory on 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Extraction was performed on the 176th day.

6.5.15 Test America Summary for SWMU68060189-4

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Blank contamination was noted and qualification was required in this SDG. For all samples greater than the method detection limit, but less than the reporting limit, mercury was qualified at the reporting limit with a non-detect (U) qualifier.

The matrix spike pair 69SB121-00 exhibited non-compliant %Rs for the analytes zing, mercury, and lead. All positive and non-detect results for zinc and mercury were qualified as estimated (J/UJ) and lead was qualified as rejected (R).

Data Validation Summary for SWMU68060189-4

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to chain of custody records, sampling was performed on 8/4/10-8/5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.16 Test America Summary for SWMU68060189-12

For SDG#68060189-4, 20 samples for lead analysis were rejected due to the matrix spike pair analysis that exhibited non-compliant %Rs (-44/-60). As a result, lead was reanalyzed.

Lead conclusions are as follows:

Lead

The matrix spike pair analysis submitted exhibited non-compliant %Rs for the target analyte requiring qualification in the field samples. All positive and non-detect results for lead and were qualified as estimated (J/UJ).

Data Validation Summary for SWMU 68060189-12

According to the chain of custody records, sampling was performed on 8/4/10 - 8/5/10 and samples were received at the laboratory on 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Extraction was performed on the 173rd and 174th days.

6.5.17 Test America Summary for SWMU68060189-5

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Blank contamination was noted and qualification was required in this SDG. For the sample 69SB127-02D, zinc was qualified at the reporting limit with a non-detect (U) qualifier.

The matrix spike pair 69SB127-02 exhibited non-compliant %Rs for the analytes antimony, chromium, and barium. All positive and non-detect results for antimony and chromium were qualified as estimated (J/UJ) and barium was qualified as rejected (R).

The field duplicate pair sample 69SB127-02 and 69SB127-02D exhibited non-compliant field duplicate reproducibility for the analytes barium, cobalt, copper, lead, chromium, and vanadium based on Region II guidelines. Barium, cobalt, copper, and lead were flagged as estimated (J) and chromium and vanadium were flagged as rejected (R). The field duplicate pair sample 69SB131-00 and 69SB131-00D exhibited non-compliant field duplicate reproducibility for the analytes barium, cadmium, chromium, copper, lead, and vanadium based on Region II guidelines. All analytes for this pair was flagged as estimated (J).

Data Validation Summary for SWMU68060189-5

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to chain of custody records, sampling was performed on 8/5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives for this SDG.

6.5.18 Test America Summary for SWMU68060189-13

For SDG#68060189-5, 20 samples for barium analysis were rejected due to the matrix spike pair analysis that exhibited non-compliant %Rs (6/-1). As a result, barium was reanalyzed.

Barium conclusions are as follows:

Barium

The matrix spike pair analysis submitted exhibited non-compliant %Rs for the target analyte requiring qualification in the field samples. All positive and non-detect results for barium and were qualified as estimated (J).

Data Validation Summary for SWMU68060189-13

According to the chain of custody records, sampling was performed on 8/5/10 and samples were received at the laboratory on 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Extraction was performed on the 173rd day.

6.5.19 Test America Summary for SWMU68060189-6

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Blank contamination was noted and qualification was required in this SDG.

The matrix spike pair sample 69SB134-01 exhibited non-compliant %Rs for the analyte antimony. All positive and non-detect results for antimony are qualified as estimated (J).

The matrix duplicate analysis for sample 69SB134-01 exhibited non-compliant RPDs for the analytes barium and cobalt. All positive and non-detect results for these analytes were qualified as estimated (J/UJ).

The field duplicate pair sample 69SB134-01 and 69SB134-01D exhibited non-compliant field duplicate reproducibility for barium based on Region II guidelines. The analyte was flagged as estimated (J). The field duplicate pair sample 69SB131-00 and 69SB131-00D exhibited non-compliant field duplicate reproducibility for the analytes barium, cadmium, chromium, copper, lead, and vanadium based on Region II guidelines. All analytes were flagged as estimated (J).

Data Validation Summary for SWMU68060189-6

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to chain of custody records, sampling was performed on 8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives of this SDG.

6.5.20 Test America Summary for SWMU68060189-7

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories

(Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

The matrix spike pair sample 69SB141-00 exhibited non-compliant %Rs for the analytes chromium, copper, lead, and mercury. Chromium, copper, and lead were qualified as estimated (J) and for positive and non-detect results, mercury was also qualified as estimated (J/UJ).

The serial dilution sample 69SB141-00 (from SDG SWMU68060189-7) exhibited a non-compliant %D for the analyte vanadium. All positive and non-detect results were qualified as estimated (J/UJ).

The field duplicate pair sample 69SB137-02 and 69SB137-02D exhibited non-compliant field duplicate reproducibility for copper and vanadium based on Region II guidelines. These two analytes were flagged as estimated (J). The field duplicate pair sample 69SB141-00 and 69SB141-00D exhibited non-compliant field duplicate reproducibility for copper, cobalt, lead, nickel, vanadium, and zing based on Region II guidelines. All these analytes were flagged as estimated (J).

Data Validation Summary for SWMU68060189-7

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to the chain of custody records, sampling was performed on 8/3/10-8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives of this SDG.

6.5.21 Test America Summary for SWMU68060189-8

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Blank contamination was noted and qualification was required in this SDG. For the samples 69SB146-01 and 69SB146-02, zinc was qualified at the reporting limit with a non-detect (U) qualifier.

The matrix spike pair sample 69SB147-02 exhibited non-compliant %Rs for copper and mercury. The analyte copper was flagged as estimated (J) and mercury was flagged as rejected (R).

The field duplicate pair sample 69SB144-01 and 69SB147-02D exhibited non-compliant field duplicate reproducibility for copper and vanadium based on Region II guidelines. Both analytes are flagged as estimated (J). The field duplicate pair 69SB147-02 and 69SB147-02D exhibited non-compliant field duplicate reproducibility for chromium, copper, lead, cobalt, and vanadium

based on Region II guidelines. The analytes chromium, copper, and lead were flagged as estimated (J) and the analytes cobalt and vanadium were flagged as rejected (R).

Data Validation Summary for SWMU68060189-8

The SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to the chain of custody records, sampling was performed on 8/3/10-8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analyses was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives of this SDG.

6.5.22 Test America Summary for SWMU68060189-9

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Blank contamination was noted and qualification was required in this SDG. For the sample 69SB149-02, zinc was qualified at the reporting limit with a non-detect (U) qualifier.

The matrix spike pair sample 69SB152-02 exhibited non-compliant %Rs for antimony and mercury. Both analytes were flagged as estimated (J).

The matrix duplicate sample 69SB152-02 exhibited a non-compliant RPD for vanadium. The analyte was flagged as estimated (J).

Data Validation Summary for SWMU68060189-9

This SDG was received complete and intact. Resubmissions were not required. Clarification regarding the internal standards of the laboratory was required and a response was provided. According to the chain of custody records, sampling was performed on 8/3/10-8/5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analyses was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives of this SDG.

6.5.23 Test America Summary for SWMU68062912-1

This SDG is relevant to the analytical findings associated with the sediment sampling at SWMU 69. Laboratory analyses were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services LLC, located in St. Louis, Missouri. Validation conclusions are as follows:

Metals

Many samples exhibited percent solids that were below 50%. All reported results in these samples were qualified as estimated (J/UJ).

The serial dilution sample 69SD02 (from SDG SWMU68062912-1) exhibited non-compliant %Ds for the analytes barium, cobalt, copper, and vanadium. All positive and non-detect results for these analytes were qualified as estimated (J/UJ).

The field duplicate pair 69SD01 and 69SD01D exhibited non-compliant field duplicate reproducibility for chromium and lead based on Region II guidelines. Both analytes were flagged as estimated (J).

Samples 69SD01, 69SD01D, 69SD02, 69SD02D, 69SD03, 69SD06, 69SD07, 69SD08, 69SD09, and 69SD10 exhibited high moisture content. As such all positive and non-detect results for all analytes for these samples are qualified as estimated (J/UJ).

Data Validation Summary for SWMU68062912-1

This SDG was received complete and intact. Resubmissions were not required. According to chain of custody records, sampling was performed on 11/5/10 and samples were received at the laboratory 11/6/10. All sample preparation and analyses was performed within Region II and/or method holding time requirements. Overall, the changes in the results due to the application of the data validation objectives are not expected to significantly compromise the data quality objectives of this SDG.

6.6 Data Completeness Summary - 2010

For project completeness, 90 to 95 percent of all sample data for a given analyte must represent valid measurements (Baker, 1995). An evaluation was conducted on the data for SWMU 69 to determine the usability of the validated data, as shown on Table 6-10. The overall project completeness goals were meet, with 98.94 percent useable data overall. There were two parameter classes for groundwater that did not meet their goals of usable data.

Based on a review of the rest of the validated analytical data for surface soil, subsurface soil, and sediment, overall project completeness goals were met and the limited amount of rejected data is not expected to have significantly compromised the usability of the preliminary data set. It is not expected that this will impact the results of the Human Health Risk Assessment (HHRA) or the ERA (i.e. underestimate potential risk). Therefore, the data, as qualified by the validator is considered acceptable for its intended use.

6.7 References

Baker, February 2008. Revised Final II Summary Report for Background Concentrations of inorganic Compounds at NAPR. Naval Activity Puerto Rico, Ceiba, Puerto Rico. February 29, 2008.

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USEPA, 2011. Regional Screening Levels Table, http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. November 2011.

7.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT

This section presents the screening level ERA (SERA) and Step 3a of the baseline ERA (BERA) for SWMU 69 – Aircraft Parking Area, located at NAPR, Ceiba, Puerto Rico. The SERA and Step 3a of the BERA were performed in accordance with Navy policy for conducting ERAs (Chief of Naval Operations [CNO], 1999) and Navy guidance for conducting ERAs (available at http://web.ead.anl.gov/ecorisk/), as well as guidance provided by the USEPA (1997).

The Navy ERA process (Figure 7-1) consists of eight steps organized into three tiers and represents a clarification and interpretation of the eight-step ERA process outlined in the USEPA ERA guidance for the Superfund program (USEPA, 1997). Tier 1 of the Navy ERA process represents the SERA:

- Screening level problem formulation and ecological effects evaluation (Step 1).
- Screening level exposure estimate and risk calculation (Step 2).

Under Navy policy (CNO, 1999), if the results of Steps 1 and 2 (Tier 1 SERA) indicate that, based on a set of conservative exposure assumptions, there are chemicals present in environmental media that may present a risk to receptor species/communities, the ERA process proceeds to the BERA. According to Superfund guidance (USEPA, 1997), Step 3 represents the problem formulation phase of the BERA. Under Navy policy, the BERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a. In Step 3a, the conservative exposure assumptions applied in Tier 1 are refined and risk estimates are recalculated using the same conceptual site model. The evaluation of risks in Step 3a also may include consideration of available background data and chemical bioavailability. If the re-evaluation of the conservative exposure assumptions in Step 3a does not support an acceptable risk determination for all potential chemical-pathway-receptor combinations, CAOs will be established for each chemical of concern (COC) to address potential ecological risks at SWMU 69.

The ERA for SWMU 69 was originally presented in the Draft CMS for SWMU 69 (Baker, 2008). That ERA evaluated surface soil, subsurface soil, and groundwater data and identified barium, cadmium, lead, and zinc as chemicals of concern (COCs) in surface soil. However, as discussed in Section 1.0, the Draft CMS was retracted on December 3, 2008 following disturbances to the SWMU that significantly altered the physical conditions of the site and potentially redistributed the COCs. A Disturbed Soil Sampling Investigation was conducted in 2010 to re-characterize the site.

The ERA is presented in two parts: first (Sections 7.1 through 7.9), the ERA methodology is described, and soil and groundwater data collected during the 2008 CMS field investigation are re-evaluated. Revisions to the ERA using the 2008 analytical data address agency comments received from the USEPA (dated January 15, 2009) on the draft Corrective Measures Study Report (Baker, 2008). Risk estimates also are recalculated using updated model input parameters, including media-specific screening values for soil and groundwater, toxicity reference values (TRVs) for avian receptors, as well as soil-to-plant, soil-to-invertebrate, and soil-to-small mammal bioaccumulation factors. The list of COCs identified using the 2008 analytical data (see Section 7.9.1.1 through 7.9.1.4 support the decision to limit the analysis of the 2010 soil and drainage ditch sediment analytical to inorganics (no organic chemical was identified as an ecological COC based on 2008 data). In Section 7.10, soil and sediment data sampled as part of the Disturbed Soil Sampling Investigation are evaluated. This section includes an update to the

problem formulation component of the ERA to reflect changing site conditions. In order to address potential risks at the SWMU as a whole, the conclusions drawn from the Draft CMS ERA (Section 7.9), as well as those from the Disturbed Soil Sampling ERA (Section 7.10) are collectively summarized in Section 7.11.

7.1 Environmental Setting

The sections that follow provide a description of the habitats occurring within and contiguous to SWMU 69, as well as the biota that may be present. The description of habitats and biota relies on literature-based information for Puerto Rico and NAPR, and is supplemented by observations made during site visits/sampling activities at the SWMU. The following description is based on site conditions observed during the 2008 CMS field investigation.

7.1.1 Terrestrial Habitats

The upland habitat bounded by NAPR is classified as subtropical dry forest (Ewel and Witmore, 1973). Similar to other forested areas of Puerto Rico, this region was previously clear-cut in the early part of the century, primarily for pastureland (Geo-Marine, Inc., 1998). After acquisition by the Navy, a secondary growth of thick scrub, dominated by lead tree (*Leucaena* spp.), Christmas tree (*Randia aculeata*), sweet acacia (*Acacia farnesiana*), and Australian corkwood (*Sesbania grandiflora*) grew in the previously grazed sections (Geo-Marine, Inc., 1998). Secondary growth communities (upland coastal forest communities and coastal scrub forest communities) exist today throughout NAPR's undeveloped upland.

Prior to the operational closure of NSRR on March 31, 2004, the upland vegetative community within and immediately adjacent to SWMU 69 consisted of maintained grasses of unknown species composition (likely to include *Bothriochloa ischaemum* [yellow bluestem], *Chloris barbata* [swollen fingergrass], and *Digitaria* spp. [crabgrass] based on maintained grasses identified during a habitat characterization conducted at SWMUs 1, 2, and 45 in May 2000 [(Geo-Marine, Inc., 2000]). The Navy continued grass cutting operations at SWMU 69 until ownership of the airfield parcel (Ofstie airfield) was transferred to the PRPA on February 7, 2008. However, the frequency of these operations was significantly reduced. It is not known if the PRPA has implemented a maintenance program after acquisition of the airfield parcel (maintenance operations were not evident during the 2008 CMS field investigation [see photographs in Appendix A]). In addition to the maintained grasses discussed above, a coastal scrub forest community is located along the western boundary of SWMU 69 (Figure 7-2).

Cobana negra (*Stahlia monosperma*), a federally threatened tree species, is known to occur between the boundary of black mangrove communities and upland coastal forest communities. This species is also known to occur in coastal forests of southeastern Puerto Rico (Little and Wadsworth, 1964). A single individual was encountered at NAPR during recent surveys conducted by Geo-Marine, Inc. (Naval Facilities Engineering Command [NAVFAC], 2006). This individual is located within a coastal scrub forest community near the Capehart housing area, west of American Circle, approximately 3.0 miles south of SWMU 69. No other plant species listed under the provisions of the Endangered Species Act of 1973 are known to occur or have the potential to occur at NAPR (Geo-Marine, Inc., 2000 and NAVFAC, 2006).

7.1.2 Aquatic Habitats

Approximately 460 acres at NAPR are covered by palustrine habitat, which includes all freshwater wetlands. These wetlands include wet meadows and marshes, dominated by cattails (*Typha* spp.) and grasses (*Panicum* spp. and *Paspalum* spp.), as well as wet coastal scrub forests. The marine environment surrounding NAPR includes mudflats, mangroves and seagrass beds. The total area of mudflats, mangroves, and seagrass beds in the offshore environment is approximately 161 acres, 2,700 acres, and 1,900 acres, respectively (Geo-Marine, Inc., 1998). Coral reefs are also located in the offshore marine environment (Figure 7-2). Coral reef types within the waters surrounding NAPR, as well as their associated acreage cover are listed below (Department of Navy [DoN], 2007):

Reef Habitat Type	Area (acres)
Colonized bedrock	266
Linear reef	84
Patch reef (aggregated)	146
Patch reef (individual)	175
Scattered coral-rock	5

Mangroves at NAPR (Figure 7-2) mainly consist of red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*) (Geo-Marine, Inc., 2000 and 2005). Red mangroves tolerate relatively deep water levels, grow in unstable, soft soil, and tolerate a salinity range of 10 to 55 parts per thousand (ppt). They develop large prop roots which usually extend above the water surface. Black and white mangroves generally grow in areas that are not inundated by water. Mangroves at NAPR are natural filters for upland runoff and protect the coastline from storm damage (Lewis, 1986). They also provide habitat for wildlife, fish, and benthic invertebrates. Lewis (1986) reported 112 species of birds that use the NAPR mangroves as habitat for feeding, nesting, and roosting. The red mangrove prop root habitat in Puerto Rico also is used by at least 13 species of fish (including the gray snapper [*Lutjanus griseus*], lane snapper [*Lutjanus synagris*], and rock beauty angelfish [*Holocanthus tricolor*]), several crustaceans (including the flat tree oyster [*Isognomon alatus*]), gastropods (including the coffee bean snail [*Melampus coffeus*] and mangrove periwinkle [*Littorina angulifera*]), echinoids (including the long-spined sea urchin [*Diadema antillarum*] and pencil sea urchin [*Eucidaris tribuloides*]), sponges (including the fire sponge [*Tedania ignis*]), ascidians (including the black tunicate [*Ascidia nigra*]), and hydroids (including the feathered hydroid [*Halocordyle disticha*]) (Geo-Marine, Inc., 2005).

The seagrass beds in eastern Puerto Rico are typical of well developed climax meadows found throughout the tropical Atlantic and Caribbean basin, consisting primarily of a dense continuous coverage of turtle grass (*Thalassia testudinum*) with lesser amounts of manatee grass (*Syringodium filiforme*) and a wide diversity of calcareous algae (Reid et al., 2001). Patchy and sparse beds of mixed species, including shoal grass (*Halodule wrightii*), manatee grass, and paddle grass (*Halophila decipiens*), occur in localized areas affected and maintained by different wave regimes, substrate type, and turbidity than what is normally found in association with the climax turtle grass meadows.

The nearest open water marine habitats to SWMU 69 are an unnamed lagoon north of the Los Machos mangrove forest (approximately 1.1 miles northeast of SWMU 69) and the Ensenada Honda (approximately 1.3 miles southeast of SWMU 69). As evidenced by Figure 7-2, seagrass

beds are prevalent throughout much of the Ensenada Honda and the unnamed lagoon. Seagrass meadows within the Ensenada Honda are dominated by a nearly continuous cover of turtle grass with a high abundance of calcareous green algae (*Avranvilla* spp., *Ventricaria ventricosa*, *Caulerpa* spp., *Valonia* spp., and *Udotea* spp.) (Reid et al., 2001). Although the species composition of the seagrass meadows within the unnamed lagoon is not known, turtle grass most likely dominates this community as well. The turtle grass climax meadows of the Ensenada Honda, as well as the seagrass meadows within the unnamed lagoon represent grazing areas for the West Indian manatee, a federally endangered species in Puerto Rico, and the green sea turtle (*Chelonia mydas*), a federally threatened species in Puerto Rico (see Section 7.1.3.1 and 7.1.3.3, respectively).

A map showing the spatial relationship of SWMU 69 to freshwater and marine wetlands is provided as Figure 7-3. The wetlands depicted on Figure 7-3, identified by the Cowardin Wetland Classification System (Cowardin et al., 1979 [Figure 7-4]), were delineated by Geo-Marine, Inc. in December 1999 from 1993 color infrared and 1998 true color aerial photography. Twenty percent of the wetlands delineated by aerial photography were field checked to verify the accuracy of the delineations. Field verification was based on the 1987 Corps of Engineers wetland delineation manual (United States Army Corps of Engineers [USACE], 1987). As evidenced by Figure 7-3, there are no freshwater wetland units within or immediately contiguous to SWMU 69. A Palustrine Emergent Persistent (PEM1) wetland unit is located approximately 800 feet southwest of SWMU 69. This PEM1 wetland is associated with a drainage ditch that originates within the town of Ceiba and is not hydrologically connected to SWMU 69. Isolated, depressional PEM1 wetland units also are located east and southeast of SWMU 69.

The most significant wetland feature in the vicinity of the airport is the Los Machos mangrove forest (located approximately 3,600 feet east of SWMU 69; Figures 7-2 and 7-3). Based on the groundwater flow direct at the airfield (southeast; se Section 5.1 and Figure 5-4), the Los Machos mangrove forest represents the most likely discharge point for SWMU 69 groundwater. Using the Cowardin Wetland Classification System (Cowardin et al., 1979), the specific wetland types located within the Los Machos mangrove forest include the following:

- Estuarine, Intertidal, Scrub-Shrub, Broad-Leaved Evergreen (E2SS3)
- Estuarine, Intertidal, Unconsolidated Shore, Mud (E2US3)
- Estuarine, Intertidal, Unconsolidated Shore, Organic (E2US4)

The examination of the groundwater analytical data indicates that three organic chemicals identified by the USEPA (2000) as important bioaccumulative compounds were detected in groundwater collected at SWMU 69 during the 2008 CMS field investigation (acenaphthene, fluorene, and phenanthrene). Each organic was detected in one groundwater sample (0.11J µg/L for acenaphthene, 0.083J µg/L for fluorene, and 0.28 µg/L for phenanthrene). Based on the low magnitude of these detections, it is unlikely that these three chemicals are migrating with groundwater to the Los Machos mangrove forest at concentrations that would present unacceptable risk to avian receptors. In addition to these organic chemicals, four bioaccumulative metals (arsenic, cadmium, nickel, and zinc also were detected within the total recoverable fraction of one or more of the SWMU 69 groundwater samples. However, maximum detected concentrations (0.56J µg/L for arsenic, 0.16J µg/L for cadmium, 0.9J µg/L for nickel, and 10J µg/L for zinc) are less than upper limit of the mean (ULM) concentrations for basewide background groundwater contained in the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds for NAPR (18.9 µg/L for arsenic, 2.21 µg/L for cadmium, 95.7 µg/L for nickel, and 548 µg/L for zinc; Baker, 2010). Therefore, it can be concluded that these four metals are not migrating with groundwater to the Los Machos

mangrove forest at concentrations greater than what would be expected under background conditions.

As discussed in Section 2.2 and depicted on Figure 2-3, a drainage ditch parallels the southern edge of the expanded aircraft parking apron, with a short branch that runs parallel to the eastern edge of the expanded concrete apron. The ditches are approximately 80 feet from the apron. An estimated 17 acres of the concrete parking apron is sloped to drain towards the southeastern corner of the expanded concrete apron area and into the drainage ditch. Surface water flow in the southern ditch is to the southeast past Day Tank 2437 fuel storage area, where it combines with runoff from the fuel storage area, the Aircraft Hydrant Refueling System, and the adjacent taxiway. The combined flows are then routed northeast to a double 4-foot by 7-foot box culvert before discharging into a triple 5-foot by 9-foot box culvert, which untimately discharges to an E2SS3 estuarine wetland system southeast of the airfield. Based on observations during the 2008 CMS field investigation, the drainage ditch was devoid of water and was overgrown with brush and tall grass. There were no signs of prolonged soil saturation to conclude the presence of hydric soils, nor was hydrophytic vegetation (i.e., vegetation adapted to grow in hydric soils) observed. The vegetation growing within the coastal scrub forest community bordering the drainage ditches adjacent to the expanded concrete apron is dominated by white lead tree and guinea grass (*Urochloa maxima*). This observation is consistent with plant species encountered within coastal scrub forest communities elsewhere at NAPR.

7.1.3 Fauna

A description of the fauna occurring in Puerto Rico and the landmass encompassed by NAPR is provided in the sections that follow. The description is supplemented by observations and information from the various field investigations conducted at SWMU 69 and within the adjacent drainage ditches.

7.1.3.1 Mammals

A total of 22 terrestrial mammal species are known historically from Puerto Rico; however, all mammals except bats (13 species) have been extirpated (Mac et al., 1998). None of the bats found on Puerto Rico are exclusive to the island, nor are they listed under provisions of the Endangered Species Act of 1973. The specific bat species known to occur on Puerto Rico are listed below:

- Fruit-eating bats: Jamaican fruit bat (*Artibeus jamaicensis*), Antillean fruit bat (*Brachyphylla cavernarum*), and red fig-eating bat (*Stenoderma rufum*)

- Nectivorous bats: brown flower bat (*Erophylla sezekoni*) and greater Antillean long-tongued bat (*Monophyllus redmani*)

- Insectivorous bats: Antillean ghost-faced bat (*Mormoops blainvillii*), Parnell's mustached bat (*Pteronotus parnellii*), sooty mustached bat (*Pteronotus quadridens*), big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), velvety free-tailed bat (*Molossus molossus*), and Brazilian free-tailed bat (*Tadarida brasiliensis*)

- Piscivorous bats: Mexican bulldog bat (*Noctilio leporinus*)

Vegetation within the coastal scrub forest community bordering the drainage ditches adjacent to SWMU 69 includes plants known to be used as a source of food by bats on Puerto Rico (white lead tree [nectar/pollen]) (Gannon et al., 2005).

Of the endangered/threatened marine mammals that may occur in Puerto Rico, only the West Indian manatee is known to occur in the marine environment surrounding NAPR (DoN, 2007). Manatee populations in Puerto Rico's coastal waters have been documented during three aerial surveys conducted from 1978 to 1979, 1984 to 1985, and in 1993 (United Nations Environmental Program [UNEP], 1995), a radio tracking study of manatee distribution and abundance (Reid and Kruer, 1998), and a year-long study of manatee distribution and abundance (Woods et al., 1984). Historical manatee sightings at NAPR are summarized on Figure 7-5. The figure (reproduced from DoN, 2007) includes information from most of the studies identified above. Feeding manatees are most often recorded within Pelican Cove and the Ensenada Honda. Feeding manatees also have also been recorded within the unnamed lagoon northeast of SWMU 69. However, as there are no transport pathways from SWMU 69 to the open water marine environments surrounding NAPR, they are not expected to represent potential exposure points for West Indian manatee dietary exposures to chemicals in SWMU 69 media.

Several mammals have been introduced into Puerto Rico, including the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), and small Indian mongoose (*Herpestes javanicus*). These nonindigenous mammals have been implicated in the decline of native bird and reptile populations (Mac et al., 1998 and United States Fish and Wildlife Service [USFWS], 1996a).

7.1.3.2 Birds

A total of 239 bird species are native to Puerto Rico (Raffaele, 1989). This total includes breeding permanent residents and non-breeding migrants. In addition, many nonindigenous bird species have been introduced to Puerto Rico, including the shiny cowbird (*Molothrus bonariensis*) and several parrot species, such as the budgerigar (*Melopsittacus undulates*), orange-fronted parrot (*Aratinga canicularis*), and monk parrot (*Myiopsitta monaqchus*). Of the 239 species native to Puerto Rico, 12 are endemic to the island (Raffaele, 1989).

Numerous native and migratory bird species have been reported at NAPR (Geo-Marine, Inc., 1998). A list of bird species reported at NAPR or having the potential to occur is provided in Table 7-1. The list, compiled from literature-based information pre-dating 1990, includes the great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), little blue heron (*Florida caerulea*), black-crowned night heron (*Nycticorax nycticorax*), belted kingfisher (*Ceryle alcyon*), spotted sandpiper (*Actitis macularia*), greater yellowlegs (*Tringa melanoleauca*), black-bellied plover (*Squatarola squatarola*), clapper rail (*Rallus longirostris*), Royal tern (*Thalasseus maximus*), sandwich tern (*Thalasseus sandvicensis*), least tern (*Stema albifrons*), yellow warbler (*Dendroica petechia*), palm warbler (*Dendroica palmarum*), prairie warbler (*Dendroica discolar*), magnolia warbler (*Dendrocia magnolia*), mourning dove (*Zenaida macroura*), red-legged thrush (*Mimocichla plumbea*), common nighthawk (*Chordeiles minor*), and red-tailed hawk (*Buteo jamaicensis*). Endemic species reported from NAPR include the Puerto Rican lizard cuckoo (*Saurothera vieilloti*), Puerto Rican flycatcher (*Myiarchus antillarum*), Puerto Rican woodpecker (*Malanerpes portoricensis*), Puerto Rican emerald (*Chlorostilbon maugaeus*), and yellow-shouldered blackbird (*Agelaius xanthomus*).

The yellow-shouldered blackbird is a federally endangered species. One of the principal reasons for the status of this species is attributed to parasitism by the nonindigenous shiny cowbird, which lays its eggs in blackbird nests and sometimes punctures the host's eggs (USFWS, 1983). Other

factors contributing to the status of this species include nest predation by the introduced black rat, Norway rat, and mongoose, as well as habitat modification and destruction (USFWS, 1996a). The entire land area of NAPR was declared critical habitat for the yellow-shouldered blackbird in 1976; however, a 1980 agreement between the Navy and the USFWS exempted certain areas from this categorization (Geo-Marine, Inc., 1998). SWMU 69 is not located within the critical habitat designation. A study conducted by the Naval Facilities Engineering Service Center (NFESC, 1996) reported that the mangrove forests surrounding NAPR should be considered the most important nesting habitats for the yellow-shouldered blackbird. A survey conducted in July 2002 by the Puerto Rico Department of Natural Resources (PRDNR, 2002) reported fifteen yellow-shouldered blackbirds (including five juveniles) at NAPR. At the time of the survey, the birds were using the structures at the NAPR airport for resting cover. Although nesting pairs were not observed (the survey was not conducted during the breeding season), the airport structures contained several inactive nests. The inactive nests and juvenile birds indicate that a small breeding population is present at NAPR.

As discussed in Section 7.1.1, the vegetative community associated with SWMU 69 includes a coastal scrub forest bordering the southern and eastern drainage ditches. Because yellow-shouldered blackbirds are arboreal feeders that forage within the canopy and sub-canopy of trees (USFWS, 1996a), they may forage within this habitat. However, arboreal insectivores, such as the yellow-shouldered blackbird, would not be expected to experience any significant exposures. This line of reasoning is consistent with USEPA's approach to ecological soil screening level (Eco-SSL) development. As discussed in Guidance for Developing Ecological Soil Screening Levels (USEPA, 2005a), aerial and arboreal insectivorous birds were excluded from Eco-SSL development because they are considered inappropriate (i.e., they do not have a clear or indirect exposure pathway link to soil [indirect exposure pathways involve ingestion of prey that have direct contact with soil]).

Other federally listed bird species that have the potential to occur at NAPR are the piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii dougallii*) (Geo-Marine, Inc., 1998). The piping plover is a rare, non-breeding winter visitor in Puerto Rico (Raffaele, 1989). This species breeds only in North America in three geographic regions (Atlantic Coast population [threatened], Great Lakes population [endangered], and Northern Great Plains population [threatened]; USFWS, 1996b). No piping plover observations were reported at NAPR during the 1990s or during sea turtle nesting surveys conducted in 2002 and 2004 (Geo-Marine, Inc., 2005). No historic evidence is available to indicate whether the roseate tern (threatened in Puerto Rico) has ever nested at NAPR and no roseate tern observations have been noted in or over coastal waters adjacent to NAPR (DoN, 2007). The nearest active roseate tern colony likely occurs on the eastern end of Vieques (more than 20 miles east of NAPR) (DoN, 2007).

Foraging birds, such as herons, egrets, sandpipers, and plovers, were not observed within the drainage ditch system downgradient from SWMU 69 during the 2008 CMS investigation. Birds also were not observed within the upland habitat adjacent to the aircraft parking area. However, vocalizations (songs and calls) were heard within these areas, indicating that these habitats may serve as resting, nesting, and/or foraging habitat for a variety of terrestrial bird species.

7.1.3.3 Reptiles and Amphibians

A total of 23 amphibians and 47 reptiles are known from Puerto Rico and the adjacent waters (Mac et al., 1998). Fifteen of the amphibians and 29 of the reptiles are endemic, while four amphibian species and three reptilian species have been introduced (Mac et al. 1998). Puerto Rico's native amphibian species include 16 species of tiny frogs commonly called coquis. On the

coastal lowlands, almost all coqui species are arboreal. The only amphibians listed under provisions of the Endangered Species Act of 1973 are the Puerto Rican crested toad (*Peltophryene lemur*) and the golden coqui (*Eleutherodactylus jasperi*). Both species are listed as threatened (USFWS, 2010). Distribution of the golden coqui is restricted to areas of dense bromeliad growth. All specimens to date have been collected from a small semicircular area of a 6-mile radius south of Cayey (approximately 30 miles southwest of NAPR), generally at elevations above 700 meters (USFWS, 1984). The Puerto Rican crested toad occurs at low elevations (below 200 meters) where there is exposed limestone or porous, well drained soil offering an abundance of fissures and cavities (USFWS, 1987). A single large population is known to exist from the southwest coast in Guánica Commonwealth Forest, and a small population is believed to survive on the north coast near Quebradillas, Arecibo, Barceloneta, Vega Baja, and Bayamón (USFWS, 1987). It also has been collected on the southeastern coastal plain near Coamo (USFWS, 1987). Given the habitat preferences and locations of known occurrences, these two amphibian species are not expected to occur at NAPR.

Puerto Rico's native reptilian species include 31 lizards, 8 snakes, 1 freshwater turtle, and 5 sea turtles (Mac et al., 1998). Of the five sea turtles, only the green sea turtle, hawksbill sea turtle (*Eretmochelys imbricata*), and loggerhead sea turtle (*Dermochelys coriacea*) nest within Puerto Rico. These three sea turtles, as well as the leatherback sea turtle (*Caretta caretta)* are listed under the provisions of the Endangered Species Act of 1973 (hawksbill sea turtle and leatherback sea turtle are listed as endangered, while the green sea turtle [Caribbean population] and loggerhead sea turtle are listed as threatened) (USFWS, 2010). Aerial surveys of turtles were performed from March 1984 through March 1995 along the Puerto Rican Coast. This information was summarized by Geo-Marine, Inc. (2005) in the Draft NAPR Disposal Environmental Assessment. Figures 7-6 and 7-7 (reproduced from Geo-Marine, Inc., 2005) present cumulative sea turtle sightings and potential turtle nesting sites at NAPR, respectively. Significant turtle observations were made near the mouth of the Ensenada Honda, the northern shore of Pineros Island, Pelican Bay, and the Medio Mundo Passage with the frequency of turtle observations listed as green > hawksbill > loggerhead > leatherback. Based on the life history information for each turtle species (summarized in Baker, 2006a and 2006b) and the availability of forage material (in the form of sea grasses), the green sea turtle has the potential to forage within the Ensenada Honda and the unnamed lagoon north of Los Machos mangrove forest. However, identical to the West Indian manatee, these two surface water bodies are not expected to represent a potential exposure point for sea turtle dietary exposures to chemicals in SWMU 69 media.

The Puerto Rican boa (*Epicrates inornatus*) is a federally endangered species. Four Puerto Rican boa sightings were reported at NAPR prior to 1999 and an additional four occurrences were reported between 2001 and 2003 (Geo-Marine, Inc., 2005). However, no boas were observed during 211 man-hours of surveys conducted within potential boa habitat in 2004 (Tolson, 2004). The Puerto Rican boa uses a variety of habitats but is most commonly found in Karst forest habitat (forested limestone hills). Based on the absence of preferred habitat, there is low probability of occurrence of this species at SWMU 69 and adjacent habitats.

7.1.3.4 Fish and Aquatic Invertebrates

A diverse fish and invertebrate community can be found in the marine environment surrounding NAPR. This can be attributed to the varied habitats that include marine and estuarine open water habitat, mud flats, sea grass beds, and mangrove forests. The fish community is represented by stingrays, herrings, groupers, needlefish, mullets, barracudas, jacks, snappers, grunts, snooks, lizardfishes, parrotfishes, gobies, filefishes, wrasses, damselfishes, and butterflyfish (Geo-Marine,

Inc., 1998). The benthic invertebrate community includes sponges, corals, anemones, sea cucumbers, sea stars, urchins, and crabs. Fish and invertebrate species inhabiting the freshwater and estuarine wetland habitats located at NAPR have not been documented in the literature. However, a qualitative benthic macroinvertebrate survey was conducted at three locations within a drainage ditch in support of an ERA conducted at SWMU 56 (Baker, 2010b). Only snails of unknown species composition were collected at each sampling point. The absence of aquatic insects, such as Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies), Odonta (dragonflies and damselflies), and Coleoptera (beetles) reflect the poor quality of available habitat within this drainage ditch. The results of the qualitative benthic macroinvertebrate survey at SWMU 56 is consistent with observations made during sediment sampling activities conducted within the SWMU 69 drainage ditches in November 2010. Only freshwater snails were encountered at each sediment sampling location. It is expected that a qualitative benthic macroinvertebrate survey within the drainage ditch associated with SWMU 59 would yield similar results.

Based on few observations of benthic macroinvertebrates, the SWMU 69 drainage ditch provides limited foraging opportunities for avian invertebrate consumers. The lack of a permanent fish population (as indicated by the absence water during the 2008 investigation) also indicates that the drainage ditch system does not represent foraging habitat for avian piscivores.

7.2 Sources of Available Analytical Data

Sampling activities at SWMU 69 have been conducted under three separate investigations: a Phase II ECP investigation in 2004, CMS field investigation in 2008, and Disturbed Soil Sampling Investigation in 2010. The Phase II ECP investigation conducted in 2004 involved the collection of five surface soil samples (designated 15E-SS01 through 15E-SS05; collected from the 0.0 to 1.0-foot depth interval) and five subsurface soil samples (designated 15E-SB01-01 through 15E-SB04-01 [collected from the 1.0 to 3.0-foot depth interval] and 15E-SB05-02 [collected from the 3.0 to 5.0-foot depth interval]). Sample locations are depicted on Figure 2-3. Each surface and subsurface soil sample was analyzed for Appendix IX VOCs, SVOCs, and metals, as well as TPH DRO and GRO. A description of the Phase II ECP field investigation and associated analytical results were previously presented in the Final Phase I/II Environmental Condition of Property (NAVFAC Atlantic, 2005). It is noted that the quality of the analytical data obtained during the Phase II ECP field investigations is questionable due to the lack of independent, third party data validation. Based on the lack of validation, the surface and subsurface soil analytical data were deemed unacceptable for use in the SERA. However, the ECP data were qualitatively evaluated in Step 3a of the BERA (Section 7.9) to ensure recommendations for soil are supported by all available analytical data.

The CMS field investigation (see description in Section 4.0) was conducted from April 29, 2008 to May 3, 2008 and involved the collection of surface soil, subsurface soil, and groundwater. A total of twenty-five surface soil samples (designated 69SB01-00 through 69SB24-00, and 69SB27-00 [collected from the 0.0 to 1.0-foot depth interval]), ten subsurface soil samples (designated 69SB07-01, 69SB07-05, 69SB08-01, 69SB08-05, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05, 69SB27-01, and 69SB27-05 [collected from the 1.0 to 3.0-foot and 9.0 to 11.0-foot depth intervals]), and seven groundwater samples (designated 69GW07, 69GW08, 69GW11, 69GW12, and 69GW25 through 69GW27) were collected. Sampling locations are depicted on Figure 4-2. Each surface soil and subsurface soil sample was analyzed for Appendix IX VOCs, SVOCs, and metals. Groundwater samples also were analyzed for Appendix IX VOCs and SVOCs, as well as total recoverable and dissolved Appendix IX metals. Analytical data for soil samples collected from the 0.0 to 1.0-foot depth interval during the 2008 CMS field investigation

were quantitatively evaluated as surface soil in the SERA. This depth interval is the most active biological zone (most soil heterotrophic activity occurs within the surface soil and soil invertebrates occur on the surface or within the oxidized root zone [Suter II, 1995]). As discussed above, subsurface soil samples were collected from two depth intervals during the CMS field investigation (1.0 to 3.0-foot depth interval and 9.0 to 11.0-foot depth interval). Analytical data for soil samples collected from the 1.0 to 3.0-foot depth interval (69SB07-01, 69SB08-01, 69SB11-01, 69SB12-01, and 69SB27-01) were quantitatively evaluated as subsurface soil in the SERA. Analytical data for subsurface samples collected from the 9.0 to 11.0-foot depth interval were not evaluated since this depth is not likely to represent a significant exposure point for ecological receptors. Based on the groundwater flow direction at SWMU 69 (east, toward the Los Machos mangrove forest), analytical data for the seven groundwater samples collected during the CMS field investigation also were quantitatively evaluated in the SERA. The surface soil, subsurface soil, and groundwater analytical data evaluated in the ERA are included as Appendix D. It is noted that the analytical laboratory reported non-detected results of 2004 ECP data and 2008 CMS Investigation data to the method detection limit (MDL).

The Disturbed Soil Sampling Investigation data are discussed in Section 7.10.1.2.

7.3 Screening Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the ERA. The products of the screening level problem formulation are (1) the preliminary conceptual model and (2) the assessment and measurement endpoints. The purpose of the preliminary conceptual model is to describe how ecological receptors may be exposed to chemicals originating from the site. The preliminary conceptual model is developed using information regarding major habitats and ecological receptors, media of concern, and potential contaminant sources in conjunction with an understanding of potential transport pathways, exposure pathways, and exposure routes. The fate, transport, and toxicological properties of the chemicals present at the site are also considered during this process. Assessment and measurement endpoints define the ecological attributes to be protected. They are selected to evaluate those receptors for which complete and potentially significant exposure pathways are likely to exist.

7.3.1 Preliminary Conceptual Model

Figure 7-8 presents a preliminary conceptual model for SWMU 69. The conceptual model outlines potential sources of contaminants, transport pathways, exposure media, potential exposure routes, and receptor groups. Specific components of the preliminary conceptual model (i.e., source areas, transport pathways, and exposure pathways and routes) are discussed in the sections that follow.

7.3.1.1 Source Area

The aircraft parking apron and expanded aircraft parking apron represent potential sources for the release of chemicals to abiotic media (i.e., downgradient surface and subsurface soil). Contaminated surface and subsurface soil also represent potential sources for the release of chemicals to downgradient surface soil, subsurface soil, and groundwater, as well as surface water and sediment within the drainage ditch and estuarine wetland system hydrolically connected to SWMU 69 via the drainage ditch (see discussion in Section 7.1.2).

7.3.1.2 Transport Pathways

A transport pathway describes the mechanisms whereby chemicals may be transported from a source of contamination to ecologically relevant media. As depicted on Figure 7-8, potential mechanisms for contaminant transport from potential source areas at SWMU 69 are believed to include the following:

- Transport of chemicals associated with historical hazardous material spills to the surface of the aircraft parking apron and expanded aircraft parking apron via surface run-off to downgradient surface soil.

- Overland transport of chemicals with surface soil via surface runoff to downgradient surface soil.

- Leaching of chemicals from surface soil and/or subsurface soil by infiltrating precipitation and transport to downgradient estuarine wetland surface water and sediment (Los Machos mangrove forest) with groundwater.

- Uptake by biota from surface soil and subsurface soil and trophic transfer to upper trophic level receptors.

A fifth potential transport pathway at SWMU 69 involves the transport of chemicals with surface soil via surface run-off to drainage ditch surface soil and subsequent transport with drainage ditch surface run-off to downgradient estuarine wetland surface water and sediment (see Section 7.1.2). As drainage ditch surface soil was not collected during the 2004 Phase II ECP or 2008 CMS field investigations, this potential pathway was not quantitatively evaluated by the 2008 ERA. Instead, the spatial distribution of chemical concentrations in soil collected from the upland portion of the SWMU maintained by grass cutting operations were examined in Step 3a of the BERA. The presence of ecological chemicals of concern (COCs) in surface soil samples collected nearest the drainage ditch would indicate that transport to drainage ditch surface soil and, therefore, surface water and sediment in the estuarine wetland wetland system southeast of the SWMU may have occurred or has the potential to occur.

7.3.1.3 Exposure Pathways and Routes

An exposure pathway links a source of contamination with one or more receptors via exposure to one or more media. Requirements for a complete exposure pathway are listed below.

- A source of contamination must be present

- Release and transport mechanisms must be available to move the contaminants from the source to an exposure point

- An exposure point must exist where ecological receptors could contact affected media

- An exposure route must exist whereby the contaminant can be taken up by ecological receptors

As depicted on Figure 7-8, potentially complete and significant exposure pathways exist at SWMU 69. An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. Exposure pathways and routes applicable to SWMU 69 are discussed in the paragraphs that follow.

The most common exposure routes are dermal contact, direct uptake, ingestion, and inhalation. Terrestrial plants may be exposed to chemicals present in surface soil directly through their root surfaces during water and nutrient uptake. Unrooted, floating aquatic plants, rooted submerged aquatic plants, and algae may be exposed to chemicals directly from the water or (for rooted plants) from sediments. Terrestrial and aquatic invertebrates may be exposed to chemicals in soil, surface water, and sediment, through dermal adsorption and ingestion. Much of the toxicological data available for terrestrial and aquatic invertebrates are based upon *in situ* studies that represent both pathways. Therefore, both pathways are typically considered together in SERAs. Invertebrates also represent a link between surface soil, surface water, and/or sediment and upper trophic level receptors through food web transfer. As such, they are often included as prey items for upper trophic level dietary exposures.

Birds, mammals, amphibians, and reptiles may be exposed to chemicals through: (1) the inhalation of gaseous chemicals or chemicals adhered to particulate matter; (2) the incidental ingestion of contaminated abiotic media (e.g., soil or sediment) during feeding or cleaning activities; (3) the ingestion of contaminated water; (4) the ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. These exposure routes, where applicable, are depicted on Figure 7-8. Their relative importance depends in part on the chemical being evaluated. For chemicals having the potential to bioaccumulate (e.g., PCBs), the greatest exposure to wildlife is likely to be from the ingestion of prey. For chemicals having a limited potential to bioaccumulate (e.g., aluminum), the exposure of wildlife to chemicals is likely to be greatest through the direct ingestion of abiotic media, such as surface soil.

Direct ingestion of drinking water is only considered if the salinity of a potential drinking water source is less than 15 ppt, the approximate toxic threshold for wildlife receptors (Humphreys, 1988). The only potential drinking water source linked to SWMU 69 is the drainage ditch system discussed in Section 7.1.2. Ingestion of surface water was not considered in risk calculations for upper trophic level receptors because, although water within the drainage ditch system is freshwater (i.e., surface run-off), surface water samples were not collected from the drainage ditch system during the 2004 or 2008 investigations. It should be noted that the drainage ditch was dry during the 2008 CMS investigation.

Certain potential exposure pathways and/or routes depicted on Figure 7-8 are considered insignificant relative to other pathways due to low potential for exposure and low levels of relevant contaminants. For example, dermal exposures are not considered significant relative to ingestion exposures for upper trophic level receptors. This is supported by evidence outlined in Suter II et al. (2000) and the USEPA (2003a), including the general fate properties of the majority of compounds detected in soil (e.g., low affinity for dermal uptake), the low potential exposure frequency (EF) and duration, and the protection offered by feathers, fur, and scales to avian, mammalian, and reptilian receptors. In addition, literature reviews indicate that dermal exposures to wildlife from classes of chemicals known or suspected to be of concern via dermal adsorption (e.g., VOCs, organophosphorous pesticides, and petroleum compounds) are often overestimated in laboratory studies (where feathers/fur are removed) and do not represent realistic exposure scenarios (USEPA, 2003a). Furthermore, though burrowing reptiles (which would be expected to experience the most significant exposure) may inhabit the vegetative units contiguous to SWMU

69, chemicals known or suspected to be of concern via dermal adsorption are not known to be associated with historical activities at the site (e.g., organophosphorous pesticides) or were detected at a low frequency and concentration (e.g., VOCs). Moreover, USEPA (2003a) calculated that the contribution of dermal exposures to the total dose received by terrestrial receptors to be 0.5 percent or less and therefore omitted the dermal pathway from consideration during Eco-SSL development. Incidental ingestion of surface soil and/or sediment during feeding and preening activities by upper trophic level receptors, as well as direct contact exposures by lower trophic level receptors (i.e., terrestrial and aquatic invertebrates) are considered significant exposure routes (Figure 7-8).

Inhalation of gaseous chemicals and chemicals adhered to particulate matter (e.g., soil) also is considered insignificant relative to ingestion pathways. As described above for dermal exposures, this approach is consistent with Suter II et al. (2000) and USEPA (1997 and 2003a), which recognize the relatively small contribution the inhalation pathway contributes to exposure estimates. For example, USEPA (2003a) estimates that the expected contribution to the total dose associated with the inhalation pathway is less than 0.01 percent for particulates and less than 1.0 percent for volatiles. Site conditions further reduce the importance of this exposure route relative to ingestion. The vegetative groundcover at 69 will minimize the suspension of dust and the potential for exposure via inhalation of chemicals adhered to soil particles. Furthermore, inhalation of gaseous chemicals that have volatilized from surface soil is likely to be insignificant given that VOCs were generally detected at a low frequency and/or concentration during the 2008 CMS field investigation.

7.3.2 Endpoints and Risk Questions

The conclusion of the screening level problem formulation includes the selection of ecological endpoints, which are based on the preliminary conceptual model. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ERA process as are risk hypotheses or risk questions (USEPA, 1997 and 1998). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1992 and 1997) and discussed in detail by Suter II (1989, 1990, and 1993). Risk questions ask how the assessment endpoints could be affected by site-related constituents.

Endpoints in the SERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur. Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to the site (USEPA, 1997). Assessment endpoints contain an entity (e.g., red-tailed hawk) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself (USEPA, 1992). Effects on individuals are important for some receptors, such as rare and endangered species; however, population- and community-level effects are typically more relevant to ecosystems.

Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level. In addition, use of criteria values designed to protect the vast majority (e.g., 95 percent) of the components of a community (e.g., National Ambient Water Quality Criteria [NAWQC] for the Protection of Aquatic Life) can be useful in evaluating potential community- and/or population-level effects.

Table 7-2 summarizes the assessment endpoints, risk questions, and measurement endpoints selected for the SERA. As evidenced by Table 7-2, the assessment endpoints selected for the upland habitat at SWMU 69 are based on the survival, growth, and reproduction of lower trophic level terrestrial receptor groups (terrestrial plants and invertebrates), terrestrial reptiles and amphibians, upper trophic level terrestrial birds (herbivores, omnivores, and carnivores), and upper trophic level terrestrial mammals (nectivorous bats).

The population traits of interest for each of the assessment endpoints listed in Table 7-2 represent components of a healthy population. Failure or impairment of survival, growth, or reproduction will adversely affect the ability of the population to be healthy and viable and fill its appropriate role in an ecosystem.

7.3.2.1 Selection of Receptors

Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. Therefore, specific receptor species (e.g., mourning dove) are often selected as surrogates to evaluate potential risks to larger components of the ecological community (e.g., avian herbivores) used to represent the assessment endpoints (e.g., survival, growth, and reproduction of avian herbivores). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, at the site;
- Have a particular ecological, economic, or aesthetic value;
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present at the site for which complete exposure pathways are likely to exist;
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations at the site; and
- Have sufficient ecotoxicological information available on which to base an evaluation.

Lower trophic level receptor species were evaluated based on those taxonomic groupings (e.g., terrestrial and aquatic plants and invertebrates) for which screening values have been developed. These groupings and screening values are used in most ERAs. As such, specific receptor species of lower trophic level terrestrial and aquatic biota were not chosen because of the limited species-specific information available. These receptors were instead dealt with on a community level via a comparison to media-specific screening values.

The upper trophic level terrestrial receptor species listed below were chosen for dietary exposure modeling to chemicals in SWMU 69 surface and subsurface soil based on the criteria listed

above, the general guidelines presented in USEPA (1991), the description of habitats and biota presented in Section 7.1, and the assessment endpoints (Table 7-2).

- Brown flower bat (*Erophylla sezekoni) (mammalian nectivore)*
- Mourning dove (*Zenaida macroura*) (avian herbivore)
- American robin (*Turdus migratorius*) (avian omnivore)
- Red-tailed hawk (*Buteo jamaicensis*) (avian carnivore)

The mourning dove and red-tailed hawk are known to occur in Puerto Rico (Raffaele, 1989). These two species also have been reported at NAPR (Table 7-1). The American robin was selected as a surrogate species to represent birds reported from NAPR with similar feeding habits and dietary preferences (e.g., red-legged thrush). SWMU 69 is not located within the critical habitat designation for the yellow-shouldered blackbird. Furthermore, based on their arboreal feeding habits, the yellow-shouldered blackbird is not expected to forage within the upland habitat immediately adjacent to the aircraft parking apron (grasses of unknown species composition). However, the vegetative community bordering the drainage ditch south and east of the expanded aircraft parking apron represents potential foraging habitat for the yellow-shouldered blackbird. However, as discussed in Section 7.1.3.2, arboreal insectivores, such as the yellow-shouldered blackbird, would not be expected to experience any significant exposures. Regardless, aspects of the feeding ecology of the American robin and yellow-shouldered blackbird indicate that the American robin can be protectively used as a surrogate receptor:

- The American robin forages on the ground for soft-bodied invertebrates, whereas the yellow-shouldered black bird is an arboreal feeder that forages within the canopy and sub-canopy of trees (USFWS, 1996a). The invertebrate prey item consumed by the American robin is assumed to be earthworms for the SERA. Because earthworms are in direct contact with soil, they will bioaccumulate soil contaminants at higher concentrations than the arboreal invertebrates consumed by the yellow-shouldered blackbird. Therefore, modeled dietary intakes that include earthworm ingestion will result in a conservative estimate of dietary exposures for the yellow-shouldered blackbird.

- The diet of the American robin is assumed to include 10.5 percent soil, whereas soil consumption by the yellow-shouldered blackbird is likely to be negligible based on their arboreal feeding behavior. Modeled dietary intakes that include soil ingestion also will result in a conservative estimate of dietary exposures for the yellow-shouldered blackbird.

Although potentially complete and significant exposure pathways exist at SWMU 69 for terrestrial ground mammals (i.e., incidental ingestion of surface soil, ingestion of surface water, and ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs), a terrestrial ground mammal was not selected as an ecological receptor for the following reasons.

- All native terrestrial ground mammals have been extirpated from Puerto Rico (Mac et al., 1998).

- The terrestrial ground mammals represented by potentially complete exposure pathways are limited to nonindigenous, nuisance species (i.e., Norway rat, black rat, and mongoose) that have been implicated in the decline of native reptilian and bird populations (Mac et al., 1998 and USFWS, 1996a).

As discussed in Section 7.1.3.1, vegetation within the coastal scrub forest community bordering the drainage ditches associated with SWMU 69 includes plants known to be used as a source of food by bats on Puerto Rico (white lead tree [nectar/pollen]). Therefore, a nectivorous bat (i.e., brown flower bat) was selected as an ecological receptor for upland habitat at the SWMU. This species is common and found throughout Puerto Rico (Gannon et al., 2005). As discussed in Section 7.1.3.2, the USEPA has excluded aerial and arboreal insectivorous birds from Eco-SSL development because they are considered inappropriate (i.e., they do not have a clear or indirect exposure pathway link to soil [indirect exposure pathways involve ingestion of prey that have direct contact with soil]). For this same reason, the USEPA also has excluded aerial insectivorous mammals (i.e., bats) from Eco-SSL development. Therefore, an aerial insectivorous bat (i.e., Antillean ghost-faced bat, Parnell's mustached bat, sooty mustached bat, big brown bat, red bat, velvety free-tailed bat, or Brazilian free-tailed bat) was not selected as an ecological receptor. A frugivorous bat (i.e., Jamaican fruit bat, Antillean fruit bat, or red fig-eating bat) also was excluded from evaluation based on the absence of fruit-bearing vegetation known to be used as a source of food on Puerto Rico. Finally, a piscivorous bat (i.e., Mexican bulldog bat) was excluded from evaluation since there are no fish associated with the SWMU.

While exposure pathways to reptiles are likely to be complete, specific reptilian species were not selected as receptors in the SERA since the life history and toxicological database concerning the effects of chemicals on reptiles is severely limited, rendering a quantitative evaluation problematic (USEPA, 2000a and 2005a). It is assumed that reptiles potentially present at the site are not exposed to significantly higher concentrations of chemicals and are not more sensitive to chemicals than the other upper trophic level receptor species evaluated in the risk assessment. Although this assumption is a source of uncertainty in the SERA, this approach is consistent with USEPA Region III guidance (USEPA, 2010a; available at http://www.epa.gov/reg3hwmd/risk/eco/index.htm), which states that "*As a general rule in Region 3, impacts to reptiles do not have to be considered as an assessment endpoint in the screening level ERA. However, the screening ERA would need to state that impacts to reptiles are being assessed qualitatively through the use of surrogate receptors. An exception to this rule is when a threatened or endangered reptile has been identified as a potential receptor on the site. In this situation, it may be appropriate to consider impact on reptiles when identifying assessment endpoints*." Based on the presence of intermittent surface water, the drainage ditch system downgradient from SWMU 69 may provide appropriate habitat for amphibian reproduction. This approach also is consistent with USEPA Region III guidance (USEPA, 2006), which states that "*Amphibians can and should be included as receptors in the screening level risk assessment as appropriate (based on the potential presence of habitat necessary to support these receptors). The assessment should consider AWQCs and any appropriate contaminant specific benchmark available in the literature*." Terrestrial amphibians are considered potential ecological receptors at SWMU 69 based on the presence of suitable habitat (see Section 7.1.3.3). Potential risk to reptiles and amphibians was qualitatively evaluated by examining exposure and risk to ecological receptors occupying similar trophic levels (i.e., avian herbivores, omnivores, and carnivores). A conclusion of acceptable or unacceptable risk to terrestrial avian receptors also was applied to terrestrial amphibians and reptiles.

The absence of a permanent fish population suggests that the drainage ditch system is flooded only intermittently. Based on the absence of a permanent fish population within the drainage

ditch system and the presence of significant aquatic habitat east and southeast of SWMU 69 (i.e., Los Machos mangrove forest and the estuarine wetland system south of Forrestal Drive), which provide significantly higher quality foraging habitat, a piscivorous bird was not selected as a receptor species.

7.3.3 Fate and Transport Mechanisms

In the absence of measured values of chemicals within biotic media, the transport and partitioning of constituents into particular environmental compartments, and their ultimate fate in those compartments, can be predicted from key physical-chemical characteristics. The physical-chemical characteristics that are most relevant for exposure modeling in this assessment include water solubility, adsorption to solids, octanol-water partitioning, and degradability. These characteristics are defined below.

The water solubility of a compound influences its partitioning to aqueous media. Highly water-soluble chemicals, such as most VOCs, have a tendency to remain dissolved in the water column rather than partitioning to sediment (Howard, 1991). Compounds with high water solubility also generally exhibit a lower tendency to bioconcentrate in aquatic organisms and a greater likelihood of biodegredation, at least over the short term (Howard, 1991).

Adsorption is a measure of a compound's affinity for binding to solids, such as soil or sediment particles. Adsorption is expressed in terms of partitioning, either as the adsorption coefficient (K_d), a unitless expression of the equilibrium concentration in the solid phase versus the water phase, or the organic carbon partition coefficient (K_{oc}, K_d normalized to the organic carbon content of the solid phase; again unitless) (Howard, 1991). For a given organic chemical, the higher the K_{oc} or K_d, the greater the tendency for that chemical to adhere strongly to soil or sediment particles. K_{oc} values can be measured directly or can be estimated from either water solubility or the octanol-water partition coefficient using one of several available regression equations (Howard, 1991).

Octanol-water partitioning indicates whether a compound is hydrophilic or hydrophobic. The octanol-water partition coefficient (K_{ow}) expresses the relative partitioning of a compound between octanol (lipids) and water. A high affinity for lipids equates to a high K_{ow} and vice versa. K_{ow} has been shown to correlate well with adsorption to soil or sediment particles and the potential to bioaccumulate in the food chain (Howard, 1991). Typically expressed as log K_{ow}, a value of 3.0 or less generally indicates that the chemical will not bioconcentrate to a significant degree (Maki and Duthie, 1978). Log K_{ow} values and K_{oc} values for organic chemicals analyzed for in environmental media collected at SWMU 69 (i.e., Appendix IX VOCs and SVOCs) are presented in Table 7-3.

Degradability is an important factor in determining whether there will be significant loss of mass or change in the form of a chemical over time in the environment. The half-life of a compound is typically used to describe losses from either degradation (biological or abiotic) or from transfer from one compartment to another (e.g., volatilization from soil to air). The half-life is the time required for one-half of the mass of a compound to undergo the loss or degradation process.

7.4 Screening Level Effects Evaluation

The purpose of the screening level effects evaluation is the establishment of chemical exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. One set of screening values is typically developed for each selected assessment endpoint. For the

SERA at SWMU 69, two types of screening values were developed (media-specific screening values and toxicity reference values [TRVs]). Media-specific screening values were developed for soil (surface and subsurface) and groundwater, while TRVs were developed for the evaluation of potential risks to upper trophic level terrestrial receptors (i.e., mammalian nectivores and avian omnivores, herbivores, and carnivores) from food web (dietary) exposures (i.e., ingested chemical doses).

7.4.1 Media-Specific Screening Values for Soil and Groundwater

The sections that follow describe the various criteria and toxicological benchmarks that were used as media-specific screening values for chemicals in soil (surface and subsurface soil) and groundwater. The media-specific screening values, listed in Tables 7-4 (soil) and 7-5 (groundwater), represent conservative exposure thresholds above which adverse ecological effects may occur.

7.4.1.1 Soil Screening Values for Terrestrial Plants and Invertebrates

The literature-based toxicological benchmarks that were used as screening values for chemicals in surface (0.0 to 1.0-feet bgs) and subsurface soil (1.0 to 3.0-feet bgs) are summarized in Table 7-4. USEPA Eco-SSLs (documentation is available at http://www.epa.gov/ecotox/ecossl/) for terrestrial plants and invertebrates were preferentially selected as soil screening values. For a given chemical, if an Eco-SSL was available for both receptor groups, the lowest value was selected as the soil screening value. In the case of chromium and vanadium, insufficient data are available from the literature for derivation of plant- and invertebrate-based Eco-SSLs (USEPA, 2008 and 2005b). However, both Eco-SSL documents list toxicological data from studies eligible for Eco-SSL derivation. The chromium Eco-SSL document cites two studies (Van Gestel et al., 1992 and 1993) that investigated the effect of chromium on earthworm (*Eisenia andrei*) reproduction, while the vanadium Eco-SSL document cites two studies (Kaplan et al., 1990) that investigated the effect of vanadium on broccoli (*Brassica oleracea*) growth. The chromium studies using earthworms reported Maximum Acceptable Toxicant Concentration (MATC) values of 57 mg/kg, while the vanadium studies using broccoli reported either a Lowest Observed Adverse Effect Concentration (LOAEC) of 100 mg/kg or a No Observed Adverse Effect Concentration (NOAEC) of 100 mg/kg. For this ERA, the MATC value of 57 mg/kg based on earthworm reproduction was used as the soil screening value for chromium, while the LOAEC value based on broccoli growth (with a safety factor of 5; Wentsel et al., 1996) was used as the soil screening value for vanadium.

For those chemicals lacking terrestrial plant and invertebrate Eco-SSLs or toxicological data eligible for Eco-SSL derivation, the literature-based toxicological benchmarks listed below were selected as soil screening values.

- Toxicological thresholds for earthworms and microorganisms (Efroymson et al., 1997a)
- Toxicological thresholds for plants (Efroymson et al., 1997b)

Identical to the Eco-SSLs, when more than one screening value was available for a given chemical from Efroymson et al. (1997a and 1997b), the lowest value was selected as the soil screening value. For those chemicals lacking an Eco-SSL, toxicological data eligible for Eco-SSL derivation, as well as a toxicological threshold from Efroymson et al. (1997a and 1997b), the following literature-based values, listed in their order of decreasing preference, were used as soil screening values:

- Toxicity reference values for plants and invertebrates listed in USEPA (1999a)

- Soil standards developed by the Ministry of Housing, Spatial Planning and Environment (MHSPE, 2000)

- Canadian soil quality guidelines (agricultural land use) developed by the Canadian Council of Ministers of the Environment (CCME, 2007)

Soil screening values based on MHSPE soil standards represent an average of the target and intervention soil standards. Values are based on a default organic carbon content of 2.0 percent, which represents the minimum value within the adjustment range (2.0 to 30.0 percent). Soil quality guidelines developed by CCME were given the lowest preference since many are background-based interim guidelines that do not represent effect-based concentrations.

7.4.1.2 Groundwater Screening Values

As discussed in Section 7.1.2 groundwater flow direction at SWMU 69 is east, toward the Los Machos mangrove forest. Because this estuarine wetland system represents a potential discharge point for SWMU 69 groundwater, the available groundwater data, collected during the 2008 CMS field investigation, were screened against the marine toxicological thresholds listed in Table 7-5.

PRWQS for Class SB coastal and estuarine waters listed in the Puerto Rico Water Quality Standards Regulation (PRWQSR) dated March 31, 2010 (PREQB, 2010) were preferentially used as groundwater screening values. PRWQS for Class SB coastal and estuarine waters were selected based on the classifications contained within Rule 1302.1 of the PRWQSR. For those chemicals lacking PRWQS for Class SB coastal and estuarine waters, groundwater screening values were identified from the following information listed in their order of decreasing preference:

- NAWQC (USEPA, 2009a)

- Final Chronic Values (FCVs) for saltwater contained in ECO Update Volume 3, Number 2 (USEPA, 1996)

- USEPA Region 4 chronic screening values for saltwater contained in Ecological Risk Assessment Bulletins – Supplement to Risk Assessment Guidance for Superfund (RAGS) (USEPA, 2001)

- Minimum chronic toxicity test endpoints (No Observed Effect Concentration [NOEC], No Observed Effect Level [NOEL], and MATC values) for marine species reported in the ECOTOX Database System (USEPA, 2007a)

- Chronic Lowest Observable Effect Levels (LOELs) for saltwater contained in National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQUIRTs) (Buchman, 2008) with a safety factor of 10 (Wentsel et al., 1996)

The order of preference was selected based on their level of protection. For example, FCVs would be expected to offer a greater degree of protection than a single species NOEC, MATC, or LOEL since their derivation considers a larger toxicological database. In the absence of the

above-mentioned FCVs, USEPA Region 4 chronic screening values, chronic test endpoints, and chronic LOELs, screening values were derived from the acute literature values listed below:

- Acute LOELs for saltwater contained in NOAA SQUIRTs (Buchman, 2008)

- Acute toxicity test endpoints (NOEC, NOEL, LOEL, Lowest Observed Effect Concentration [LOEC], median lethal concentration [LC_{50}], and median effective concentration [EC_{50}] values) for marine species contained in the ECOTOX Database System (USEPA, 2007a)

- LC_{50} values for marine species contained in Superfund Chemical Matrix (USEPA, 2004)

Chronic-based screening values were extrapolated from acute NOEC, NOEL, LOEC, LOEL, LC_{50}, and EC_{50} values as follows:

- An uncertainty factor of 30 was used to convert an acute NOEC or NOEL a chronic-based screening value (Wentsel et al., 1996)

- An uncertainty factor of 50 was used to convert an Acute LOEC or LOEL to a chronic-based screening value (Wentsel et al., 1996)

- An uncertainty factor of 100 was used to convert an EC_{50} or LC_{50} to a chronic-based screening value (Wentsel et al., 1996)

When acute toxicity data were used to extrapolate a chronic screening value, NOECs/NOELs were given preference over LOECs/LOELs, LOECs/LOELs were given preference over LC_{50} and EC_{50} values, and EC_{50} values were given preference over LC_{50} values. When more than one value was available from the literature for a given test endpoint (e.g., NOEC), the minimum value was conservatively used to extrapolate a chronic screening value.

As evidenced by Table 7-5, the total recoverable screening values selected for arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc are PRWQS for Class SD surface waters, while the total recoverable screening value selected for mercury is a USEPA saltwater NAWQC (CCC value). PRWQSR has adopted USEPA total recoverable NAWQC as PRWQS for arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc (the PRWQSR for these eight metals are identical to the total recoverable CCC values listed in National Recommended Water Quality Criteria [USEPA, 2009a]). Because groundwater samples collected at SWMU 69 were analyzed for total recoverable and dissolved metals, dissolved screening values also were identified from the literature. PRWQS expressed in terms of the dissolved metal in the water column are not available from the PRWQSR. However, USEPA saltwater CCC values for arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc, as well as mercury, can be expressed as dissolved or total recoverable concentrations (USEPA, 2009a). Therefore, screening values for these nine metals, expressed in terms of the dissolved metal in the water column, were derived by multiplying total recoverable PRWQS/USEPA CCC values by the saltwater conversion factors listed below (USEPA, 2009a):

- Arsenic: 1.000
- Cadmium: 0.994
- Chromium: 0.993 (value shown is for hexavalent chromium)
- Copper: 0.830

- Lead: 0.951
- Mercury: 0.850
- Nickel: 0.990
- Selenium: 0.998
- Zinc: 0.946

Total recoverable screening values were conservatively used to screen dissolved analytical data for those metals lacking screening values expressed as dissolved concentrations (i.e., antimony, barium, beryllium, cobalt, silver, thallium, tin, and vanadium).

Chronic-based screening values were extrapolated from acute NOEC, NOEL, LOEC, LOEL, LC_{50}, and EC_{50} values using the safety factors from Wentsel et al. (1996) identified above.

In some cases, acute and/or chronic saltwater LOELs for chemical classes (e.g., PAHs) were available from the literature (Buchman, 2008). A saltwater LOEL based on a chemical class was used as the groundwater screening value only if that chemical lacked freshwater and saltwater literature-based benchmarks and/or toxicity test endpoints.

7.4.2 Toxicity Reference Values for Avian and Mammalian Dietary Exposures

Not all chemicals analyzed for in surface soil, subsurface soil, surface water, and sediment were evaluated for avian and mammalian dietary exposures. The organic chemicals evaluated for dietary exposures are limited to those listed in Table 7-3 with the potential to bioaccumulate to a significant extent. Bioaccumulative organic chemicals are defined as those with a maximum reported log K_{ow} greater than or equal to 3.0. Rational for using a log K_{ow} of 3.0 to define an organic chemical with the potential to bioaccumulate is included as Appendix E. For conservatism, all inorganic chemicals (i.e., metals) also were evaluated for dietary exposures. The list of chemicals selected for evaluation contains many chemicals that are not identified as "important bioaccumulative compounds" by the USEPA (2000b). Their inclusion in the evaluation of avian and mammalian dietary exposures is consistent with the conservatism of the SERA.

TRVs for avian and mammalian dietary exposures to chemicals in surface soil and subsurface soil were compiled from the literature for each receptor species and chemical evaluated for dietary exposures. If available, TRVs identified and used by the USEPA in the derivation of avian and mammalian Eco-SSLs were preferentially used to evaluate risks from ingested dietary doses.

For chemicals lacking an avian/mammalian Eco-SSL, toxicological information from the literature for wildlife species most closely related to the receptor species was used if available. This information was supplemented by laboratory studies of non-wildlife species when necessary. Chronic No Observed Adverse Effect Levels (NOAELs) based on growth or reproduction were preferentially used as TRVs for upper trophic level receptors. NOAELs represent the highest dose of a chemical at which an effect being measured in a toxicity test does not occur. If several chronic toxicity studies were available from the literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. When chronic NOAEL values were unavailable, estimates were derived or extrapolated from chronic Lowest Observed Adverse Effect Levels (LOAELs) or median lethal dose (LD_{50}) acute values. LOAELs represent the lowest dose of a chemical at which an effect being measured in a toxicity test occurs, while an LD_{50} represents the dose of a chemical at which half of the organisms being tested die. An uncertainty factor of 5 was used to

convert a reported chronic LOAEL to a chronic NOAEL (Wentsel et al., 1996), while an uncertainty factor of 100 was used to convert the acute LD_{50} to a chronic NOAEL (i.e., the LD_{50} was multiplied by 0.01 to obtain the chronic NOAEL [Wentsel et al., 1996 and USEPA, 1997]).

TRVs for the avian species selected as ecological receptors (i.e., American robin, mourning dove, and red-tailed hawk), expressed as milligrams of the chemical per kilogram body weight of the receptor per day (mg/kg-BW/day) are provided in Table 7-6. Sample et al. (1996) consider a scaling factor of 1.0 most appropriate for interspecies extrapolation between birds. Therefore, the NOAEL and LOAEL values listed in Table 7-6 were not adjusted to reflect differences in body weights between avian test species and avian receptor species. TRVs for the mammalian species selected as an ecological receptor (i.e., brown flower bat) are provided in Table 7-7. Studies have shown that numerous physiological functions such as metabolic rates, as well as responses to toxic chemicals, are a function of body size. Smaller animals have higher metabolic rates and usually are more resistant to toxic chemicals because of more rapid rates of detoxification. Although body-weight scaling factors are typically used for interspecies extrapolation among mammals (Travis and White, 1988, Travis et al., 1990, and Sample et al., 1996), the mammalian TRVs were not adjusted in the screening level ERA to account for differences between receptor and test organism body weights. This is considered a conservative approach since the body weight of the brown flower bat (0.016 to 0.0205 kg [Gannon et al., 2005]) is lower than the body weight of all the test species listed in Table 7-7. Differences in receptor and test species body weights will be accounted for in Step 3a of the BERA (see Section 7.9).

7.5 Screening Level Exposure Estimation

This section presents the analytical data, exposure assumptions, and the exposure models and input parameters that were used to estimate the potential exposure of ecological receptors to chemicals in soil and groundwater.

7.5.1 Selection Criteria for Analytical Data

The analytical data used in the SERA (described in Section 7.2 and summarized in Appendix D) were reviewed against a set of selection criteria to identify specific data that would be used to estimate potential exposures to ecological receptors. The criteria used to select these analytical data are listed below.

- Data must have been validated by a qualified data validator using acceptable data validation methodology. Rejected ("R") values were not used in the SERA. Unqualified data and data qualified as estimated, "J" was treated as detected, while data qualified as "U "or estimated, "UJ" was treated as non-detected.

- The available soil analytical data were divided into surface soil data (i.e., analytical data for soil samples collected from the 0.0 to 1.0-foot depth interval) and subsurface soil data (analytical data for soil samples collected from the 1.0 to 2.0-foot and 2.0 to 3.0-foot depth intervals, which will be evaluated collectively as the 1.0 to 3.0-foot depth interval), and evaluated independently from each other. The evaluation of available soil analytical data was limited to these depth ranges since most soil heterotrophic activity and soil invertebrates occur on the surface or within the oxidized root zone (Suter II, 1995).

- For groundwater, only total (unfiltered) analytical data were used in the Step 2 screening level risk calculation.

- Maximum MDLs were conservatively used to estimate exposure for non-detected chemicals.

- In some instances, duplicate samples were collected in the field (Table 4-1). The maximum concentration of each chemical (or the maximum non-detected value) in the original or duplicate sample was used as a conservative estimate of contaminant concentration at a particular sampling point. Results from duplicate samples were not evaluated individually.

7.5.2 Exposure Estimation

Maximum detected concentrations in soil (surface and subsurface soil) and groundwater were used to conservatively estimate potential chemical exposures for the ecological receptors selected to represent the assessment endpoints. For conservatism, maximum MDLs for chemicals that were analyzed for but not detected also were compared to media-specific screening values and (where appropriate) used for food web exposure modeling. This was done to ensure that MDLs are similar to, or less than, chemical concentrations at which potential adverse effects to ecological receptors may occur. For samples with duplicate analyses, the higher of the two concentrations was used in the screening (when both values were detects or both values were non-detects). In cases where one result was a detection and the other a non-detect, the detected value was used in the assessment.

7.5.2.1 Lower Trophic Level Terrestrial and Aquatic Receptor Groups

Maximum measured chemical concentrations in soil and groundwater were compared to the media-specific screening values discussed in Section 7.4.1 and summarized in Tables 7-4 and 7-5 to conservatively evaluate the potential for adverse ecological effects to the lower trophic level receptor groups selected as assessment endpoints (e.g., terrestrial and aquatic plants and invertebrates).

7.5.2.2 Upper Trophic Level Receptors

Exposures for upper trophic level terrestrial receptor species via the food web were determined by estimating chemical-specific concentrations in each dietary component using uptake and food web models. Incidental ingestion of soil was included when calculating the total level of exposure. As indicated previously, maximum measured soil was used in all calculations to provide a conservative assessment.

For the screening level exposure estimation, tissue concentrations were modeled for terrestrial plants (food item for the mourning dove and brown flower bat), soil invertebrates (food item assumed for the American robin), and small mammals (food item for the red-tailed hawk). The omnivorous Norway rat was selected as the small mammal food item for the red-tailed hawk. A small mammal herbivore and/or insectivore were excluded as potential food items for the red-tailed hawk because they are not part of the Puerto Rican mammalian fauna (see Section 7.1.3.1).

7.5.2.2.1 Exposure Point Concentrations

The uptake of chemicals from the abiotic media into terrestrial food items is based (where available) on chemical-specific uptake equations (i.e., regressions based on measured soil and tissue concentrations) or conservative (e.g., maximum or 90th percentile) bioaccumulation factors

(BAFs) from the literature. Generic models based on Log K_{ow} values (presented in USEPA [2007b]) or default factors of 1.0 were used for chemicals only when uptake equations and/or BAF data were unavailable from the literature. The methodology and models used to derive these estimates are described below.

Terrestrial plants. Tissue concentrations in the aboveground vegetative portion of terrestrial plants were estimated by chemical-specific uptake equations (i.e. regressions developed from measured soil and tissue data) or by multiplying maximum measured soil concentrations by conservative, chemical-specific BAFs (maximum or 90th percentile values) either obtained directly from the literature or derived from literature data sets (Table 7-8). The chemical-specific BAF values listed in Table 7-8 are based on root uptake from soil and on the ratio between dry-weight soil and dry-weight plant tissue. Literature values based on the ratio between dry-weight soil and wet-weight plant tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content of terrestrial plants (15 percent [0.15]; Sample et al., 1997). Chemical-specific regressions developed by Bechtel Jacobs (1998) or USEPA (2007b) were given preference over high-end BAF values (i.e., maximum and 90th percentile values) if the regressions were significant ($p < 0.05$).

For bioaccumulative organic chemicals lacking significant regressions and chemical-specific BAFs, soil-to-plant BAFs were estimated from their Log K_{ow} using the rinsed foliage regression equation provided in Figure 5, Panel B of USEPA (2007b):

$$Log\ BAF = (-0.4057)\ (Log\ K_{ow}) + 1.781$$

where:

Log BAF = Log Soil-to-plant BAF (unitless; dry-weight basis)
Log K_{ow} = Log Octanol-water partitioning coefficient (unitless)

The Log K_{ow} values used in this equation are listed in Table 7-3.

Earthworms. Tissue concentrations in soil invertebrates (earthworms) were estimated by chemical-specific uptake equations (i.e. regressions developed from measured soil and tissue data) or by multiplying maximum measured soil concentrations for each chemical by conservative, chemical-specific soil-to-invertebrate BAFs (90th percentile values) obtained directly from the literature or derived from literature data sets (Table 7-8). The chemical-specific BAF values used in the SERA (Table 7-8) are based on the ratio between dry-weight soil and dry-weight earthworm tissue. Literature values based on the ratio between dry-weight soil and wet-weight earthworm tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content of earthworms (16 percent [0.16]; USEPA, 1993). BAFs based on depurated analyses (soil was purged from the gut of the earthworm prior to analysis) were given preference over undepurated analyses since direct ingestion of surface soil is accounted for separately in the food web model. Chemical-specific regressions developed by Sample et al. (1998a) were given preference over high-end BAF values (i.e., 90th percentile values) if the regressions were significant ($p < 0.05$).

For inorganic chemicals without available chemical-specific uptake equations or high-end BAFs, an earthworm BAF of 1.0 was assumed. For organic chemicals lacking chemical-specific uptake equations or high-end BAFs, earthworm BAF values were estimated from the model presented in Section 3.2.2 of USEPA (2007b) using the chemical-specific Log K_{ow} values listed in Table 7-3.

Small mammals. Whole-body tissue concentrations in small mammals (omnivores) were estimated using one of two methodologies. When available, chemical-specific uptake equations (i.e., regressions developed from measured soil and tissue data) or conservative, chemical-specific soil-to-small mammal BAFs (90th percentile values) obtained directly from the literature or derived from literature data sets were used to estimate whole-body tissue concentrations (Table 7-9). The chemical-specific BAFs listed in Table 7-9 are based on the ratio between dry-weight soil and dry-weight tissue. Literature values based on the ratio between dry-weight soil and wet-weight tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content of small mammals (32 percent [0.32]; USEPA, 1993). Chemical-specific regressions developed by Sample et al. (1998b) for general small mammals were given preference over high-end BAF values (i.e., 90th percentile values) if the regressions were significant ($p < 0.05$).

For those chemicals lacking chemical-specific uptake equations or literature-based BAF values, an alternate approach was used to estimate whole-body tissue concentrations. Because most chemical exposure for small mammal species is via the diet, it was assumed that the concentration of each chemical in a small mammal's tissues is equal to the chemical concentration in its diet multiplied by a diet to whole-body BAF (wet-weight basis) derived from the literature. For chemicals lacking literature-based diet to whole-body BAF values, a diet to whole-body BAF value of 1.0 was assumed. Resulting tissue concentrations (wet-weight) were converted to dry weight using an estimated solids content of 32 percent (see above). The use of a diet to whole-body BAF of 1.0 is likely to result in a conservative estimate of chemical concentrations for chemicals that are not known to biomagnify in terrestrial food chains (e.g., aluminum). For chemicals that are known to biomagnify, a diet to whole-body BAF value of one will likely result in a realistic estimate of tissue concentrations based on reported literature values. For example, a maximum BAF (wet weight) value of 1.0 was reported by Simmons and McKee (1992) for PCBs based on laboratory studies with white-footed mice. Menzie et al. (1992) reported BAF values (wet-weight) for dichlorodiphenyltrichloroethane (DDT) of 0.3 for voles and 0.2 for short-tailed shrews. Reported BAF (wet-weight) values for dioxin are only slightly above one (1.4) for the deer mouse (USEPA, 1990).

7.5.2.2.2 Dietary Intakes

Dietary intakes for each upper trophic level receptor species were calculated using the following formula modified from USEPA (1993).

$$DI_{xj} = \frac{[[\sum_i [(FIR_j)(FC_{xi})(PDF_i)]] + [(FIR_j)(SC_x)(PDS)]][AUF_j]}{BW_j}$$

where:

DI_{xj} = Dietary intake of chemical x by receptor j (mg chemical/kg body weight/day)
FIR_j = Food ingestion rate for receptor j (kilograms per day [kg/day]; dry-weight)
FC_{xi} = Maximum concentration of chemical x in food item i (mg/kg; dry weight)
PDF_i = Proportion of diet composed of food item i (unitless; dry weight basis)
SC_x = Maximum concentration of chemical x in soil (mg/kg; dry weight)
PDS = Proportion of diet composed of soil (unitless; dry weight basis)
BW_j = Body weight of receptor j (kg; wet weight basis)
AUF_j = Area Use Factor for receptor j (unitless)

Conservative, receptor-specific exposure parameters (maximum food ingestion rates, maximum water ingestion rates, and minimum body weights) for the American robin, mourning dove, red-tailed hawk, and brown flower bat are provided in Table 7-10. The food items selected for each receptor species are provided in Table 7-11. Although American robins are omnivores, an exclusive diet of earthworms was assumed for the SERA. Table 7-10 contains exposure parameters and Table 7-11 contains a dietary composition for the Norway rat (assumed diet of the red-tailed hawk). This assumption is based on likely small mammal prey species present in Puerto Rico (rats). Identification of exposure parameters and food items was necessary when estimating small mammal whole body tissue concentrations for those chemicals that lack a literature-based soil-to-small mammal BAF (i.e., an exposure dose was necessary to estimate tissue concentrations). Identical to the American robin, an exclusive diet of earthworms was assumed.

For the SERA, an AUF of 1.0 was assumed (i.e., each receptor is assumed to spend 100 percent of its time on the site). As such, receptor-specific home ranges were not considered in the estimation of dietary intakes.

7.6 Screening Level Risk Calculation

The screening level risk calculation represents the final step in a SERA. In this step, maximum chemical concentrations in abiotic media or maximum exposure doses for upper trophic level receptor species are compared with the corresponding screening values to derive screening level risk estimates. The outcome of this step is a list of ecological chemicals of potential concern (COPCs) for each media-pathway-receptor combination evaluated or a conclusion of negligible risk.

7.6.1 Selection of Ecological Chemicals of Potential Concern

Ecological COPCs were selected using the hazard quotient (HQ) method. For a given chemical, an HQ was calculated by dividing the maximum chemical concentration in the medium being evaluated by the corresponding medium-specific screening value or, in the case of upper trophic level receptors, by dividing the maximum exposure dose (derived by the equation presented in Section 7.5.2.2.2) by the corresponding TRV.

The following conservative methodology was used to identify ecological COPCs for lower trophic level receptor exposures to chemicals in soil (surface and subsurface soil) and groundwater.

- The maximum detected concentrations in surface soil, subsurface soil, and groundwater were used to calculate media-specific HQs. For a given medium, chemicals with HQs greater than 1.0 based on maximum detected concentrations were identified as ecological COPCs.

- For non-detected chemicals, maximum MDLs were used to calculate media-specific HQs. For a given medium, non-detected chemicals with HQs greater than 1.0 based on maximum MDLs were identified as ecological COPCs.

- Detected and non-detected chemicals without media-specific screening values were identified as ecological COPCs.

To select preliminary ecological COPCs for terrestrial dietary exposures, maximum chemical concentrations in surface soil and subsurface soil were used to estimate dietary doses for each receptor. HQs were calculated with NOAELs, LOAELs, and MATCs. The MATC is derived by taking the geometric mean of the NOAEL and LOAEL. Calculations with NOAELs provide the most conservative risk estimate, while calculations with LOAELs provide the least conservative risk estimate. Calculations with MATCs provide realistic risk estimates since the MATC represents an estimation of the threshold concentration (i.e., the concentration above which a toxic effect on the test endpoint is produced). For the SERA, chemicals (detected and non-detected) with NOAEL-based HQs greater than 1.0 were identified as ecological COPCs. Identical to the media-specific screening evaluation, detected and non-detected chemicals without literature-based TRVs also were identified as ecological COPCs for upper trophic level receptor exposures.

HQs greater than 1.0 indicate the potential for risk since the chemical concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure doses are derived using intentionally conservative assumptions (e.g., maximum media concentrations, maximum ingestion rates, and minimum body weights) such that HQs greater than 1.0 do not necessarily indicate that risks are present or impacts are occurring. Rather, they identify chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs less than 1.0 indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

In most cases, the SERA considers independent effects of chemicals. However, the potential does exist for multiple chemicals in environmental media to interact. Much uncertainty is involved with the interpretation of chemical interactions due to the complexity of potential effects (e.g., synergistic, antagonistic, or additive), and due to varying toxicities of compounds in different species. For these reasons, cumulative effects are not addressed for most chemicals in the SERA. Chemical interactions can be addressed by site-specific studies conducted in Step 6 of the Navy ERA process (i.e., site investigation and data analysis [Figure 7-1]).

7.6.2 Screening Level Risk Calculation: 2008 Data

Screening level risk calculations (i.e., HQ calculations) for SWMU 69 surface soil, subsurface soil, and groundwater are presented in Tables 7-12, 7-13, and 7-14, respectively. These calculations apply only to lower trophic level community exposures (i.e., HQ calculations for terrestrial plant and invertebrate exposures to chemicals in surface and subsurface soil, and pelagic and benthic biota exposures to chemicals in groundwater discharging to the downgradient estuarine wetland system). Screening level risk calculations for SWMU 69 avian and small mammal dietary exposures are presented in Tables 7-15 (surface soil) and 7-16 (subsurface soil). Ecological COPCs were identified in Step 2 of the SERA using the procedures outlined in Section 7.6.1.

7.6.2.1 Surface Soil

Table 7-12 presents the results of the screening level risk calculation for plant and invertebrate exposures to chemicals in SWMU 69 surface soil. Seven VOCs (4-methyl-2-pentanone, acetone, benzene, ethylbenzene, toluene, trans-1,4-dichloro-2-butene, and xylene [total]) were detected in SWMU 69 surface soil. Maximum detected concentrations are 7.7J µg/kg for 4-methyl-2-pentanone, 260 µg/kg for acetone, 0.99J µg/kg for benzene, 6.2J µg/kg for ethylbenzene, 3.3J µg/kg for toluene, 59J µg/kg for trans-1,4-dichloro-2-butene, and 28J µg/kg for total xylene. Based on HQs less than 1.0, benzene, ethylbenzene, toluene, trans-1,4-dichloro-2-butene and total

xylene are not identified as ecological COPCs. However, 4-methyl-2-pentanone and acetone are identified as ecological COPCs for SWMU 69 surface soil based on the lack of soil screening values. An additional twenty-five non-detected VOCs also are identified as ecological COPCs based on the lack of soil screening values (Table 7-12).

Five SVOCs (1,2,4,5-tetrachlorobenzene, bis[2-ethylhexyl]phthalate, butyl benzyl phthalate, di-n-octyl phthalate, and pentachlorobenzene) were detected in SWMU 69 surface soil. Maximum detected concentrations are 29J µg/kg for 1,2,4,5-tetrachlorobenzene, 1,000J µg/kg for bis(2-ethylhexyl)phthalate, 300J µg/kg for butyl benzyl phthalate, 26J µg/kg for di-n-octyl phthalate, and 13J µg/kg for pentachlorobenzene. Based on HQs less than 1.0, none of the five detected SVOCs are identified as ecological COPCs for SWMU 69 surface soil. Fifty-four non-detected SVOCs are identified as ecological COPCs based on the lack of soil screening values.

Seventeen PAHs were detected in SWMU 69 surface soil. Information available from the literature indicates that PAH toxicities in waters, tissues, and sediments are additive or nearly additive (USEPA 2003b). Assuming that PAH toxicities in soils are also additive or nearly additive, the combined toxicological contributions of the PAH mixture in SWMU 69 soils was considered. The USEPA (2007c) developed Eco-SSLs for low molecular weight (LMW) and high molecular weight (HMW) PAHs (29,000 µg/kg and 18,000 µg/kg, respectively [soil invertebrate-based values]). LMW PAHs are defined as PAH compounds composed of fewer than four carbon rings, while HMW PAHs are defined as PAH compounds composed of four or more carbon rings (USEPA, 2007c). A total of eight LMW PAH compounds (i.e., 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene) and nine HMW PAH compounds (i.e., benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene, and pyrene) were analyzed for in SWMU 69 surface soil. The sum of maximum LMW PAH concentrations across the SWMU (1,451.6 µg/kg; maximum MDL used for non-detected PAHs) is less than the LMW PAH Eco-SSL value (29,000 µg/kg). The sum of maximum HMW PAH concentrations across the SWMU (7,650 µg/kg) also is less than the HMW PAH Eco-SSL (18,000 µg/kg). Based on the comparison of maximum LMW and HMW PAH concentrations to the invertebrate-based Eco-SSLs, PAHs are not identified as ecological COPCs for SWMU 69 surface soil.

Sixteen metals were detected in SWMU 69 surface soil. Although detected, antimony, arsenic, beryllium, nickel, silver, and tin are not identified as ecological COPCs because maximum detected concentrations are less than soil screening values (i.e., maximum HQs are less than 1.0). However, maximum detected barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc concentrations exceed soil screening values (HQ values range from 1.13 for cadmium to 14.00 for vanadium; Table 7-12). Based on maximum detected concentrations greater than soil screening values, these ten metals are identified as ecological COPCs for SWMU 69 surface soil.

In summary, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc were detected and identified as ecological COPCs for SWMU 69 surface soil because maximum detected concentrations exceed soil screening values. The detected VOCs 4-methyl-2-pentanone and acetone also were identified as ecological COPCs based on the lack of soil screening values. An additional twenty-five non-detected VOCs and fifty-four non-detected SVOCs were identified as ecological COPCs based on the lack of soil screening values.

7.6.2.2 Subsurface Soil

Table 7-13 presents the results of the screening level risk calculation for plant and invertebrate exposures to chemicals in SWMU 69 subsurface soil (1.0 to 3.0-foot depth interval). Acetone and carbon disulfide were detected in SWMU 69 subsurface soil and are identified as ecological COPCs based on the lack of soil screening values. An additional twenty-four non-detected VOCs are identified as ecological COPCs based on the lack of soil screening values.

SVOCs (excluding PAHs) were not detected in subsurface soil collected at SWMU 69. However, fifty-four non-detected SVOCs are identified as ecological COPCs for SWMU 69 subsurface soil based on the lack of soil screening values.

PAHs were not detected in subsurface soil. As discussed in Section 7.6.2.1, PAH toxicities in soil are assumed to be additive or nearly additive. The USEPA (2007c) developed Eco-SSLs for LMW and HMW PAHs (29,000 µg/kg and 18,000 µg/kg, respectively [soil invertebrate-based values]). The sum of maximum LMW PAH concentrations across the SWMU (13.52 µg/kg; maximum MDL used for non-detected PAHs) is less than the LMW PAH Eco-SSL value (29,000 µg/kg). The sum of maximum HMW PAH concentrations across the SWMU (12.89 µg/kg; maximum MDL used for non-detected PAHs) also is less than the HMW PAH Eco-SSL (18,000 µg/kg). Based on the comparison of the sum of maximum LMW and HMW PAH concentrations to the invertebrate-based Eco-SSLs, PAHs are not identified as ecological COPCs for SWMU 69 subsurface soil.

Fourteen metals were detected in SWMU 69 subsurface soil. Although detected, arsenic, barium, beryllium, cadmium, chromium, lead, nickel, silver, and zinc are not identified as ecological COPCs because maximum detected concentrations are less than soil screening values (i.e., maximum HQs are less than 1.0). Cobalt, copper, mercury, selenium, and vanadium are identified as ecological COPCs because maximum detected concentrations exceed soil screening values. HQ values range from 1.10 for mercury to 19.00 for vanadium.

In summary, cobalt, copper, mercury, selenium, and vanadium were detected and identified as ecological COPCs for SWMU 69 subsurface soil because maximum detected concentrations exceed soil screening values. Two detected VOCs (acetone and carbon disulfide) were identified as ecological COPCs based on the lack of soil screening values. An additional twenty-four non-detected VOCs and fifty-four non-detected SVOCs were identified as ecological COPCs based on the lack of soil screening values.

7.6.2.3 Groundwater

Table 7-14 presents the results of the screening level risk calculation for SWMU 69 groundwater. 2-Hexanone, acetone, chloromethane were detected in SWMU 69 groundwater. However, because maximum detected concentrations (1.1J µg/L for 2-hexanone, 15J µg/L for acetone, and 1.5J µg/L for chloromethane) are less than groundwater screening values (HQs < 1.0), they are not identified as ecological COPCs. Although not detected, acrolein is identified as an ecological COPC because the maximum MDL for this VOC exceeds the groundwater screening value (HQ = 32.73). In addition, five non-detected VOCs are identified as ecological COPCs based on the lack of groundwater screening values.

3,4-Methylphenol, acenaphthene, dibenzofuran, fluorene, and phenanthrene were detected in SWMU 69 groundwater. As evidenced by Table 7-14, maximum detected concentrations for these five SVOCs are less than groundwater screening values (HQs < 1.0); as such, the detected SVOCs are not identified as ecological COPCs for SWMU 69 groundwater. Although not detected, hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene are identified as ecological COPCs because maximum MDLs exceed groundwater screening values (HQs = 2.08, 7.00, and 2.50, respectively). An additional sixteen non-detected SVOCs are identified as ecological COPCs based on the lack of groundwater screening values.

Arsenic, barium, cobalt, nickel, vanadium, and zinc were detected within the total recoverable fraction of SWMU 69 groundwater. Because all maximum detected concentrations are less than groundwater screening values (HQs range from 0.02 for arsenic to 0.58 for vanadium), these six metals are not identified as ecological COPCs for SWMU 69 groundwater.

In summary, one non-detected VOC (acrolein) and three non-detected SVOCs (hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene) were identified as ecological COPCs for SWMU 69 groundwater because maximum MDLs exceed screening values. An additional five non-detected VOCs and sixteen non-detected SVOCs were identified as ecological COPCs based on the lack of marine surface water screening values.

7.6.2.4 Upper Trophic Level Dietary Exposures

Results of the screening level risk calculation for SWMU 69 dietary exposures are presented in Tables 7-15 (brown flower bat, American robin, mourning dove, and red-tailed hawk dietary exposures to chemicals in surface soil) and 7-16 (brown flower bat, American robin, mourning dove, and red-tailed hawk dietary exposures to chemicals in subsurface soil). A discussion of these results is presented in the sections that follow.

7.6.2.4.1 Dietary Exposures to Chemicals in Surface Soil

Results of the screening level risk calculation for avian and mammalian dietary exposures to chemicals in SWMU 69 surface soil are presented in Table 7-15. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, one detected PAH (pyrene) and two detected metals (barium and selenium) have NOAEL-based HQ values greater than 1.0 for the brown flower bat (HQs = 1.25 for pyrene, 1.20 for barium, and 1.18 for selenium). For this reason, pyrene, barium, and selenium are identified as ecological COPCs for brown flower bat dietary exposures to chemicals in SWMU 69 surface soil. In addition, one detected SVOC (1,2,4,5-tetrachlorobenzene), four non-detected VOCs, and twenty-one non-detected SVOCs are identified as ecological COPCs for mammalian dietary exposures based on the lack of TRVs.

Ten detected chemicals (barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc) have NOAEL-based HQ values greater than 1.0 for one or more of the avian receptors. The highest HQ values were calculated for the American robin, including an HQ of 40.16 for vanadium, 30.68 for mercury, 26.36 for chromium, 24.07 for cadmium, and 11.58 for lead. Remaining HQs for metals were each less than 10.00. Based on maximum exposures doses greater than NOAEL-based TRVs, these ten metals are identified as ecological COPCs for avian dietary exposures to chemicals in SWMU 69 surface soil. Two detected VOCs (ethylbenzene and toluene), three detected SVOCs (1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, and pentachlorobenzene), and one detected metal (beryllium), as well as ten non-detected VOCs and twenty-six non-detected SVOCs also are identified as ecological COPCs for avian dietary exposures based on the lack of TRVs.

As potential risk to amphibians and reptiles is qualitatively evaluated based on potential risk to avian receptors, each of the chemicals identified as ecological COPCs for avian dietary exposures to surface soil in the preceding paragraph is also identified as an ecological COPC for amphibians and reptiles.*7.6.2.4.2* *Dietary Exposures to Chemicals in Subsurface Soil*

Results of the screening level risk calculation for avian and mammalian dietary exposures to chemicals in SWMU 69 subsurface soil are presented in Table 7-16. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, no chemicals have HQ values greater than 1.0 for the brown flower bat in SWMU 69 subsurface soil. Four non-detected VOCs and twenty-two non-detected SVOCs are identified as ecological COPCs for the brown flower bat based on the lack of TRVs.

Six detected chemicals (chromium, copper, mercury, nickel, vanadium and zinc) have NOAEL-based HQ values greater than 1.0 for one or more of the avian receptors. Identical to surface soil, the highest HQ values were calculated for the American robin, including a HQ of 54.50 for vanadium and 21.09 for mercury. The remaining HQs for metals were each less than 10.00. Based on maximum exposures doses greater than NOAEL-based TRVs, these six metals are identified as ecological COPCs for avian dietary exposures to chemicals in SWMU 69 subsurface soil. One detected metal (beryllium), as well as twelve non-detected VOCs and twenty-nine non-detected SVOCs also are identified as ecological COPCs based on the lack of TRVs.

As potential risk to amphibians and reptiles is qualitatively evaluated based on potential risk to avian receptors, each of the chemicals identified as ecological COPCs for avian dietary exposures to subsurface soil in the preceding paragraph is also identified as an ecological COPC for amphibians and reptiles.

7.7 Uncertainties Associated with the SERA

The procedures used in this evaluation to assess risks to ecological receptors, as in all such assessments, are subject to uncertainties because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. Reliance on results from a risk assessment can be misleading without a consideration of the uncertainties, limitations, and assumptions inherent in the process. The major uncertainties associated with the SERA for SWMU 69 are identified and discussed below.

Analytical Data

- Analytical data for many chemicals were qualified as estimated, "J" because the results fall between the MDL and method reporting limit (MRL). Although concentrations that fall between the MDL and MRL are considered detected, the confidence in the quantified values is low.

- A second source of uncertainty related to the analytical data applies to the spatial coverage of subsurface soil collected during the 2008 CMS field investigation. A total of five subsurface soil samples were collected from the 1.0 to 3.0-foot depth interval. The limited subsurface soil data from this depth interval is a source of uncertainty since it is not known if the available data capture maximum concentrations.

- A third source of uncertainty related to the analytical data applies to chemicals for which all data were rejected during data validation. In surface soil, all data were rejected for the VOC isobutyl alcohol and the SVOC 4-nitroquinoline-1-oxide. In subsurface soil, all

data were rejected for the VOCs acrolein and isobutyl alcohol, and for the SVOC 4-nitroquinoline-1-oxide. In groundwater, all data were rejected for the SVOCs 4-nitroquinoline-1-oxide and hexachlorophene. None of these chemicals are specifically known to have been used historically at the SWMU.

- A fourth source of uncertainty related to analytical data involves the lack of surface water data. The drainage ditch acts as an intermittently flooded drainage swale. No water was present during the 2008 CMS Investigation, and the ditch area was not sampled as part of this investigation. As such, surface water ingestion was not included in food web modeling. This uncertainty is addressed further in Sections 7.10.7 and 7.10.10.

- A fifth source of uncertainty related to analytical data involves the lack of soil samples from the drainage ditch. Sampling during the 2008 CMS was focused on the area adjacent to the aircraft parking area, which was the source of contamination at the site. It should be noted that the drainage ditch was sampled as part of the 2010 Disturbed Soil Sampling Investigation (Section 7.10).

Identification of Ecological COPCs

- Chemicals without available screening values were identified as ecological COPCs even if they were not detected. Non-detected chemicals with MDLs greater than screening values also were identified as ecological COPCs in the SERA. This approach likely overstates the number of actual COPCs.

- A second source of uncertainty related to the selection of ecological COPCs applies to the use of NOAEL-based TRVs in risk calculations for upper trophic level receptors. The use of NOAEL-based TRVs is extremely conservative since they give no indication as to how much higher a dose must be before adverse effects are observed. This uncertainty does not apply to NOAEL-based TRVs obtained from Eco-SSL documents for 7,12-dimethylbenz(a)anthracene, pentachlorophenol, arsenic, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, vanadium, and zinc since these values are based on a compilation of NOAEL and LOAEL values.

Exposure Point Concentrations

- The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges and for species populations (even those that are immobile or have limited home ranges) are those based on mean concentrations or 95 percent Upper Confidence Limit (UCL) of the mean concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the Wildlife Exposure Factors Handbook (USEPA, 1993), which specify the use of average media concentrations. Given the mobility of the upper trophic level receptor species used in the SERA (i.e., brown flower bat, American robin, mourning dove, and red-tailed hawk), the use of maximum chemical concentrations to estimate the exposure via food webs is very conservative.

Media-Specific Screening Values

- Literature-based toxicological thresholds were not available for many of the chemicals evaluated in the SERA. Furthermore, many of the surface soil screening values used in the comparison to surface soil analytical data are background-based concentrations (i.e., Canadian soil quality guidelines; Table 7-4). Because background-based screening values do not represent effect concentrations, their use in the SERA likely resulted in an overstatement of the actual number of ecological COPCs.

- When a toxicological threshold was available for both terrestrial plants and invertebrates, the minimum value was selected as the screening value. For several chemicals, only a plant or earthworm toxicological threshold was available from the literature. It was assumed in the SERA that the screening value selected for these chemicals are protective of both receptor communities. If a given chemical does not have an available screening value for both terrestrial plants and invertebrates, this approach will result in an underestimation of potential risks if the screening value is not based on the most sensitive receptor community.

- A third source of uncertainty related to media-specific screening values applies to groundwater screening values. PRWQS or USEPA NAWQC expressed as total recoverable concentrations were used as groundwater water screening values for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Because the filtered fraction more closely approximates the bioavailable fraction of these nine metals in the water column (USEPA, 1999b and 2002a), use of screening values expressed in terms of the total recoverable concentration in the water column likely resulted in an overstatement of the actual number of ecological COPCs. It is noted that the uncertainty associated with the comparison of total recoverable metal concentrations to NAWQC was addressed in Step 3a of the BERA by comparing dissolved metals concentrations to screening values expressed as dissolved concentrations. It is further noted that this uncertainty does not apply to filter feeding organisms (e.g., clams and mussels), which may receive exposure from total metals in surface water.

Toxicity Reference Values

- Data on the toxicity of many chemicals to the receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation for ERAs because so few wildlife species have been tested directly for most chemicals. The uncertainties associated with toxicity extrapolation were minimized through the selection of the most appropriate test species for which suitable toxicity data were available. The factors that were considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet. Regardless, the use of NOAEL and LOAEL values derived from laboratory studies with non-wildlife species may have resulted in an overstatement or understatement of potential risks if the sensitivities of the receptor and test species differ appreciably.

- As discussed in Section 7.4.2, the mammalian TRVs listed in Table 7-7 were not adjusted in the screening level ERA to account for differences between receptor and test organism body weights. Given that the body weight of the brown flower bat (0.016 to 0.0205 kg [Gannon et al., 2005]) is lower than the body weight of all the test species listed in Table

7-7, this resulted in an overstatement of potential risks since smaller animals have higher metabolic rates and usually are more resistant to toxic chemicals because of more rapid rates of detoxification.

- A third source of uncertainty related to the derivation of TRVs applies to metals. Most of the toxicological studies on which the TRVs for metals were based used forms of the metal (such as salts [Table 7-6]) that have high water solubility and high bioavailability to receptors. Since the analytical samples on which site-specific exposure estimates were based measured total metal concentrations, regardless of form, and these highly bioavailable forms are expected to compose only a fraction of the total metal concentration, this is likely to result in an overestimation of potential risks for these chemicals.

- A fourth source of uncertainty related to the derivation of TRVs applies to mercury. The NOAEL-based mercury TRV used for birds (0.026 mg/kg-BW/day) was based on an organometallic (methylated) form (methyl mercury dicyandiamide). Avian TRVs for inorganic forms of mercury are an order of magnitude higher (0.45 mg/kg-BW/day for mercuric chloride [Sample et al., 1996]. The USEPA (2001b) reports that between 0.5 to 5.3 percent of the total mercury in soil is present as methylmercury. These data indicate that methylmercury represents a fraction of the total mercury in soil. As such, the use of a TRV based on a methylated form, which assumes that 100 percent of the detected mercury is present as methyl mercury, likely resulted in an overestimation of potential risks to avian receptors.

Ecological Receptors

- Although exposure pathways to terrestrial reptiles are likely to be complete, assessment endpoints were not selected for this receptor group. As discussed in the SERA, there is a paucity of data concerning the toxicological effects of chemicals for reptiles, rendering a quantitative evaluation problematic (USEPA, 2000a and 2005a). Therefore, for a given ecological COC, a conclusion of acceptable or unacceptable risk to terrestrial avian omnivores also was applied to terrestrial reptiles. It was assumed that terrestrial reptiles at SWMU 69 are not exposed to significantly higher concentrations of ecological COCs and are not more sensitive to ecological COCs than the avian receptors evaluated by the ERA. If terrestrial reptiles are exposed to significantly higher concentrations of ecological COCs and/or are more sensitive to ecological COCs than the avian receptors, this approach resulted in an underestimation of potential risks. However, reptiles are poikilotherms (body temperature varies with environmental temperature), while birds are homeotherms (temperature is regulated, constant, and largely independent of environmental temperatures). Therefore, reptiles tend to have much lower metabolic rates and lower caloric intake requirements than birds. As a consequence, birds are likely to consume more food than reptiles on a daily dietary intake basis, assuming similar caloric content of the food items. Therefore, potential risks to terrestrial reptiles are likely overstated when risk estimates for avian receptors are applied to herpetofauna.

Exposure Routes

- Although inhalation and/or dermal adsorption represent potential exposure routes for upper trophic level receptors, they were not evaluated in the SERA because they were considered insignificant relative to ingestion exposures (see Section 7.3.1.3). While this

is a reasonable assumption for the terrestrial birds and mammals selected as ecological receptors, the exclusion of inhalation and dermal adsorption represents a source of uncertainty that may have resulted in an underestimation of potential risks.

Dietary Exposure Modeling

- Chemical concentrations in avian food items (terrestrial plants, invertebrates, and small mammal omnivores) and mammalian food items (terrestrial plants) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and BAFs introduces some uncertainty into the risk estimates and may have resulted in an overstatement or understatement of potential risks. The values selected and the methodologies employed were intended to provide a reasonable estimate of potential dietary exposure concentrations.

- A second source of uncertainty related to the food web models is the use of default assumptions for exposure parameters such as BAFs. Although chemical-specific uptake equations and BAFs for many chemicals were readily available from the literature and were used in the ERA, the use of a default factor of 1.0 to estimate the concentration of some chemicals in receptor prey items is a source of uncertainty. The assumption that the chemical body burden in the prey item is at the same concentration as in soil is conservative for chemicals that are not known not to accumulate to any significant degree. However, if a chemical does accumulate in receptor prey items, the use of a default factor of 1.0 may have resulted in an underestimation of potential risks to the upper trophic level receptors evaluated by this ERA.

- A third source of uncertainty related to dietary exposure modeling applies to the assumed diet of the red-tailed hawk. In the SERA, it was assumed that the diet of the red-tailed hawk consisted solely on rodents (i.e., Norway rat). However, red-tailed hawks are opportunistic feeders and prey will vary with regional and seasonal availability. In Puerto-Rico's El Yunque rainforest, the following food items were delivered to nestlings: rats (black rat and Norway rat), birds (such as the zenaida dove), lizards (*Anolis* spp.), snakes (such as the Puerto Rican racer [*Alsophis portoricensis*]), and coquis (*Eleutherodactylus* spp.) (Global Raptor Information Network, 2010). Santana and Temple (1988) reported the diet of red-tailed hawks in mountain rain and cloud forests of Puerto Rico consisted primarily of birds, reptiles, and amphibians captured from the tree canopy, while the diet of lowland hawks was comprised mostly of mammals. The diet of lowland hawks reported by Santana and Temple (1988) support the diet assumption used in the SERA. However, if red-tailed hawks at NAPR consume a mixed diet of rats, birds, and reptiles, and bioaccumulation of chemicals in birds and reptiles differ from their bioaccumulation in rats, an assumed diet of 100 percent rats may have resulted in an overestimation or underestimation of potential risks.

- A fourth source of uncertainty related to the food web models is the use of unrealistically conservative exposure parameters. The use of maximum ingestion rates and minimum body weights resulted in a conservative estimate of exposure. In addition, AUFs were assumed to equal one. This is a conservative assumption since a significant percentage of each upper trophic level receptor species time could be spent foraging off-site in areas not impacted by site-related chemicals or areas where chemical concentrations are expected to be significantly lower.

Chemical Mixtures

- The cumulative impacts of ecological COPCs in a given medium cannot be directly addressed by a screening level ERA, which is specifically designed to compare individual chemical concentrations to individual chemical threshold values established by regulatory agencies or the scientific literature. Approaches exist to conservatively sum Step 2 risk estimates (i.e., HQ values); however, they can vastly overestimate the potential for risk and have been identified as "*a conservative estimator of risk that may have little ecological relevance*" (Dyer et al., 2000).

  Although cumulative effects may be indirectly examined via detailed literature reviews and toxicity testing of site media, this level of investigation is reserved for a BERA (i.e., Steps 3a through 7 of the Navy ERA process; Figure 7-1), which has a goal of collecting and interpreting site-specific information. It is important to note that Norwood et al. (2003) performed a review of the impacts of mixtures of inorganic constituents on aquatic biota and found that additive, synergistic, and antagonistic responses were found with equal frequency. This finding indicates that generalizations cannot be made in Step 2.

7.8 SERA Decision Point and Recommendations: 2008 Data

The results of the SERA for SWMU 69 indicated that, based on a set of conservative exposure assumptions, there are one or more chemicals in surface soil, subsurface soil, and groundwater that may present risks to one or more of the receptor species/receptor groups evaluated (see Section 7.6.2). Under Navy policy, if the results of the Steps 1 and 2 (Tier 1 SERA) indicate that there are chemicals present in environmental media that may present risks to receptor species/receptor groups, the ERA process proceeds to the BERA (i.e., Step 3a). Therefore, further evaluation of each medium in Step 3a of the BERA is warranted.

7.9 Step 3a of the BERA: 2008 Data

The results of the screening level risk calculation indicated that, based on a set of conservative assumptions, there are one or more chemicals in each medium evaluated that may present risks to ecological receptors groups and/or specific receptor species. As such, the ERA process at SWMU 69 proceeded to the BERA. According to Superfund guidance (USEPA, 1997), Step 3 initiates the problem formulation phase of the BERA. Under Navy guidance (CNO, 1999), the BERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a (Figure 7-1). In Step 3a, the conservative assumptions employed in the SERA (Tier 1) are refined and risk estimates are recalculated using the same conceptual model. Step 3a may also include consideration of background data and chemical bioavailability.

The specific assumptions, parameters, and methods that were modified for the recalculation of media-specific and dietary HQ values are identified below, along with justification for each modification. These refinements and methods were used in Step 3a of the BERA to weigh the evidence of potential risk for each ecological COPC identified for each medium and receptor to determine whether the ecological COPCs should be identified as ecological COCs.

- Lower trophic level and upper trophic level risk estimates for ecological COPCs in surface soil were refined using 95 percent UCL of the mean chemical concentrations rather than maximum concentrations. 95 percent UCL of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software [USEPA, 2010b; see

Appendix F]). This approach was agreed upon in the Navy's responses (dated February 15, 2008) to USEPA comments (dated December 11, 2007) on the Final Additional Data Collection Work Plan for SWMU 14 (Baker, 2007). However, as specified in the USEPA's December 11, 2007 comment letter, 95 percent UCL of the mean concentrations were not derived for those ecological COPCs with data sets that do not have more than 70 percent non-detected results and a minimum of eight detected values.

For individual upper trophic-level receptor species, 95 percent UCL of the mean concentrations provide a better estimate of the likely level of chemical exposure because each receptor would be expected to forage in several different areas of the site, and, in many cases, off-site. Mean concentrations are also appropriate for evaluating impacts *to populations* of lower trophic level receptors (e.g., terrestrial invertebrates). Because some of these receptors are relatively immobile, *individuals* are likely to be impacted by locations of maximum concentrations. However, an evaluation of exposure based on 95 percent UCL of the mean concentrations is more indicative of the level of impact that might be expected at the *population* level. It is noted that the magnitude of detections above soil screening values was considered when evaluating refined risk estimates based on 95 percent UCL of the mean concentrations (Parker et al., 2003). This consideration ensures that potential effects of hot spots are not diluted by calculating 95 percent UCL of the mean concentrations.

Based on the limited size of the SWMU 69 subsurface soil and groundwater data sets (n = 5 and n = 7, respectively), Step 3a of the BERA for these media did not include a refinement of risk estimates for terrestrial and aquatic receptor groups using 95 percent UCL of the mean concentrations.

- Central tendency estimates (e.g., mean, median, midpoint) for body weight, food ingestion rate, and water ingestion rate (Table 7-17) were used to develop exposure estimates for upper trophic level receptors rather than the minimum body weights and maximum ingestion rates used in the SERA. The use of central tendency estimates is more relevant because these estimates represent the characteristics of a greater proportion of the individuals in the population. The evaluation of dietary exposures still assumed an AUF of 1.0.

- The diets used for the American robin and Norway rat (food item for the red-tailed hawk) were adjusted to reflect their omnivorous feeding behavior. Wheelwright (1986), as cited in USEPA (1993), reported seasonal dietary compositions for American robins in the western United States. Martin et al. (1951) also reported seasonal dietary compositions for the American robin throughout North America. The highest percentage of invertebrates in the diet of the American robin was reported during the spring: 83.0 percent by Wheelwright (1986) and 78.9 percent by Martin et al. (1951). For conservatism, the contribution that earthworms have to the total diet of the American robin in the BERA was assumed to be 83.0 percent (highest seasonal contribution reported by Wheelwright (1986) and Martin et al. (1951). Using the relationship presented in Sample and Suter II (1994), a diet of 83.0 percent earthworms extrapolates to a soil contribution of 8.7 percent to the total diet. The remainder of the diet was assumed to be plants (7.3 percent). This diet was used to refine risk estimates for American robin dietary exposures to ecological COPCs in soil. The diet of the Norway rat was assumed to be 49.0 percent terrestrial invertebrates, 49.0 percent terrestrial plants, and 2.0 percent soil. The specific diets that were used in Step 3a of the BERA for the American robin, mourning dove, and red-tailed hawk are summarized in Table 7-18.

- The TRVs listed in Table 7-7 for pyrene and selenium (ecological COPCs for mammalian dietary exposures to chemicals in SWMU 69 surface soil) were adjusted in Step 3a of the BERA to reflect differences in body weights between the mammalian test species and the brown flower bat. Using the NOAEL as an example, this was accomplished by using the following scaling equation (Sample et al., 1996):

$$NOAEL_r = NOAEL_t(BW_t/BW_r)^{1/4}$$

where:

$NOAEL_r$	=	NOAEL for the receptor species (mg/kg-BW/day)
$NOAEL_t$	=	NOAEL for the test species (mg/kg-BW/day)
BW_t	=	Body weight of test species (kg)
BW_r	=	Body weight of receptor species (kg)

Adjusted TRVs for pyrene and selenium are summarized within the table below:

Ecological COPC	**Adjusted TRVs**		
	NOAEL	**LOAEL**	**MATC**
Pyrene	**0.353**	**1.728**	**0.781**
Selenium	**0.382**	**0.574**	**0.468**

Although barium was identified as an ecological COPC for brown flower bat dietary exposures to chemicals in SWMU 69 surface soil (Table 7-15), the TRVs for this chemical could not be adjusted since it is based on multiple studies that used different test species (Table 7-7). The uncertainty of this limitation is discussed in Section 7.9.2.

- The chemical-specific uptake equations used in the SERA to estimate tissue concentrations in terrestrial plants and invertebrates also were used in Step 3a of the BERA. However, soil concentrations used in the estimation were 95 percent UCL of mean values (in place of maximum concentrations) for those ecological COPCs with data sets that meet the criteria specified within the bullet item above (i.e., less than 70 percent non-detected results and a minimum of eight detected values). In addition, the uptake equations used for small mammals (general uptake equations for all small mammals developed by Sample et al. [1998b]) were replaced by uptake equations developed specifically for small mammal omnivores. Identical to uptake equations for terrestrial plants and invertebrates, 95 percent UCL of the mean concentrations were used to estimate small mammal tissue concentrations for those ecological COPCs with data sets having less than 70 percent non-detected results and a minimum of eight detected values. When chemical-specific BAFs were used to estimate prey item tissue concentrations, BAFs based on central tendency estimates (e.g., mean, median, midpoint) were used in place of maximum or high-end (e.g., 90th percentile) values. An assumed BAF of 1.0 was still used for those chemicals lacking a chemical-specific uptake equation or BAF. The chemical-specific uptake equations and BAFs that were used in Step 3a for those chemicals identified as ecological COPCs in the Step 2 screening level risk calculation are summarized in Tables 7-19 (plant and earthworm BAFs) and 7-20 (small mammal omnivore BAFs).

- In addition to the NOAEL-based risk estimates used in the SERA for the mourning dove, red-tailed hawk, and brown flower bat, consideration also was given to food web risk

estimates based on LOAELs and MATCs. However, because the American robin is being used as a surrogate for the yellow-shouldered blackbird, only NOAEL-based risk estimates were considered for this receptor.

- For detected chemicals lacking medium-specific screening values, the USEPA (2009b and 2009c) Ecological Structure Activity Relationships (ECOSAR) Class Program (MS-Windows Version 1.00a; http://www.epa.gov/opptintr/newchems/tools/21ecosar.htm), was used to estimate their toxicity based on structural similarities to chemicals for which toxicity data are available (i.e., structure activity relationships [SARs]).

- For inorganic ecological COPCs (i.e., metals) in SWMU 69 surface soil, subsurface soil, and groundwater, consideration was given to available background data. This was accomplished by statistically comparing SWMU-specific media concentrations to background concentrations in accordance with Navy guidance (NFESC, 2002 and 2003). Statistical comparisons included descriptive summaries of each data set (e.g., maximum, mean, and 95 percent UCL of the mean concentrations), statistical tests on the mean/median of the distributions (i.e., two sample t-test, Wilcoxon rank sum test, Gehan test, or Satterthwaite t-test), and statistical tests on the right tail of the distributions (i.e., quantile test and slippage test). The significance level (i.e., the probability criteria for rejecting the null hypothesis that the SWMU 69 and background data sets were sampled from the same population) was set at 0.05 for all statistical tests (NFESC, 2002 and 2003). Based on the limited size of the SWMU 69 subsurface soil and groundwater data sets (n = 5 and 7, respectively), the statistical evaluations for these two media were limited to a descriptive comparison.

  The background soil data used in Step 3a of the BERA is the background airfield data set presented in Addendum B (airfield soil) of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010b).

- Chemicals that were not identified as ecological COPCs because maximum detected concentrations (or maximum MDLs in the case of non-detected chemicals) were less than media-specific screening values were not evaluated in Step 3a of the BERA since a conclusion of no unacceptable risk can be made with high confidence. Detected and non-detected chemicals with maximum dietary intakes less than NAOEL-based TRVs also were excluded from further evaluation in Step 3a of the BERA.

- Non-detected chemicals lacking media-specific screening values (or, in the case of dietary exposures, TRVs) were excluded from further evaluation in Step 3a of the BERA. It is not possible to quantitatively address the potential for risk from chemicals that are not detected and that do not have established screening values with which to compare them. Even considerations of the most conservative measurement (the maximum MDL) are not informative when no threshold value has been established. Because of these limitations, the approach follows that outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300, Appendix A), which does not establish a release when the sample measurement is less than the contract required detection limit as determined by a USEPA certified laboratory. As all samples were analyzed by a certified laboratory, and were validated by an independent third party, the exclusion of non-detected chemicals is considered reasonable and appropriate. Although eliminated from further evaluation, they remain ecological COPCs but are not considered ecological COCs. It is additionally noted that any site-specific studies, which may be

conducted during a BERA, would indirectly evaluate the impacts of non-detected chemicals.

7.9.1 Refined Risk Evaluation: 2008 Data

Detected chemicals with maximum concentrations and/or maximum exposure doses greater than screening values, as well as detected chemicals lacking screening values were identified as ecological COPCs in Step 2 of the SERA. Non-detected chemicals with maximum MDLs and/or maximum exposure doses greater than screening values, as well as non-detected chemicals lacking screening values also were identified as ecological COPCs in the Step 2 risk calculations. Only those detected and non-detected chemicals with maximum concentrations and/or maximum exposure doses greater than screening values, and those detected chemicals lacking screening values were addressed in Step 3a of the BERA. Although non-detected chemicals lacking screening values were eliminated from further evaluation, they remain ecological COPCs, but are not considered ecological COCs.

7.9.1.1 Step 3a Risk Evaluation for Surface Soil

Section 7.6.2.1 presented the results of the Step 2 screening level risk calculation for SWMU 69 surface soil. Screening level risk estimates (i.e., HQ values) also were provided in Table 7-12. Barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values. 4-Methyl-2-pentanone and acetone were detected and identified as ecological COPCs based on the lack of soil screening values. The spatial extent of detected ecological COPC concentrations greater than soil screening values is depicted on Figure 7-9. The refined screening level risk calculation for SWMU 69 surface soil is presented in Table 7-21. As discussed in Section 7.9, risk estimates for surface soil were re-calculated using 95 percent UCL of the mean concentrations for those ecological COPCs having less than 70 percent non-detected results and a minimum of eight detected values (i.e., barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc). The refined risk evaluation for SWMU 69 surface soil is presented and discussed within the paragraphs that follow.

As discussed above, two detected VOCs (4-methyl-2-pentanone and acetone) were identified as ecological COPCs for SWMU 69 surface soil in Step 2 of the SERA based on the lack of invertebrate or plant-based soil screening values. 4-Methyl-2-pentanone was detected in one of twenty-five (1/25) surface soil samples at a concentration of 7.7J µg/kg (69SB22-00), resulting in a frequency of detection of only four percent. USEPA (1989) guidance allows for the elimination of chemicals from further consideration in HHRAs if the FOD is less than five percent when twenty or more samples are collected. Elimination of chemicals based on FOD also is an acceptable approach for ERAs (USEPA, 2001c and Parker et al., 2003). As 4-methyl-2-pentanone was detected in only one of twenty-five (1/25) surface soil samples (FOD of four percent), the FOD criteria specified for HHRAs can be used to justify elimination of this VOC from further consideration in the ERA. A comparison of the detected concentration to soil screening values developed for other VOCs (Table 7-4) provides an additional line of evidence supporting the elimination of this VOC from further consideration. As evidenced by the available screening values listed in Table 7-4, the detected 4-methyl-2-pentanone concentration in SWMU 69 surface soil is less than the minimum soil screening value developed for other VOCs (11 µg/kg [vinyl chloride screening value]). A search of the literature did not identify any studies that investigated the effects of 4-methyl-2-pentanone in soil on terrestrial plants and invertebrates. However, the USEPA (2009b and 2009c) ECOSAR Class Program (Version 1.00a) indicates that 4-methyl-2-pentanone is relatively non-toxic to earthworms. The SARs analysis predicts a 14-

day LC_{50} of 213 mg/L for the earthworm. Although solution exposures cannot be used to predict effects from soil exposures, the LC_{50} value estimated using SARs analysis illustrates the low toxicity of 4-methyl-2-pentanone to earthworms. Based on the low magnitude of the single detection and the relative non-toxicity of this VOC to earthworms in solution, 4-methyl-2-pentanone is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Acetone was detected in sixteen of twenty-three (16/23) surface soil samples at concentrations ranging from 9.1J µg/kg (69SB07-00) to 260 µg/kg (69SB05-00). A search of the literature did not identify any studies that investigated the effects of acetone in soil on terrestrial plants and invertebrates. However, Gorsuch et al. (1990), as cited in Organization for Economic Co-operation and Development (OECD, 1999), investigated the effect of acetone on emergence and growth of radish (*Raphanus sativus*), lettuce (*Lactuca sativa*), and rye grass (*Lolium perenne*) in solution. The 7-day NOEC for all three species was 100 mg/L. Although solution exposure studies cannot be used to predict effects from soil exposures, the results of the study conducted by Gorsuch et al. (1990) illustrate the low toxicity of acetone to terrestrial plants. The USEPA (2009b and 2009c) ECOSAR Class Program (Version 1.00a) also indicates that acetone is relatively non-toxic to earthworms. As discussed in Section 7.9, ECOSAR is a program that is used to estimate the toxicity of chemicals lacking data based on their structural similarity to chemicals for which toxicity data are available (i.e., SARs). The SARs analysis predicts a 14-day LC_{50} of 172 mg/L for the earthworm, illustrating the low toxicity of acetone to earthworms. Based on the low toxicity of this VOC in solution to terrestrial plants and earthworms, acetone is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values (Table 7-12). To further evaluate the potential significance of risks presented by these metals, risk estimates were re-calculated using 95 percent UCL of the mean concentrations (Table 7-21). It is acknowledged that terrestrial plants are immobile and many terrestrial invertebrates are relatively immobile; therefore, individuals are likely to be impacted by locations of maximum concentrations. However, as discussed in Section 7.9, evaluation of the 95 percent UCL of the mean exposure case is more indicative of the level of impact that might be expected at the population level. In addition to the re-calculation of risk estimates using 95 percent UCL of the mean concentrations, the SWMU 69 surface soil data were statistically compared to the background airfield soil data set contained within Addendum B of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Chemicals (Baker, 2010b in accordance with Navy guidance (NFESC, 2002). The risk evaluation also took into consideration the magnitude and spatial distribution of barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc detections above soil screening values and/or background concentrations.

Barium was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 14 mg/kg (69SB12-00 and 69SB19-00) to 800 mg/kg (69SB05-00). Two of the detected concentrations exceed the soil screening value of 330 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 2.42; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (225.70 mg/kg; HQ = 0.68; Table 7-21) indicates that the potential risk from barium to terrestrial invertebrate and plant populations is acceptable. The descriptive statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets indicate that the arithmetic mean barium concentration in SWMU 69 surface soil (77.84 mg/kg) is less than the

arithmetic mean in background soil (86.23 mg/kg), while the maximum and 95 percent UCL of barium concentrations in SWMU 69 surface soil (800 mg/kg and 225.70 mg/kg, respectively) exceed these parameters for the background data set (284 mg/kg and 111.80 mg/kg, respectively). Tests of the right tail of the distribution (quantile and slippage tests) indicate that SWMU 69 barium concentrations are not elevated relative to background, while the non-parametric Gehan test indicates that the median of SWMU data is elevated relative to the background median. The distribution of detections indicates two hot spots of contamination: 800 mg/kg (69SB05-00) and 410 mg/kg (69SB23-00). The Phase II ECP analytical data (discussed in Section 7.2) also indicate that barium is a site-related chemical. This metal was detected in each of the five ECP surface soil samples; the detection in 15E-SS04-00 (1,400 mg/kg; Table 6-5) exceeded the soil screening value. Based on the magnitude of detections at 15E-SS04, 69SB23, and 69SB05, barium is identified as an ecological COC for SWMU 69 surface soil, and additional evaluation is recommended.

Cadmium was detected in twenty-four of twenty-five (24/25) surface soil samples at concentrations ranging from 0.051J mg/kg (69SB12-00) to 36J mg/kg (69SB05-00). The maximum detected concentration was the only exceedance of the soil screening value of 32 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 1.13; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (18.58 mg/kg; HQ = 0.58; Table 7-21) indicates that the potential risk from cadmium to terrestrial invertebrate and plant populations is acceptable. The descriptive and distributional statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets indicate that cadmium concentrations in SWMU 69 surface soil are elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean in SWMU 69 surface soil (36J mg/kg, 3.24 mg/kg, and 18.58 mg/kg, respectively) are greater than corresponding parameters in background soil (0.92J mg/kg, 0.25 mg/kg, and 0.28 mg/kg, respectively). The quantile test and slippage tests of the right tail of the distribution could not be performed (see notes on Table 7-22). The Gehan test of the median of the distribution indicates that SWMU 69 cadmium concentrations exceed airfield background concentrations. The distribution of detections indicates two hot spots of cadmium contamination: 36 mg/kg (69SB05-00) and 18 mg/kg (69SB09-00). As indicated above, the maximum detected concentration was the only exceedance of the soil screening value. Cadmium was not detected in surface soil at concentrations greater than the soil screening value in the Phase II ECP data (Table 6-5). Based on the relatively low maximum HQ (1.13) and 95 percent UCL of the mean HQ indicating acceptable risk to terrestrial plant and invertebrate populations (0.58), cadmium is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended. It should be noted that the location of maximum cadmium detection (69SB05-00) will be addressed during any remedial actions at the SWMU because this location also had maximum concentrations of the surface soil COCs barium, lead, and zinc (discussed in preceding paragraphs and below).

Chromium was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 15J mg/kg (69SB04-00) to 89J mg/kg (69SB05-00). Four of the detected concentrations exceed the soil screening value of 57 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 1.56; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (42.19 mg/kg; HQ = 0.74; Table 7-21), indicates that the potential risk from chromium to terrestrial invertebrate and plant populations is acceptable. The descriptive statistics presented in Table 7-22 indicate that the maximum chromium concentration in SWMU 69 surface soil (89 mg/kg in 69 SB05-00) is not elevated above the maximum background concentration (101J mg/kg), but that the arithmetic mean and 95 percent UCL of the mean chromium

concentrations (35.64 mg/kg and 42.19 mg/kg, respectively) are elevated above the corresponding background parameters (28.04 mg/kg and 34.05 mg/kg, respectively). Distributional statistics also were contradictory. Statistical tests evaluating the right tail of the distributions (quantile test and slippage test) indicate that chromium concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations, while the statistical test evaluating the mean of the distributions (Satterthwaite t-test) indicates that chromium concentrations in SWMU 69 surface soil are statistically elevated above background concentrations. Based on the similarity of the mean concentrations and the presence on the maximum detected concentration in the background dataset, chromium concentrations in surface soil are considered to be consistent with background levels. Chromium was detected in a single Phase II ECP surface soil sample at a concentration greater than the soil screening value (58 mg/kg in 15E-SS04; Table 6-5); however, the magnitude of the exceedance is low (soil screening value 57 mg/kg). Based on the relatively low maximum HQ (1.56), 95 percent UCL of the mean HQ (0.74) indicating acceptable risk, and SWMU concentrations consistent with background levels, chromium is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Cobalt was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 5.7 mg/kg (69SB08-00) to 18 mg/kg (69SB27-00). Five of the detected concentrations exceed the soil screening value of 13 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 1.38; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (11.61 mg/kg; HQ = 0.89; Table 7-21), indicates that the potential risk from cobalt to terrestrial invertebrate and plant population is acceptable. The descriptive and distributional statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets indicate that cobalt concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean cobalt concentrations in SWMU 69 surface soil (18 mg/kg, 10.34 mg/kg, and 11.61 mg/kg, respectively) are less than the corresponding background parameters (64 mg/kg, 16.60 mg/kg, and 26.47 mg/kg, respectively). Distributional statistics (Gehan test, quantile test, and slippage test) also indicate that cobalt concentrations in SWMU 69 surface soil are not statistically elevated above background levels. The maximum detected cobalt concentration in surface soil collected during the Phase II ECP investigation (16 mg/kg; Table 6-5) just exceeds the soil screening value (13 mg/kg), but is less than the maximum background concentration (64 mg/kg) and background ULM concentration (44.13 mg/kg). Based on a relatively low maximum HQ (1.56), 95 percent UCL of the mean HQ indicating acceptable risk (0.89), and SWMU concentrations within background levels, cobalt is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Copper was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 16 mg/kg (69SB07-00) to 130 mg/kg (69SB05-00 and 69SB09-00). Five of the detected concentrations exceed the soil screening value of 70 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 1.86; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (58.37 mg/kg; HQ = 0.83; Table 7-21), indicates that the potential risk from copper to terrestrial invertebrate and plant populations is acceptable. The descriptive and distributional statistics presented in Table 7-22 indicate that copper concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean copper concentrations in SWMU 69 surface soil (130J mg/kg, 47.16 mg/kg, and 58.37 mg/kg, respectively) are less than the corresponding background parameters (260J mg/kg, 95.07 mg/kg, and 115 mg/kg, respectively). Distributional statistics (two sample t-test, quantile test, and slippage test) also indicate that copper concentrations in SWMU 69 surface soil are not

statistically elevated above background levels. The maximum detected copper concentration in surface soil collected during the Phase II ECP investigation (110 mg/kg; Table 6-5) exceeds the soil screening value (70 mg/kg) but is less than the maximum background concentration (260J mg/kg) and background ULM concentration (225.21 mg/kg). Based on the relatively low maximum HQ (1.86), 95 percent UCL of the mean HQ indicating acceptable risk to terrestrial plant and invertebrate populations (0.83), and SWMU concentrations within background levels, copper is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Lead was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 0.71 mg/kg (69SB12-00) to 520 mg/kg (69SB05-00). Three of the detected concentrations exceed the soil screening value of 120 mg/kg (Figure 7-9). The screening level risk estimate, derived using the maximum detected concentration (HQ = 4.33; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (100 mg/kg; HQ = 0.84; Table 7-21), indicates that the potential risk from lead to terrestrial invertebrate and plant populations is acceptable. The descriptive and distributional statistics presented in Table 7-22 indicate that lead concentrations in SWMU 69 surface soil are elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean SWMU 69 lead concentrations (520 mg/kg, 57.50 mg/kg, and 100.40 mg/kg, respectively) are greater than corresponding background parameters (21J mg/kg, 5.80 mg/kg, and 9.84 mg/kg, respectively). Distributional statistics (Satterthwaite t-test, quantile test, and slippage test) also conclude that lead concentrations in SWMU 69 surface soil are statistically elevated above background levels. The distribution of detections indicates hot spots of contamination: 520 mg/kg (69SB05-00), 250J mg/kg (69SB09-00), and 220 mg/kg (69SB11). The Phase II ECP surface soil analytical data presented in Table 6-5 also show lead hot spots: 390 mg/kg in 15E-SS03-00 and 450 mg/kg in 15E-SS04-00. Although the 95 percent UCL of the mean HQ indicated acceptable risk, based on the indication of potential risk at hot spots of contamination, lead is identified as an ecological COC for SWMU 69 surface soil, and additional evaluation is recommended.

Mercury was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 0.0066J mg/kg (69SB16-00) to 0.16 mg/kg (69SB04-00). Three of the detected concentrations exceed the soil screening value of 0.1 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 1.60; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (0.05 mg/kg) indicates that the potential risk from mercury to terrestrial invertebrate and plant populations is acceptable (HQ = 0.55). The descriptive and distributional statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets indicate that mercury concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean SWMU 69 mercury concentrations (0.16 mg/kg, 0.04 mg/kg, and 0.0547 mg/kg, respectively) are similar to the corresponding background parameters (0.12J mg/kg, 0.04 mg/kg, and 0.0462 mg/kg, respectively). Distributional statistics (slippage test and Gehan tests) indicate that lead concentrations in SWMU 69 surface soil are not statistically elevated above background levels. The maximum detected mercury concentration in surface soil collected during the Phase II ECP investigation (0.061 mg/kg; Table 6-5) is less than the surface soil screening value (0.1 mg/kg), maximum background concentration (0.12J mg/kg) and background ULM concentration (0.10 mg/kg). Based on the relatively low maximum HQ (1.60), 95 percent UCL of the mean HQ indicating acceptable risk (0.55), and SWMU concentrations consistent with background levels, mercury is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Selenium was detected in twenty-one of twenty-five (21/25) surface soil samples at concentrations ranging from 0.13J mg/kg (69SB19-00) to 1.8 mg/kg (69SB04-00). Six of the detected concentrations exceed the soil screening value of 0.52 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 3.46; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (0.52 mg/kg), indicates that potential risk from to terrestrial invertebrate and plant populations is also unacceptable (HQ = 1.01; Table 7-21). The descriptive and distributional statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets indicate that selenium concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum and arithmetic mean of selenium concentrations in SWMU 69 surface soil (1.8 mg/kg and 0.38 mg/kg, respectively) are less than the corresponding background parameters (3.8J mg/kg and 0.58 mg/kg, respectively). Distributional statistics were limited to the slippage test on the right tail of the distribution because there were greater than 50 percent non-detected values in the combined SWMU and background data sets. The slippage test concluded that selenium in SWMU 69 surface soil is not statistically elevated above background levels. Selenium was not detected in surface soil collected during the Phase II ECP investigation. Based on the relatively low maximum HQ (3.46), low 95 percent UCL of the mean HQ (1.01), and indications that SWMU concentrations are within background concentrations, selenium is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Vanadium was detected in twenty-five of twenty-five (25/25) SWMU 69 surface soil samples at concentrations ranging from 46J mg/kg (69SB15-00) to 280 mg/kg (69SB08-00). Each of the detected concentrations exceeds the soil screening value of 20 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 14.00; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (137 mg/kg; HQ = 6.84; Table 7-21), also indicates potential risk from vanadium to terrestrial invertebrate and plant populations. The descriptive and distributional statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets indicated that vanadium concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean vanadium concentrations in SWMU 69 surface soil (280 mg/kg, 116 mg/kg, and 137 mg/kg, respectively) are less than the corresponding background parameters (410 mg/kg, 176 mg/kg, and 201 mg/kg, respectively). Distributional statistics (two sample t-test, quantile test, and slippage test) also indicate that vanadium concentrations in SWMU 69 surface soil are not statistically elevated above background levels. The maximum detected vanadium concentration in surface soil collected during the Phase II ECP investigation (97 mg/kg; Table 6-5) exceeds the soil screening value, but is less than the maximum background concentration (410 mg/kg) and background ULM concentration (367 mg/kg). Based on the descriptive and distributional statistics indicating that vanadium concentrations in SWMU surface soil are within background levels, vanadium is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Zinc was detected in twenty-five of twenty-five (25/25) surface soil samples at concentrations ranging from 9 mg/kg (69SB16-00) to 650 mg/kg (69SB05-00). Four of the detected concentrations exceed the soil screening value of 120 mg/kg (Figure 7-9). The screening level risk estimate (HQ = 5.42; Table 7-12) indicates unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (114 mg/kg; HQ = 0.9; Table 7-21), indicates that the potential risk from zinc to terrestrial invertebrate and plant populations is acceptable. The descriptive and distributional statistics presented in Table 7-22 for the SWMU 69 and background surface soil data sets present conflicting results regarding whether or not zinc concentrations in SWMU 69 surface soil are

elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean zinc concentrations in SWMU 69 surface soil (650 mg/kg, 77.44 mg/kg, and 114 mg/kg, respectively) are each greater than the corresponding background parameters (140J mg/kg, 47.22 mg/kg, and 70.61 mg/kg, respectively). Conversely, distributional statistics on the right tail of the distribution (i.e., quantile and slippage tests), and on the mean of the distribution (two sample t-test) indicate that zinc concentrations in SWMU 69 surface soil are not elevated above background levels. The distribution of detections indicates two hot spots of zinc contamination: 270J mg/kg (69SB09-00) and 650 mg/kg (69SB05-00). The Phase II ECP analytical data summarized in Table 6-5 also show the presence of elevated zinc concentrations at two sample locations (250E mg/kg at 15E-SS03-00 and 380E mg/kg at 15E-SS04-00). Based on the magnitude of detections at 69SB09, 69SB05, 15E-SS03 and 15E-SS04, zinc is identified as an ecological COC in SWMU 69 surface soil, and additional evaluation is recommended.

In summary, barium, lead, and zinc are identified as ecological COCs for SWMU 69 surface soil. Each of these metals had hot spots of contamination at the SWMU and/or exceeded distributional statistics. Although 4-methyl-2-pentanone, acetone, cadmium, chromium, cobalt, copper, mercury, selenium, and vanadium were detected in SWMU 69 surface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs, and no additional evaluation is recommended. 4-Methyl-2-pentanone and acetone are not recommended for additional evaluation based on their predicted toxicity to earthworms using SARs, while cadmium, chromium, cobalt, copper, mercury, selenium, and vanadium are not recommended for additional evaluation based on statistical evaluations performed on the SWMU 69 surface soil and background airfield soil data sets. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

7.9.1.2 Step 3a Risk Evaluation for Subsurface Soil

Section 7.6.2.2 presented the results of the Step 2 screening level risk calculation for SWMU 69 subsurface soil. Screening level risk estimates also were provided in Table 7-13. Cobalt, copper, mercury, selenium, and vanadium were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values. Two detected VOCs (acetone and carbon disulfide) were identified as ecological COPCs based on the lack of soil screening values. The spatial extent of detected ecological COPC concentrations greater than soil screening values is depicted on Figure 7-10. The refined risk evaluation for SWMU 69 subsurface soil is presented and discussed within the paragraphs that follow. As discussed in Section 7.9, risk estimates for detected ecological COPCs using 95 percent UCL of the mean concentrations could not be calculated based on the small size of the subsurface soil data set (n = 5 for soil collected from the 1.0 to 3.0-foot depth interval). As such, the refined risk evaluation for these chemicals (cobalt, copper, mercury, selenium, and vanadium) was limited to a statistical comparison to available background data.

Acetone and carbon disulfide were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA based on the lack of invertebrate or plant-based soil screening values. Acetone was detected in five of five (5/5) subsurface soil samples at concentrations ranging from 9J µg/kg (69SB07-01) to 47J µg/kg (69SB27-01). As discussed in Section 7.9.1.1, studies investigating the effects of acetone in soil on terrestrial plants and invertebrates were not identified in the literature. However, a study investigating the effect of acetone on the emergence and growth of radish, lettuce, and ryegrass in solution (Gorsuch et al., 1990 as cited in OECD, 1999) illustrates the low toxicity of this VOC to terrestrial plants (7-day NOEC for each species was 100 mg/L). The USEPA (2009b and 2009c) ECOSAR Class Program (Version1.00a) also indicates that acetone is relatively non-toxic to earthworms. The

SARs analysis predicts a 14-day LC_{50} of 172 mg/L for the earthworm. Based on the low toxicity of acetone in solution to terrestrial plants and earthworms, acetone is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Carbon disulfide was detected in one of five (1/5) subsurface soil samples at a concentration of 0.59J µg/kg (69SB27-01). A comparison of the detected concentration to soil screening values developed for other VOCs (Table 7-4) provides a strong line of evidence supporting the elimination of this VOC from further consideration. As evidenced by the available screening values listed in Table 7-4, the detected carbon disulfide concentration in SWMU 69 subsurface soil is less than the minimum soil screening value developed for other VOCs (11 µg/kg [vinyl chloride screening value]). Identical to acetone, studies investigating the effects of carbon disulfide in soil on terrestrial plants and invertebrates were not identified in the literature. The USEPA (2009b and 2009c) ECOSAR Class Program (Version 1.00a) indicates that carbon disulfide is relatively non-toxic to earthworms. The SARs analysis predicts a 14-day LC_{50} of 134 mg/L for the earthworm. Based on the low magnitude of the single detection and the low toxicity of carbon disulfide in solution to earthworms, carbon disulfide is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Cobalt was detected in five of five (5/5) subsurface soil samples at concentrations ranging from 7.9 mg/kg (69SB07-01) to 27 mg/kg (69SB12-01). Two of the detected concentrations exceed the soil screening value of 13 mg/kg (Figure 7-10). The screening level risk estimate (HQ = 2.08; Table 7-13) indicates unacceptable risk to terrestrial invertebrates and plants. As evidenced by Table 7-23, the maximum detected cobalt concentration (27 mg/kg) is less than maximum and ULM background airfield soil concentrations (64 mg/kg and 44.13 mg/kg, respectively). These data indicate that cobalt concentrations in SWMU 69 subsurface soil are consistent with background concentrations. As such, cobalt is not likely to be present at concentrations that would present ecological risks above background levels. A review of the ECP analytical data (Table 6-6) shows that the maximum cobalt concentration in SWMU 69 subsurface soil collected from the 1.0 to 3.0-foot depth interval (19 mg/kg) is less than the maximum background concentration and background ULM concentration. Based on SWMU concentrations within background levels, cobalt is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Copper was detected in five of five (5/5) subsurface soil samples at concentrations ranging from 72J mg/kg (69SB07-01) to 110 mg/kg (69SB12-01). Each of the detected concentrations exceed the soil screening value of 70 mg/kg (Figure 7-10). The screening level risk estimate (HQ = 1.57; Table 7-13) indicates unacceptable risk to terrestrial invertebrates and plants. As evidenced by Table 7-23, the maximum detected copper concentration (110 mg/kg) is less than maximum and ULM background airfield soil concentrations (260J mg/kg and 225 mg/kg, respectively). These data indicate that copper concentrations in SWMU 69 subsurface soil are consistent with background concentrations. As such, copper is not likely to be present at concentrations that would present ecological risks above background levels. A review of the ECP analytical data (Table 6-6) shows that the maximum copper concentration in SWMU 69 subsurface soil collected from the 1.0 to 3.0-foot depth interval (220 mg/kg) is less than the maximum background concentration and background ULM concentration. Based on SWMU concentrations within background levels, copper is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Mercury was detected in five of five (5/5) subsurface soil samples at concentrations ranging from 0.024 mg/kg (69SB11-01) to 0.11 mg/kg (69SB07-01). One of the detected concentrations exceeds the soil screening value of 0.1 mg/kg (Figure 7-10). The screening level risk estimate

(HQ = 1.10; Table 7-13) indicates unacceptable risk to terrestrial invertebrates and plants. As evidenced by Table 7-23, the maximum detected mercury concentration (0.11 mg/kg) is less than maximum background airfield soil concentration and only slightly elevated above the background ULM concentration (0.12J mg/kg and 0.10 mg/kg, respectively). These data indicate that mercury concentrations in SWMU 69 subsurface soil are consistent with background concentrations. As such, mercury is not likely to be present at concentrations that would present ecological risks above background levels. A review of the ECP analytical data (Table 6-6) shows that the maximum mercury concentration in SWMU 69 subsurface soil collected from the 1.0 to 3.0-foot depth interval (0.063 mg/kg) is less than the maximum background concentration and background ULM concentration. Based on SWMU concentrations within background levels, mercury is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Selenium was detected in five of five (5/5) subsurface soil samples at concentrations ranging from 0.17J mg/kg (69SB11-01) to 1.2 mg/kg (69SB08-01). Two of the detected concentrations exceed the soil screening value of 0.52 mg/kg (Figure 7-10). The screening level risk estimate (HQ = 2.31; Table 7-13) indicates unacceptable risk to terrestrial invertebrates and plants. As evidenced by Table 7-23, the maximum detected selenium concentration (1.2 mg/kg) is less than maximum and ULM background airfield soil concentrations (3.8J mg/kg and 1.85 mg/kg, respectively). These data indicate that selenium concentrations in SWMU 69 subsurface soil are consistent with background concentrations. As such, selenium is not likely to be present at concentrations that would present ecological risks above background levels. Selenium was not detected in any of the Phase II ECP subsurface soil samples collected from the 1.0 to 3.0-foot depth interval. The maximum MDL for selenium for ECP data (1.2 mg/kg; Appendix B) is less than the maximum background concentration and background ULM concentration established for this metal. Based on SWMU concentrations within background levels, selenium is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Vanadium was detected in five of five (5/5) subsurface soil samples at concentrations ranging from 170 mg/kg (69SB11-01) to 380 mg/kg (69SB08-01). Each of the detected concentrations exceeds the soil screening value of 20 mg/kg (Figure 7-10). The screening level risk estimate (HQ = 19.00; Table 7-13) indicates unacceptable risk to terrestrial invertebrates and plants. As evidenced by Table 7-23, the maximum detected vanadium concentration (380 mg/kg) is less than maximum background airfield soil concentration and only slightly elevated above the background ULM concentration (410 mg/kg and 367 mg/kg, respectively). These data indicate that vanadium concentrations in SWMU 69 subsurface soil are consistent with background concentrations. As such, vanadium is not likely to be present at concentrations that would present ecological risks above background levels. A review of the ECP analytical data (Table 6-6) shows that the maximum vanadium concentration in SWMU 69 subsurface soil collected from the 1.0 to 3.0-foot depth interval (270 mg/kg) is less than the maximum background concentration and background ULM concentration. Based on SWMU concentrations within background levels, vanadium is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

In summary, although acetone, carbon disulfide, cobalt, copper, mercury, selenium, and vanadium were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not considered ecological COCs, and no additional evaluation is recommended. Acetone and carbon disulfide are not recommended for additional evaluation based on their predicted toxicity to earthworms using SARs, while cobalt, copper, mercury, selenium, and vanadium are not recommended for additional evaluation based on a descriptive

comparison of the SWMU 69 subsurface soil analytical data to background airfield soil analytical data. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

7.9.1.3 Step 3a Risk Evaluation for Groundwater

Section 7.6.2.3 presented the results of the Step 2 screening level risk calculation for SWMU 69 groundwater. Screening level risk estimates also were provided in Table 7-14. One non-detected VOC (acrolein) and three non-detected SVOCs, (hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene) were identified as ecological COPCs because maximum MDLs exceed groundwater screening values. The refined risk evaluation for SWMU 69 groundwater is presented and discussed within the paragraphs that follow.

As discussed above, the non-detected VOC acrolein and the non-detected SVOCs hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene were identified as ecological COPCs in Step 2 of the SERA because maximum MDLs exceeded marine surface water screening values. Analytical data from twenty-two of twenty-five (22/25) surface soil samples and all subsurface soil samples were rejected for acrolein during data validation activities (see Section 4.10). Although acrolein was not detected in the three non-rejected surface soil samples, the absence of detections in SWMU 69 soil cannot be used as a strong line of evidence for the refined risk evaluation. The largest industrial use for acrolein is as an intermediate in the manufacture of acrylic acid (Agency for Toxic Substances and Disease Registry [ATSDR], 2007). Acrolein also is used as a biocide in the control of algae and mollusks in recirculating process water systems, as a slimacide in the paper industry, in the cross-linking of protein collagen in leather tanning, as a tissue fixative in histological samples, in the manufacture of colloidal forms of metals, and in the production of perfumes (ATSDR, 2007). Based on these uses, acrolein is not likely to be present in abiotic media at SWMU 69 and is not identified as an ecological COC for groundwater.

Hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene were not detected in surface or subsurface soil collected during the 2008 CMS field investigation (Tables 7-12 and 7-13). The absence of detections in SWMU 69 surface and subsurface soil indicate that these three SVOCs are not site-related and are not likely to be present in SWMU 69 groundwater. High log K_{ow} values for hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene (5.89, 5.39, and 4.64, respectively; Table 7-3) also indicate that these three SVOCs have a high affinity for adsorption to soil particles. Therefore, even if these three SVOCs are present in SWMU 69 surface or subsurface soil, vertical migration with infiltrating precipitation to SWMU 69 groundwater and subsequent migration to downgradient surface water and sediment within the Los Machos mangrove forest does not represent a likely transport pathway. In summary, based on the absence of detections in SWMU 69 surface and subsurface soil and their physical characteristics (i.e., log K_{ow} values), hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene are not identified as ecological COCs for SWMU 69 groundwater, and no additional evaluation is recommended.

In summary, COPCs for groundwater identified in the Step 2 of the SERA were limited to non-detected chemicals (acrolein, hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene). No additional evaluation is recommended for these non-detected chemicals because data from other media indicates that they are not site related.

7.9.1.4 Step 3a Risk Evaluation for Terrestrial Dietary Exposures

Tables 7-15 and 7-16 presented the results of the Step 2 screening level risk calculation for mammalian and avian dietary exposures to chemicals in surface and subsurface soil, respectively. Potential risk to avian receptors was assumed to also indicate potential risk to amphibians and reptiles (Section 7.3.2.1). HQ values for the refined risk calculations are summarized in Tables 7-24 (mammalian exposures to surface soil), 7-25 (avian exposures to surface soil), and 7-26 (avian exposures to subsurface soil). A discussion of the refined risk evaluation is presented and discussed within the subsections that follow.

7.9.1.4.1 Mammalian Dietary Exposures: Surface Soil

Section 7.6.2.4.1 presented the results of the Step 2 screening level risk calculation for terrestrial dietary exposures to chemicals in surface soil. Screening level risk estimates also were provided in Table 7-15. One detected PAH (pyrene) and two detected metals (barium and selenium) were identified as COPCs based on NOAEL-based HQ values greater than 1.0 for the brown flower bat. Due to the lack of a TRV, one detected SVOC (1,2,4,5-tetrachlorobenzene) also was identified as a mammalian COPC. The results of the refined screening level risk calculation for dietary exposures to SWMU 69 surface soil (i.e., NOAEL-, MATC-, and LOAEL-based HQ values) are presented in Table 7-24 and discussed in the sections that follow.

As indicated above, 1,2,4,5-tetrachlorobenzene was detected in SWMU 69 surface soil and identified as an ecological COPC for mammalian dietary exposures based on the lack of a TRV for the brown flower bat. 1,2,4,5-Tetrachlorobenzene was detected in two of twenty-five (2/25) surface soil samples at 26J ug/kg (69SB05-00) and 29J ug/kg (69SB11-00). 1,2,4,5-tetrachlorobenzene is identified as an important bioaccumulative chemical by the USEPA (2000b). As evidenced by Figure 4-1, 69SB05-00 and 69SB11-00 were collected at locations adjacent to the expanded aircraft parking apron (69SB05 and 69SB11). This SVOC was not detected in surface soil samples collected downgradient from these locations (69SB04-00, 69SB06-00, 69SB08-00, 69SB10-00, 69SB12-00, and 69SB13-00). Given the low magnitude of detections and the limited spatial distribution of 1,2,4,5- tetrachlorobenzene in SWMU 69 surface soil, it is unlikely that this SVOC would impact small mammal populations. Based on these considerations, 1,2,4,5-tetrachlorbenzene is not identified as an ecological COC for mammalian dietary exposures, and no additional evaluation is recommended. It is noted that surface soil samples with 1,2,4,5-tetrachlorobenzene detections were collected at locations that will be subjected to corrective measures to address chemicals identified as ecological COCs for terrestrial invertebrate and plant populations (i.e., barium, lead, and/or zinc; see Section 7.9.1.1), thereby eliminating potential dietary exposures to this SVOC.

Pyrene was detected in surface soil and identified as an ecological COPC for mammalian dietary exposures because maximum exposure doses exceed the NOAEL-based screening value established for the brown flower bat. Refined dietary exposure doses for pyrene (derived using 95 percent UCL of the mean chemical concentrations [680.3 µg/kg], mean receptor body weights, mean receptor food ingestion rates, mean receptor water ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) are less than NOAEL-, MATC-, and LOAEL-based TRVs established for the brown flower bat (Table 7-24), indicating acceptable risk to small mammals. Based on a refined HQ value less than 1.0, pyrene is not identified as an ecological COC for mammalian dietary exposures, and no additional evaluation is recommended.

Barium and selenium were detected in surface soil and identified as ecological COPCs for mammalian dietary exposures because maximum exposure doses exceed the NOAEL-based

screening values established for the brown flower bat. Refined dietary exposure doses for barium and selenium (derived using 95 percent UCL of the mean chemical concentrations, mean receptor body weights, mean receptor food ingestion rates, mean receptor water ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) are less than NOAEL-, MATC-, and LOAEL-based TRVs established for the brown flower bat (Table 7-24), indicating acceptable risk to small mammals. The descriptive and distributional statistics presented in Table 7-22 for selenium also show that concentrations in SWMU 69 surface soil are not elevated above background levels. The evaluation presented in Section 7.9.1.1 identified barium hot spots at Phase II ECP sample location 15E-04 and CMS sample locations 69SB05 and 69SB23. The maximum detection among these hot spots is 1,400 mg/kg in 15E-SS04. The maximum NOAEL-based HQ calculated with this barium concentration and conservative exposure assumptions (i.e., Step 2 exposure parameters) is 2.09. However, based on the aboreal feeding habits of the mammalian receptor, it is highly unlikely that they will forage exclusively at this location of maximum detection. Based on the relatively low maximum HQ and refined HQs less than 1.0 for the brown flower bat, barium was not identified as an ecological COC for mammalian dietary exposures. Based on refined HQ values less than 1.0 and SWMU concentrations consistent with background, selenium is also not identified as an ecological COC for mammalian dietary exposures. No additional evaluation of barium or selenium is recommended.

Although detected and identified as ecological COPCs in Step 2 of the SERA, 1,2,4,5-tetrachlorobenzene, pyrene, barium, and selenium are not identified as ecological COCs, and additional evaluation is not recommended. The recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs and/or the descriptive and distributional statistics presented in Table 7-22. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

7.9.1.4.2 Avian Dietary Exposures: Surface Soil

Section 7.6.2.4.1 presented the results of the Step 2 screening level risk calculation for terrestrial dietary exposures to chemicals in surface soil. Screening level risk estimates also were provided in Table 7-15. Ten detected metals (barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc) were identified as ecological COPCs for avian receptors in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for the American robin, mourning dove, and/or red-tailed hawk. Two detected VOCs (ethylbenzene and toluene), three detected SVOCs (1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, and pentachlorobenzene), and one detected metal (beryllium) also were identified as avian ecological COPCs based on the lack of TRVs. The results of the refined screening level risk calculation for avian dietary exposures to SWMU 69 surface soil (i.e., NOAEL-, MATC-, and LOAEL-based HQ values) are presented in Table 7-25, and discussed in the sections that follow.

As indicated above, ethylbenzene, toluene, 1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, pentachlorobenzene, and beryllium were detected in SWMU 69 surface soil and identified as ecological COPCs for avian dietary exposures based on the lack of TRVs. Pentachlorobenzene was detected in one of twenty-five (1/25) surface soil samples (13J ug/kg in 69SB05-00). As discussed in Section 7.9.1.1, USEPA (1989) guidance allows for the elimination of chemicals from further consideration in HHRAs if the FOD is less than five percent when twenty or more samples are collected. Elimination of chemicals based on FOD also is an acceptable approach for ERAs (USEPA, 2001c and Parker et al., 2003). As pentachlorobenzene was detected in only one of twenty-five (1/25) surface soil samples (FOD of four percent), the FOD criteria specified for HHRAs can be used to justify elimination of this VOC from further consideration in the ERA.

Therefore, based on the low FOD, pentachlorobenzene is not identified as an ecological COC for avian dietary exposures, and no additional evaluation is recommended. It is noted that the location of the single pentachlorobenzene detection (69SB05) is the location of maximum concentrations of barium, lead, and zinc, which were identified as surface soil COCs for terrestrial invertebrates and plants (Section 7.9.1.1). As such, this location will be addressed as part of any corrective measures that may be recommended at the SWMU, thereby reducing potential avian dietary exposures to this VOC.

Ethylbenzene was detected in two of twenty-five (2/25) surface soil samples (2.2J ug/kg in 69SB06-00 and 6.2J ug/kg in 69SB09-00), while toluene was detected in three of twenty-five (3/25) surface soil samples (3.3J ug/kg in 69SB02-00, 2.5J ug/kg in 69SB06-00, and 0.53J ug/kg in 69SB20-00). Given the low magnitude of detections, ethylbenzene and toluene are not likely to impact avian receptor populations. Furthermore, these two organics are not identified as important bioaccumulative chemicals by the USEPA (2000b). Based on their low magnitude of detections and the likely low potential to bioaccumulate in terrestrial food items (based on their omission by the USEPA [2000b] as important bioaccumulative chemicals), ethylbenzene and toluene are not identified as ecological COCs for avian dietary exposures, and no additional evaluation is recommended. It is noted that the location of the maximum ethylbenzene detection (69SB09) is a hot spot for lead and zinc, which were identified as surface soil COCs for terrestrial invertebrates and plants (Section 7.9.1.1). As such, this location will be addressed as part of any corrective measures that may be recommended at the SWMU, thereby reducing potential avian dietary exposures to this VOC.

Butyl benzyl phthalate was detected in eleven of twenty-five (11/25) surface soil samples at concentrations ranging from 16J ug/kg (69SB17-00) to 300J ug/kg (69SB05-00). Identical to pentachlorobenzene, ethylbenzene, and toluene, butyl benzyl phthalate is not identified as an important bioaccumulative chemical by the USEPA (2000b). Given that butyl benzyl phthalate has a low potential to bioaccumulate in terrestrial avian food items (based on its omission by the USEPA [2000b] as important bioaccumulative chemicals), this SVOC is not identified as an ecological COC for avian dietary exposures, and no additional evaluation is recommended. It is noted that the locations of the two highest butyl benzyl phthalate detections (69SB05 [300 J ug/kg] and 69SB11 [180J ug/kg]) are hot spots for barium, lead, and/or zinc, which were identified as surface soil COCs for terrestrial invertebrates and plants (Section 7.9.1.1). As such, these locations will be addressed as part of any corrective measures that may be recommended at the SWMU, thereby reducing potential avian dietary exposures to this VOC.

1,2,4,5-Tetrachlorobenzene was detected in two of twenty-five (2/25) surface soil samples at 26J ug/kg (69SB05-00) and 29J ug/kg (69SB11-00). Unlike ethylbenzene, toluene, butyl benzyl phthalate, and pentachlorobenzene, 1,2,4,5-tetrachlorobenzene is identified as an important bioaccumulative chemical by the USEPA (2000b). As evidenced by Figure 4-1, 69SB05-00 and 69SB11-00 were collected at locations adjacent to the expanded aircraft parking apron. This SVOC was not detected in surface soil samples collected downgradient from these locations (69SB04-00, 69SB06-00, 69SB08-00, 69SB10-00, 69SB12-00, and 69SB13-00). Given the low magnitude of detections and the limited spatial distribution of 1,2,4,5- tetrachlorobenzene in SWMU 69 surface soil, it is unlikely that this SVOC would impact avian herbivore, omnivore, and carnivore populations. Based on these considerations, 1,2,4,5-tetrachlorobenzene is not identified as an ecological COC for avian dietary exposures, and no additional evaluation is recommended. It is noted that the surface soil samples with 1,2,4,5-tetrachlorobenzene detections were collected at locations that are hot spots for barium, lead, and/or zinc, which were identified as surface soil COCs for terrestrial invertebrates and plants (Section 7.9.1.1). As such, these

locations will be addressed as part of any corrective measures that may be recommended at the SWMU, thereby reducing potential avian dietary exposures to this SVOC.

Beryllium was detected in twenty-five of twenty-five (25/25) surface soil samples. As evidenced by the descriptive statistics presented in Table 7-22, maximum, arithmetic mean, and 95 percent UCL of the mean beryllium concentrations in SWMU 69 surface soil (0.35 mg/kg, 0.10 mg/kg, and 0.13 mg/kg, respectively) are less than maximum, arithmetic mean, and 95 percent UCL of the mean background airfield soil concentrations (0.81 mg/kg, 0.29 mg/kg, and 0.34 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (i.e., Gehan test and slippage test; Table 7-22) also show that beryllium concentrations in SWMU 69 surface soil are not elevated above background levels. Based on the descriptive and distributional statistics presented in Table 7-22, beryllium is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 surface soil, and additional evaluation is not recommended.

Barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc were detected in surface soil and identified as ecological COPCs for avian food web exposures because maximum exposure doses exceed the NOAEL-based TRVs established for one or more of the avian receptors evaluated by the ERA (American robin, mourning dove, and/or red-tailed hawk). Refined dietary exposure doses for barium, chromium, copper, mercury, nickel, selenium, and zinc (derived using 95 percent UCL of the mean chemical concentrations, mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) are less than NOAEL-, MATC-, and LOAEL-based TRVs established for each of the avian receptors (Table 7-25), indicating acceptable risk to avian herbivore, omnivore, and carnivore populations. The descriptive and distributional statistics presented in Table 7-22 and discussed in Section 7.9.1.1 demonstrated that chromium, copper, mercury, nickel, and selenium are not present in SWMU 69 surface soil at concentrations elevated above background levels and/or at concentrations that would indicate the presence of hot spots (i.e., the magnitude of detections above maximum background concentrations and background ULM concentrations is low). Based on refined HQ values less than 1.0 and the descriptive and distributional statistics presented in Table 7-22, chromium, copper, mercury, nickel, and selenium are not identified as ecological COCs for avian dietary exposures, and no additional evaluation is recommended. The evaluation presented in Section 7.9.1.1 identified barium hot spots at Phase II ECP sample location 15E-SS04 and CMS sample locations 69SB05 and 69SB23. The maximum detection among these hot spots is 1,400 mg/kg in 15E-SS04. The NOAEL-based HQ calculated with this barium concentration and the refined Step 3a exposure assumptions is 1.91 (for the mourning dove; 1.54 for the American robin). Because there is the potential for the endangered yellow shouldered blackbird to forage at the SWMU (represented by the American robin), and because potential risk to individuals is indicated at a hot spot of contamination under the refined exposure scenarios, barium is identified as an ecological COC for avian foodweb exposures, and additional evaluation is recommended. The evaluation presented in Section 7.9.1.1 identified zinc hot spots at Phase II ECP sample location 15E-SS03 and 15E-SS04 and CMS sample locations 69SB05 and 69SB09. The maximum detection among these hot spots is 650 mg/kg at 15E-SB05. The NOAEL-based HQ calculated with this zinc concentration and the refined Step 3a exposure assumptions is 1.32 (for the American robin). The NOAEL-based HQ also exceeds 1.0 for sample location 15E-SS04 (380E mg/kg). Because there is the potential for the the endangered yellow shouldered blackbird to forage at the SWMU (represented by the American robin), and because potential risk to individuals is indicated at hot spots of contamination under the refined exposure scenarios, zinc is identified as an ecological COC for avian foodweb exposures, and additional evaluation is recommended.

Refined American robin dietary exposure doses for cadmium exceed NOAEL-, MATC-, and LOAEL-based TRVs established for this receptor (NOAEL-based HQ = 6.45; Table 7-25). In addition, refined American robin dietary exposure doses for lead exceed NOAEL-based TRVs (NOAEL-based HQ = 1.04). HQs for the remaining receptors were less than 1.0. The descriptive and distributional statistics presented in Table 7-22 and discussed in Section 7.9.1.1 indicate that cadmium and lead are present in SWMU 69 surface soil at concentrations elevated above background levels. Based on a NOAEL-based HQs value greater than 1.0 for the American robin and the distributional and descriptive statistics presented in Table 7-22, cadmium and lead are identified as ecological COCs for avian omnivore dietary exposures, and additional evaluation is recommended.

Refined exposure does for vanadium exceed NOAEL-, MATC-, and LOAEL-based TRVs established for the American robin and mourning dove (American robin NOAEL-based HQ = 6.39; mourning dove NOAEL-based HQ = 3.11; Table 7-25). However, the statistical evaluation of the SWMU 69 and background airfield soil data sets presented in Table 7-22 and Section 7.9.1.1 concluded that vanadium concentrations in SWMU 69 surface soil are not elevated above background levels. For this reason, vanadium is not identified as an ecological COC for avian dietary exposures to chemicals in surface soil, and no additional evaluation is recommended.

In summary, barium, cadmium, lead, and zinc are identified as ecological COCs for avian omnivore dietary exposures to chemicals in SMWU 69 surface soil. Although detected and identified as ecological COPCs in Step 2 of the SERA, ethylbenzene, toluene, 1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, pentachlorobenzene, beryllium, chromium, copper, mercury, nickel, selenium, and vanadium are not identified as ecological COCs, and no additional evaluation is recommended. In the case of ethylbenzene, toluene, 1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, and pentachlorobenzene, no additional evaluation is recommended based on the low magnitude and low frequency of detection, and/or the low potential for these SVOCs to bioaccumulate in terrestrial food items. In the case of beryllium, chromium, copper, mercury, nickel, selenium, and vanadium, a recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs and/or the descriptive and distributional statistics presented in Table 7-22. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

As discussed in Section 7.3.2.1, a conclusion of acceptable or unacceptable risk to terrestrial avian receptors also was applied to terrestrial amphibians and reptiles (i.e., the American robin, mourning dove, and red-tailed hawk were used as surrogates). Based on a conclusion of unacceptable risk to the American robin dietary exposures to barium, cadmium, lead, and zinc in SWMU 69 surface soil, it is assumed that these metals also present unacceptable risk to terrestrial amphibians and reptiles.

7.9.1.4.3 Mammalian Dietary Exposures: Subsurface Soil

Section 7.6.2.4.2 presented the results of the Step 2 screening level risk calculation for terrestrial dietary exposures to chemicals in subsurface soil. Screening level risk estimates also were provided in Table 7-16. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, no chemicals were identified as ecological COPCs for brown flower bat exposures to SWMU 69 subsurface soil. As such, no COCs are identified for brown flower bat exposures to SWMU 69 subsurface soil, and no further evaluation is recommended.

7.9.1.4.4 *Avian Dietary Exposures: Subsurface Soil*

Section 7.6.2.4.2 presented the results of the Step 2 screening level risk calculation for terrestrial dietary exposures to chemicals in subsurface soil. Screening level risk estimates also were provided in Table 7-16. Six detected metals (chromium, copper, mercury, nickel, vanadium, and zinc) were identified as ecological COPCs in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based screening values for one or more of the avian receptors (i.e., maximum HQs greater than 1.0). One detected metal (beryllium) also was identified as an ecological COPC based on the lack of an avian TRV. The results of the refined screening level risk calculation are presented in Table 7-26 and discussed in the sections that follow. Due to the limited sample size of the subsurface soil data set, maximum detected concentrations were used in the refined HQ calculations rather than 95 percent UCL of the mean concentrations (see Section 7.9). Therefore, specific refinements were limited to the use of mean body weights, mean food ingestion rates, and BAFs based on, or modeled from, central tendency estimates.

Beryllium was detected in five of five (5/5) subsurface soil samples. As evidenced by the descriptive statistics presented in Table 7-23, maximum and arithmetic mean beryllium concentrations in SWMU 69 subsurface soil (0.27 mg/kg and 0.226 mg/kg, respectively) are less than maximum and ULM of background airfield soil concentrations (0.81 mg/kg and 0.65 mg/kg, respectively). Based on the descriptive statistics presented in Table 7-23, beryllium is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 subsurface soil, and additional evaluation is not recommended.

As discussed above, chromium, copper, mercury, nickel, vanadium, and zinc were identified as ecological COPCs for terrestrial avian dietary exposures in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for the American robin, mourning dove, and/or red-tailed hawk. With the exception of vanadium, refined exposure doses for the ecological COPCs are less than NOAEL-, MATC-, and LOAEL-based TRVs for each avian receptor (Table 7-26). Refined exposure doses for vanadium exceed NOAEL-, MATC-, and LOAEL-based ingestion screening values for the American robin and mourning dove (maximum refined NOAEL-based HQ = 17.77 for the American robin). However, as evidenced by the descriptive statistics presented in Table 7-23 and discussed in Section 7.9.1.2, chromium, copper, mercury, nickel, vanadium, and zinc concentrations are consistent with background concentrations. Maximum chromium, copper, mercury, nickel, vanadium, and zinc concentrations in SWMU 69 subsurface soil (0.27 mg/kg, 29 mg/kg, 110 mg/kg, 0.11 mg/kg, 11 mg/kg, 380 mg/kg, 82 mg/kg, respectively) are less than maximum background concentrations and/or ULM background concentrations. Thus, any risk posed by chromium, copper, mercury, nickel, vanadium, and zinc would be within background levels. Based on refined HQ values less than 1.0 and/or the descriptive statistics presented in Table 7-23, beryllium, chromium, copper, mercury, nickel, vanadium, and zinc are not identified as ecological COCs for avian dietary exposures, and no additional evaluation is recommended.

Although detected and identified as ecological COPCs in Step 2 of the SERA, beryllium, chromium, copper, mercury, nickel, vanadium, and zinc are not identified as ecological COCs, and no additional evaluation is recommended based on refined exposure doses less than 1.0 and/or the statistics presented in Table 7-23. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

As discussed in Section 7.3.2.1, a conclusion of acceptable or unacceptable risk to terrestrial avian receptors also was applied to terrestrial amphibians and reptiles (i.e., the American robin, mourning dove, and red-tailed hawk were used as surrogates). Based on a conclusion of

acceptable risk to terrestrial avian receptors, no chemicals are identified as ecological COCs for amphibian and reptile dietary exposures to SWMU 69 subsurface soil.

7.9.2 Uncertainties Associated With Step 3a of the BERA

Many of the uncertainties identified in Section 7.7 for the SERA (i.e. Steps 1 and 2 of the Navy ERA process) also apply to the refined risk calculation and evaluation (i.e. Step 3a of the BERA). Those uncertainties specific to the refined risk calculation for SWMU 69 are listed below.

- Due to the low sample size of the subsurface soil and groundwater data sets (n = 5 and n = 7 respectively), risk estimated for these two media were not refined using 95 percent UCL of the mean concentrations. The result is a more conservative risk evaluation that may overstate risks to ecological receptor populations at the SWMU.

- For inorganic chemicals in subsurface soil and groundwater, consideration was given to available background data. However, due to low sample size, statistical evaluations performed on the SWMU 69 and background analytical data for subsurface soil and groundwater were limited to a descriptive comparison.

- Non-detected chemicals lacking media-specific and/or avian TRVs were not evaluated by the refined risk evaluation, nor were they identified as ecological COCs. This approach may have resulted in an understatement of the actual number of ecological COCs if any of the non-detected chemicals lacking screening values and/or TRVs are present at ecologically significant concentrations.

7.9.3 Step 3a Decision Point and Recommendations: 2008 Data

Table 7-27 presents a summary of the ecological COPCs identified in Step 2 of the SERA, as well as the ecological COCs identified in Step 3a of the BERA. Recommendations for each media and dietary exposure pathway are presented in the sections that follow.

7.9.3.1 Surface Soil

Based on the refined media-specific risk evaluation presented in Section 7.9.1.1, barium, lead, and zinc were identified as ecological COCs for SWMU 69 surface soil (Table 7-27). Hot spots of each of these three COCs were identified that exceeded both soil screening values and background concentrations. Although 4-methyl-2-pentanone, acetone, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc were detected and identified as ecological COPCs in Step 2 of the SERA (see Section 7.6.2.1), these twelve chemicals were not identified as ecological COCs in Step 3a of the BERA. 4-Methyl-2-pentanone and acetone were eliminated from further evaluation based on their predicted toxicity to earthworms using SARs, while barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, vanadium, and zinc were eliminated from further evaluation based on statistics performed on the SWMU 69 and background airfield soil data sets, which showed that SWMU 69 surface soil concentrations for these ten metals are not elevated above background levels (Table 7-22).

7.9.3.2 Subsurface Soil

Based on the refined risk evaluation presented in Section 7.9.1.2, no chemicals were identified as ecological COCs in Step 3a of the BERA for SWMU 69 subsurface soil (Table 7-27). Although acetone, carbon disulfide, cobalt, copper, mercury, selenium, and vanadium were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, these chemicals were not identified as ecological COCs in Step 3a of the BERA. Acetone and carbon disulfide were eliminated from further evaluation based on their predicted toxicity to earthworms using SARs, while cobalt, copper, mercury, selenium, and vanadium were eliminated from further evaluation based on descriptive statistics, which showed that SWMU 69 subsurface soil concentrations for these five metals are not elevated above background levels (Table 7-23).

7.9.3.3 Groundwater

Based on the refined risk evaluation presented in Section 7.9.1.3, no chemicals were identified as ecological COCs for SWMU 69 groundwater in Step 3a of the BERA (Table 7-27). Four non-detected organic chemicals (acrolein, hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene) were identified as ecological COPCs in Step 2 of the SERA because maximum MDLs exceed screening values. These four non-detected chemicals were eliminated from further evaluation in Step 3a of the BERA based on industrial uses (in the case of acrolein) or the lack of detections in SWMU 69 surface and subsurface soil (in the case of hexachlorobenzene, hexachlorocyclopentadiene, and pentachloronitrobenzene), which indicates that they are not site-related and not likely to be present at ecologically important concentrations.

7.9.3.4 Mammalian Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.9.1.4.1, no chemicals were identified as ecological COCs for mammalian dietary exposures to chemicals in surface soil (Table 7-27). Although pyrene, 1,2,4,5-tetrachlorobenzene, barium, and selenium were detected in SWMU 69 surface soil and identified as ecological COPCs for mammalian receptors in Step 2 of the SERA, these chemicals were eliminated from further evaluation in Step 3a of the BERA. In the case of pyrene, barium, and selenium, no additional evaluation is recommended based on refined dietary exposure doses less than NOAEL-, MATC-, and LOAEL-based TRVs established for the brown flower bat (Table 7-24), indicating acceptable risk to small mammals. No additional evaluation is recommended for 1,2,4,5-tetrachlorobenzene based on the low magnitude of detections.

7.9.3.5 Avian Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.9.1.4.2, barium, cadmium, lead, and zinc were identified as ecological COCs for avian dietary exposures to chemicals in SWMU 69 surface soil (Table 7-27). Hot spots of barium and zinc pose risk to individual avian receptors. Cadmium and lead concentrations throughout the site are elevated relative to background levels (i.e., contamination is not limited to hot spots). Refined exposure doses of COCs exceed NOAEL-based ingestion screening values for the American robin.

Although ethylbenzene, toluene, 1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, pentachlorobenzene, beryllium, chromium, copper, mercury, nickel, selenium, and vanadium were detected in SWMU 69 surface soil and identified as ecological COPCs for avian receptors in Step 2 of the SERA, these chemicals were eliminated from further evaluation in Step 3a of the BERA. In the case of ethylbenzene, toluene, 1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, and pentachlorobenzene, no additional evaluation is recommended based on the low magnitude of

detections and/or the low potential for these organic chemicals to bioaccumulate in terrestrial food items. In the case of beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and vanadium, a recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs (Table 7-25) and/or the descriptive and distributional statistics presented in Table 7-22.

7.9.3.6 Amphibian and Reptile Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.9.1.4.2 for avian dietary exposures to surface soil, barium, cadmium, lead, and zinc were identified as ecological COCs for amphibian and reptile dietary exposures to chemicals in SWMU 69 surface soil (Table 7-27). As indicated in the previous section, hot spots of barium and zinc pose risk to individual avian (and assumed amphibian and reptile) receptors. Cadmium and lead concentrations throughout the site are elevated relative to background levels (i.e., contamination is not limited to hot spots). Refined exposure doses of COCs exceed NOAEL-based ingestion screening values for the American robin.

Although ethylbenzene, toluene, 1,2,4,5-tetrachlorobenzene, butyl benzyl phthalate, pentachlorobenzene, beryllium, chromium, copper, mercury, nickel, selenium, and vanadium were detected in SWMU 69 surface soil and identified as ecological COPCs for avian (and assumed amphibian and reptile) receptors in Step 2 of the SERA, these chemicals were eliminated from further evaluation in Step 3a of the BERA for reasons noted in the preceding section.

7.9.3.7 Mammalian Dietary Exposures: Subsurface Soil

Based on the screening level risk evaluation presented in Section 7.6.2.4.2, no chemicals were identified as COPCs for mammalian dietary exposures to chemicals in subsurface soil in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs. As such, no COCs were identified for mammalian exposures to chemicals in SWMU 69 subsurface soil.

7.9.3.8 Avian Dietary Exposures: Subsurface Soil

Based on the refined risk evaluation presented in Section 7.9.1.4.4, no chemicals were identified as ecological COCs for avian dietary exposures to chemicals in SWMU 69 subsurface soil. Although beryllium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc were detected in SWMU 69 subsurface soil and identified as ecological COPCs for avian dietary exposures in Step 2 of the SERA, they are not identified as ecological COCs for terrestrial dietary exposures based on refined exposure doses less than NOAEL-based TRVs (Table 7-26) and/or the descriptive statistics presented in Table 7-23.

7.9.3.9 Amphibian and Reptile Dietary Exposures: Subsurface Soil

Based on the refined risk evaluation presented in Section 7.9.1.4.4 for avian dietary exposures to subsurface soil, no chemicals were identified as ecological COCs for amphibian and reptile dietary exposures to chemicals in SWMU 69 subsurface soil. Although beryllium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc were detected in SWMU 69 subsurface soil and identified as ecological COPCs for avian (and assumed amphibian and reptile) dietary exposures in Step 2 of the SERA, they are not identified as ecological COCs for terrestrial dietary exposures based on refined exposure doses less than NOAEL-based TRVs (Table 7-26) and/or the descriptive statistics presented in Table 7-23.

7.10 Evaluation of Data from 2010 Disturbed Soil Sampling Investigation

This section describes changes in site conditions subsequent to the 2008 CMS Field Investigation, updates the CSM and problem formulation, and presents the results of the evaluation of 2010 data.

7.10.1 Environmental Setting

The following are noted changes in site conditions from the 2008 CMS field investigation to the 2010 disturbed soil data collection investigation:

- As discussed in Sections 1.0 and 2.3, following the 2008 CMS field investigation at SWMU 69, in support of the conversion of the airfield to a commercial facility, significant areas of soil associated with SWMU 69 were disturbed by contractors. Based on observations made October 2, 2008, the vegetation along the eastern and southern sides of the apron was disturbed, a trench was dug approximately 10 feet off the eastern and southern edges of the concrete, some scraping of surface soils was apparent, some of the scraped soils were pushed down slope away from the apron towards the southern drainage ditch, and scraped soil piles were present at various locations within the site. Based on the altered site conditions, migration of soil into the drainage ditches and downgradient was possible.

- In addition to alterations to the terrestrial habitat, the aquatic habitat at the site was changed. In 2008, the drainage area was dry and overgrown with terrestrial plant species and showed no indication of hydric soils or hydrophytic vegetation. However, in 2010, an accumulation of water at the headwaters of the ditch system was noted, apparently caused by vegetative debris that impedes flow in the channel. This is likely the result of the cessation of maintenance activities within the drainage ditch. Water within the ditch during the September 2010 sampling was approximately 2-4 inches in depth at the farthest upgradient locations and approximately 8-10 inches in depth at the farthest downgradient areas (see log notes in Appendix A). Sediment has accumulated within the channel, resulting in the establishment of an intermittently flooded PEM1 wetland unit, as evidenced by the presence of emergent wetland vegetation (see Photograph A-8) and indications of hydric soils (Appendix A). Vegetation growing within the southern ditch and adjacent upland habitat was documented during the 2010 sediment sampling. The dominant vegetation encountered included the following:

  - Ditch habitat**:** southern cattail (*Typha domingensis*), knotted spikerush (*Eleocharis interstincta*), and Bay Biscane creeping-oxeye (*Sphagneticola trilobata*)

  - Adjacent upland habitat: white lead tree (*Leucaena leucocephala)*, oceanblue morning-glory (*Ipomoea indica*), and guinea grass (*Urochloa maxima*)

  The Carribean region wetland indicator status for dominant vegetation growing within the drainage ditch is obligate wetland for southern cattail and knotted spikerush, and facultative for Bay Biscane creeping-oxeye (United States Department of Agriculture [USDA], 2010). The Caribbean region wetland indicator status for dominant vegetation growing within the adjacent upland habitat is facultative for white lead tree and oceanblue morning-glory and facultative upland for guinea grass (USDA, 2011).

Freshwater snails were observed during sediment sampling on November 5, 2010, but no fish were observed. The absence of a permanent fish population suggests that the drainage ditch system is flooded only intermittently and that the habitat is incapable of supporting a avian piscivores.

- Consistent with 2008 observations, foraging birds, such as herons, egrets, sandpipers, and plovers, were not observed within the drainage ditch system downgradient from SWMU 69 during the 2010 diturbed soil sampling investigation/vegetative assessment.

7.10.2 2010 Analytical Data

The Disturbed Soil Sampling Investigation was conducted from August 3, 2010 to August 6, 2010 (surface and subsurface soil collection) and on November 5, 2010 (sediment collection). A total of fifty-two surface soil samples (designated 69SB101-00 through 69SB152-00; collected from the 0.0 to 1.0-foot depth interval) and one hundred four subsurface soil samples (designated 69SB101-01 through 69SB152-01 and 69SB101-02 through 69SB152-02; from the 1.0 to 2.0-foot and 2.0 to 3.0-foot depth intervals, respectively) were collected. Subsurface soil samples from the 1.0 to 2.0-foot and 2.0 to 3.0-foot depth intervals were combined for the ERA. Fourteen drainage ditch sediment samples (designated 69SD01 through 69SD14) were collected from the portion of the drainage ditch within the SWMU boundary, depicted on Figure 4-2. All samples were analyzed for Appendix IX metals. The surface soil, subsurface soil, and sediment analytical data evaluated in the ERA are included as Appendix D. It is noted that the analytical laboratory reported non-detected results of the 2010 Disturbed Soil Sampling Investigation data to the reporting limit (RL).

7.10.3 Revised Screening Level Problem Formulation

Figure 7-11 presents a revision of the preliminary conceptual model for SWMU 69 based on the changes to site conditions noted in 2010. The primary change to the problem formulation is the identification of aquatic habitat within the drainage ditch system adjacent to the airfield (e.g., presence of hydric soils, observations of benthic invertebrates, as discussed in the preceeding section). Source areas are the same as identified in 2008. Transport pathways now include overland transport of chemicals with surface soil via surface runoff to downgradient surface soil and drainage ditch surface water and sediment. In addition, uptake by biota is expanded to include uptake by biota from drainage ditch sediment and trophic transfer to upper trophic level receptors. As in the 2008 conceptual site model, the drainage ditch system is a potential drinking water source. As no surface water samples were collected in 2004, 2008, or 2010 investigations, this exposure pathway was not evaluated in the ERA.

In addition to the assessment endpoints, risk questions, and measurement endpoints identified in Section 7.3.2 and Table 7-2, endpoints for the Disturbed Soil Sampling ERA include the survival, growth, and reproduction of lower trophic level aquatic receptor groups (aquatic plants, invertebrates, and amphibians). In addition to these receptor groups, an assessment endpoint based on the survival, growth, and reproduction of terrestrial avian omnivores was selected for the drainage ditch (Table 7-28). The American robin was selected as a surrogate species to represent birds reported from NAPR with similar feeding habits and dietary preferences (e.g., red-legged thrush). As drainage ditch surface water was not collected during the 2004 Phase II ECP or subsequent investigations conducted in 2008 and 2010, this potential pathway was not quantitatively evaluated by the ERA.

7.10.4 Screening Level Effects Evaluation

In addition to the screening values presented in Section 7.4, sediment screening values were developed for the Disturbed Soil Sampling ERA. Because the drainage ditch sediment is a freshwater habitat (fed by precipitation), freshwater sediment screening values were developed.

MacDonald et al. (2000) developed consensus-based sediment quality guidelines (SQGs) for freshwater using existing SQGs established for the protection of sediment-dwelling organisms. The consensus-based SQGs (Threshold Effect Concentrations [TECs] and Probable Effect Concentrations [PECs]) were derived by calculating the geometric mean of existing SQGs. TECs are intended to identify contaminant concentrations below which harmful effects on sediment-dwelling organisms are not expected, while PECs are intended to identify contaminant concentrations above which harmful effects are expected to occur frequently. The TECs developed by MacDonald et al. (2000) were preferentially selected for use as sediment screening values (Table 7-29). For those chemicals lacking a consensus-based TEC from MacDonald et al. (2000), sediment screening values were identified from the freshwater toxicological benchmarks listed and described below:

- **Sediment quality assessment guidelines (SQAGs) for Florida inland waters.** The consensus-based SQGs (i.e., TECs and PECs) derived by MacDonald et al. (2000) were adopted for use as SQAGs for Florida inland waters (MacDonald et al., 2003). SQAGs also were identified for twenty additional chemicals using effects-based guidelines promulgated in other jurisdictions. Identical to the consensus-based SQGs developed by MacDonald et al. (2000), only TEC-based SQAGs guidelines were used as sediment screening values.

- **Ontario Ministry of the Environment Lowest Effect Level (LEL) Provincial sediment quality guidelines (PSQGs).** The Ontario Ministry of the Environment (Persaud et al., 1993) developed PSQGs expressed as LELs and Severe Effect Levels (SELs). The LEL and SEL PSQGs are based on matched sediment chemistry and biological effects measures (co-occurrence analysis) from a wide range of geographical areas within the province. The LEL represents the chemical concentration at which actual ecotoxicological effects become apparent (e.g., species absence), while the SELs represent chemical concentrations that could potentially eliminate most benthic organisms. Only LELs were selected as sediment screening values.

- **Canadian interim freshwater sediment quality guidelines (ISQGs).** The CCME (2002) developed ISQGs using literature-based data from models (i.e., equilibrium partitioning [EqP]) spiked sediment toxicity tests, and field studies (co-occurrence data consisting of matching sediment chemistry and biological effect data). This information was used to establish associations between concentrations of chemicals in sediments and adverse biological effects.

For a given chemical, when more than one toxicological threshold was available from the sources listed above (i.e., MacDonald et al., 2003, Persaud et al., 1993, and CCME, 2002), the minimum value was conservatively selected as the sediment screening value. For those chemicals lacking a consensus-based SQG, SQAG, PSQG, and ISQG, the marine and estuarine toxicological benchmarks listed and described below were used as sediment screening values:

- **Effects Range-Low (ER-L) marine and estuarine SQGs**. Long and Morgan (1991) developed effects-based SQGs using literature-based data from EqP modeling, spiked-sediment toxicity tests, and matched sediment chemistry and biological effects measures. For a given chemical, the data were arranged in ascending order of concentration with each data entry assigned an "effects" or "no effects" descriptor, and the 10th percentile and 50th percentile concentrations of the "effects" data were calculated. The 10th and 50th percentiles of the "effects" data represent the ER-L and Effects Range-Median (ER-M), respectively. The ER-L and the ER-M delineate three concentration ranges for a given chemical. The concentration range below the ER-L value represents a minimal effects range (i.e., the concentration range in which effects would be rarely observed). Concentrations equal to or greater than the ER-L but less than the ER-M represent a possible effects range within which effects would occasionally occur, while concentrations greater than the ER-M represent a probable-effects range within which effects would frequently occur. The ER-L and ER-M values were recalculated by Long et al. (1995) after omitting a small amount of freshwater data included in the original calculations (Long and Morgan 1991) and incorporating more recent marine and estuarine data from the literature. Only ER-Ls were selected as sediment screening values in this screening level ERA.

- **Threshold Effect Level (TEL) SQAGs for Florida coastal waters.** The updated and revised data set used by Long et al. (1995) also was used by MacDonald (1994) to calculate SQAGs for Florida coastal waters (TELs and Probable Effect Levels [PELs]). Unlike the methodology used by Long et al. (1991) to derive ER-L and ER-M values, the derivation of TELs and PELs took into consideration the "no effects" data set. Specifically, TELs were derived by calculating the geometric mean of the 15th percentile in the "effects" data set and the 50th percentile in the "no effects" data set, while PELs were derived by calculating the geometric mean of the 50th percentile in the "effects" data set and the 85th percentile in the "no effects" data set.

  Identical to ER-Ls and ER-Ms, TELs and PELs delineate three concentration ranges for a given chemical. The TEL represents the upper limit of the range of sediment concentrations dominated by "no effects" data. Within this range, concentrations are not considered to represent significant hazards to sediment-associated biota. The PEL represents the lower limit of the range of sediment concentrations that are usually or always associated with adverse biological effects. The range of concentrations that could be associated with biological effects is delineated by the TEL and PEL. Within this range of concentrations, adverse biological effects are possible.

- **Apparent Effects Threshold (AET) marine SQGs.** The AET method, developed by Tetra Tech, Inc (1986), associates chemical concentrations in sediments with adverse biological effects (lethal and sub-lethal toxicity as measured using sediment toxicity tests or changes in benthic macroinvertebrate abundance and community structure as measured by *in situ* biological surveys). For a given chemical and measurement of biological effect (biological indicator), the AET value represents the sediment concentration above which statistically significant biological effects are always observed. The AET values shown in Table 7-29 represent the lowest AET value from a suite of seven biological indicators (amphipod mortality, oyster larval abnormality, Microtox® luminescence, benthic macroinvertebrate abundance, bivalve larvae mortality/abnormality, Echinoderm larvae mortality/abnormality, and juvenile polychaete growth). It is noted that the AET values included within Table 7-29 are interim values subject to change (Buchman 2008).

Minimum, chemical-specific AET values are used by the Washington State Department of Ecology (1995) as sediment management standards for Puget Sound. Minimum AET values also are used by the USACE (USEPA/USACE, 1998) as "reason to believe" guidance for screening levels for the Dredged Material Management Program (DMMP). The DMMP screening levels are implemented for use in Puget Sound and Grays Harbor/Willapa Bay in the State of Washington. Current Washington State Department of Ecology sediment management standards and USACE DMMP screening levels do not reflect the interim AET values reported by Buchman (2008).

Identical to the freshwater toxicological benchmarks, when more than one marine and estuarine toxicological benchmark was available from the sources listed above, the minimum value was conservatively selected as the sediment screening value.

7.10.5 Screening Level Exposure Estimation

Screening-level exposure estimation for surface and subsurface soil followed the methods identified in Section 7.5.2. Consistent with that approach, for sediment maximum detected concentrations (or maximum detection limits for non-detected chemicals) were used to conservatively estimate potential chemical exposures for the ecological receptors selected to represent the assessment endpoints.

7.10.6 Screening Level Risk Calculation: 2010 Data

The HQ method described in Section 7.6.1 was used to select COPCs for the Disturbed Soil Sampling ERA. For sediment, maximum detected concentrations (or maximum RLs for non-detected chemicals) were used to calculate media-specific HQs.

Screening level risk calculations (i.e., HQ calculations) for SWMU 69 surface soil, subsurface soil, and drainage ditch sediment are presented in Tables 7-30, 7-31, and 7-32, respectively. These calculations apply only to lower trophic level community exposures (i.e., HQ calculations for terrestrial plant and invertebrate exposures to chemicals in surface and subsurface soil, and benthic biota exposures to chemicals in drainage ditch sediment). Screening level risk calculations for SWMU 69 mammalian and avian dietary exposures are presented in Tables 7-33 (surface soil) and 7-34 (subsurface soil), while avian omnivore dietary exposures to chemicals in drainage ditch sediment are presented in Table 7-35. Ecological COPCs were identified in Step 2 of the SERA using the procedures outlined in Section 7.6.1.

7.10.6.1 Surface Soil

Table 7-30 presents the results of the screening level risk calculation for plant and invertebrate exposures to inorganic chemicals in SWMU 69 surface soil. Fifteen metals were detected in SWMU 69 surface soil. Although detected, arsenic, beryllium, cadmium, lead, nickel, silver, and thallium are not identified as ecological COPCs because maximum detected concentrations are less than soil screening values (i.e., maximum HQs are less than 1.0). However, maximum detected barium, chromium, cobalt, copper, mercury, selenium, vanadium, and zinc concentrations exceed soil screening values (HQs range from 1.19 for chromium to 27.50 for vanadium; Table 7-30). Based on maximum detected concentrations greater than soil screening values, these eight metals are identified as ecological COPCs for SWMU 69 surface soil.

In summary, barium, chromium, cobalt, copper, mercury, selenium, vanadium, and zinc were detected and identified as ecological COPCs for SWMU 69 surface soil because maximum detected concentrations exceed soil screening values.

7.10.6.2 Subsurface Soil

Table 7-31 presents the results of the screening level risk calculation for plant and invertebrate exposures to inorganic chemicals in SWMU 69 subsurface soil (1.0 to 3.0 foot depth interval). Fifteen metals were detected in SWMU 69 subsurface soil. Although detected, arsenic, barium, beryllium, cadmium, chromium, lead, nickel, silver, thallium, and zinc are not identified as ecological COPCs because maximum detected concentrations are less than soil screening values (i.e., maximum HQs are less than 1.0). Cobalt, copper, mercury, selenium, and vanadium are identified as ecological COPCs because maximum detected concentrations exceed soil screening values. HQs range from 1.80 for mercury to 29.00 for vanadium.

In summary, cobalt, copper, mercury, selenium, and vanadium were detected and identified as ecological COPCs for SWMU 69 subsurface soil because maximum detected concentrations exceed soil screening values.

7.10.6.3 Drainage Ditch Sediment

Table 7-32 presents the results of the screening level risk calculation for benthic biota exposures to inorganic chemicals in SWMU 69 drainage ditch sediment. Fifteen metals were detected in drainage ditch sediment. Although detected, arsenic, cobalt, mercury, selenium, and silver are not identified as ecological COPCs because maximum detected concentrations are less than sediment screening values (i.e., maximum HQs are less than 1.0). Barium, cadmium, chromium, copper, lead, nickel, vanadium, and zinc are identified as ecological COPCs because maximum detected concentrations exceed sediment screening values (Table 7-32). Maximum HQs range from 1.50 for nickel to 24.24 for cadmium. Beryllium and thallium also were detected and identified as ecological COPCs based on the lack of sediment screening values. Although not detected, antimony and tin were identified as ecological COPCs because the maximum RLs exceeded the sediment screening value.

In summary, barium, cadmium, chromium, copper, lead, nickel, vanadium, and zinc were detected and identified as ecological COPCs for drainage ditch sediment because maximum detected concentrations exceed sediment screening values. Beryllium and thallium also were detected and identified as ecological COPCs based on the lack of sediment screening values. Although not detected, antimony and tin were identified as ecological COPCs because maximum RLs exceed sediment screening values.

7.10.6.4 Mammalian and Avian Dietary Exposures

Results of the screening level risk calculation for SWMU 69 avian dietary exposures are presented in Tables 7-33 (surface soil), 7-34 (subsurface soil), and 7-35 (sediment). A discussion of these results is presented in the sections that follow.

7.10.6.4.1 Mammalian and Avian Dietary Exposures: Surface Soil

Results of the screening level risk calculation for mammalian and avian dietary exposures to chemicals in SWMU 69 surface soil are presented in Table 7-33. Based on maximum exposure

doses greater than NOAEL-based TRVs for the brown flower bat, selenium is identified as an ecological COPC for mammalian dietary exposures to chemicals in SWMU 69 surface soil. Based on the comparison of maximum exposure doses to NOAEL-based TRVs for the American robin, mourning dove, and red-tailed hawk, ten detected metals (barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc) have HQs greater than 1.0 for one or more of the terrestrial avian receptors. The highest HQs were calculated for the American robin, including an HQ of 20.14 for chromium, 34.51 for mercury, and 78.88 for vanadium. Remaining HQs were each less than 10.00. Based on maximum exposures doses greater than NOAEL-based TRVs, these ten metals are identified as ecological COPCs for avian dietary exposures (selenium is considered a COPC for both mammalian and avian exposures) to chemicals in SWMU 69 surface soil. One detected metal (beryllium) is identified as an ecological COPC for terrestrial avian exposures based on the lack of TRVs, while one non-detected metal (tin) is identified as an ecological COPC for terrestrial avian exposures because the maximum exposure dose exceeds the NOAEL-based TRV.

As potential risk to terrestrial amphibians and reptiles is qualitatively evaluated based on potential risk to avian receptors, each of the chemicals identified as ecological COPCs for avian dietary exposures to surface soil in the preceding paragraph is also identified as an ecological COPC for amphibians and reptiles.

7.10.6.4.2 Mammalian and Avian Dietary Exposures: Subsurface Soil

Results of the screening level risk calculation for mammalian and avian dietary exposures to chemicals in SWMU 69 subsurface soil are presented in Table 7-34. Based on maximum exposure doses greater than NOAEL-based TRVs for the brown flower bat, selenium is identified as an ecological COPC for mammalian dietary exposures to chemicals in SWMU 69 subsurface soil. Based on the comparison of maximum exposure doses to NOAEL-based TRVs for the American robin, mourning dove, and red-tailed hawk, eight detected metals (chromium, copper, mercury, nickel, selenium, silver, vanadium, and zinc) have HQs greater than 1.0 for one or more of the terrestrial avian receptors. The highest HQs were calculated for the American robin, including an HQ of 15.70 for chromium, 34.51 for mercury, and 83.18 for vanadium. Remaining HQs were each less than 10.00. Based on maximum exposures doses greater than NOAEL-based TRVs, these eight metals are identified as ecological COPCs for avian dietary exposures (selenium is considered a COPC for both mammalian and avian exposures) to chemicals in SWMU 69 subsurface soil. One detected metal (beryllium) is identified as an ecological COPC for terrestrial avian exposures based on the lack of TRVs, while one non-detected metal (tin) is identified as an ecological COPC for terrestrial avian exposures because the maximum exposure dose exceeds the NOAEL-based TRV.

As potential risk to terrestrial amphibians and reptiles is qualitatively evaluated based on potential risk to avian receptors, each of the chemicals identified as ecological COPCs for avian dietary exposures to subsurface soil in the preceding paragraph is also identified as an ecological COPC for amphibians and reptiles.

7.10.6.4.3 Avian Omnivore Dietary Exposures: Drainage Ditch Sediment

Results of the screening level risk calculation for avian dietary exposures to chemicals in SWMU 69 sediment are presented in Table 7-35. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, ten detected metals (cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc) have HQs greater than 1.0 for the American robin. The highest HQs were calculated for cadmium (HQ = 17.39), chromium (HQ = 29.33), lead (HQ =

14.98), mercury (HQ = 26.84), and vanadium (HQ = 53.06). Remaining HQs were each less than 10.00. Based on maximum exposures doses greater than NOAEL-based TRVs, these ten metals are identified as ecological COPCs for avian omnivore dietary exposures to chemicals in SWMU 69 sediment. Beryllium was detected in SWMU 69 sediment and is identified as an ecological COPC based on the lack of an avian TRV. Although not detected, tin is identified as an ecological COPC because the maximum exposure dose exceeds the NOAEL-based TRV.

As potential risk to terrestrial amphibians and reptiles is qualitatively evaluated based on potential risk to avian receptors, each of the chemicals identified as ecological COPCs for avian dietary exposures to drainage ditch sediment in the preceding paragraph is also identified as an ecological COPC for amphibians and reptiles.

7.10.7 Uncertainties Associated With Step 2 of the SERA

The uncertainties identified in Section 7.7 for the SERA (i.e. Steps 1 and 2 of the Navy ERA process) for 2008 CMS Investigation data also apply to the SERA for 2010 Disturbed Soil Sampling Investigation data. In addition, the following uncertainties apply to the 2010 Disturbed Soil Sampling ERA:

- The literature-based, bulk sediment toxicological thresholds used as screening values in the SERA do not take into consideration site-specific conditions that can influence chemical bioavailability and toxicity. These conditions include acid volatile sulfides (AVS), which can influence the bioavailability of metals. As exposure does not necessarily equate to risk, bulk sediment screening values may overstate risk to benthic macroinvertebrates.

- Measurement endpoints for aquatic plants and amphibians included a comparison of chemical concentrations in sediment with sediment screening values. However, as discussed in Section 7.10.4, the literature-based AET, TEC, TEL, and LEL values selected as sediment screening values were developed from data specific to invertebrates. Therefore, they may not be protective of plants and amphibians.

- Surface water was not collected from the drainage ditch, thus no evaluation of potential risk from surface water exposures was conducted. It should be noted that the drainage ditch is intermittently flooded and is not a permanent source of surface water at the SWMU. Surface water is expected to be present in the ditch following significant precipitation events and would consist of overland flow from the airfield and surrounding soils. The uncertainty regarding the lack of surface water data is reduced by the evaluation of sediment data, which would serve as a secondary source for surface water contamination. Chemicals not identified as COCs in surface soil or sediment are not likely to be identified as COCs in surface water.

7.10.8 Step 3a of the BERA: 2010 Data

The results of the screening level risk calculation indicated that, based on a set of conservative assumptions, there are one or more chemicals in each medium that may present risks to ecological receptor groups and/or specific receptor species. As such, the ERA process proceeded to the BERA.

The refined exposure estimation for surface and subsurface soil followed the methods identified in Section 7.9. Consistent with that approach, for sediment 95 percent UCL of the mean chemical

concentration (calculated using ProUCL; Appendix F) was used as an exposure point estimate in lieu of maximum detected concentrations for those chemicals having at least 8 detected values and no more than 70 percent non-detected values when calculating. Consideration was also given to background data by statistically comparing 2010 surface soil, subsurface soil, and sediment data to airfield soil data (for surface and subsurface soil data) and airfield drainage ditch sediment (for sediment data). The background soil and sediment data used in Step 3a of the BERA are the background airfield data sets presented in Addendums B (airfield soil) and C (airfield drainage ditch sediment), respectively of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010).

7.10.9 Refined Risk Evaluation: 2010 Data

Detected chemicals with maximum concentrations and/or maximum exposure doses greater than screening values, as well as detected chemicals lacking screening values were identified as ecological COPCs in Step 2 of the SERA. Non-detected chemicals with maximum RLs and/or maximum exposure doses greater than screening values also were identified as ecological COPCs in the Step 2 risk calculations. Only those detected and non-detected chemicals with maximum concentrations and/or maximum exposure doses greater than screening values, and those detected chemicals lacking screening values were addressed in Step 3a of the BERA. All ecological COPCs identified in Step 2 of the SERA match this criterion. The refined risk evaluation for 2010 Disturbed Soil Sampling Investigation data is presented in the following sections.

7.10.9.1 Step 3a Risk Evaluation for Surface Soil

Section 7.10.6.1 presented the results of the Step 2 screening level risk calculation for SWMU 69 surface soil data. Screening level risk estimates (i.e., HQs) also were provided in Table 7-30. Barium, chromium, cobalt, copper, mercury, selenium, vanadium, and zinc were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values. The spatial extent of detected ecological COPC concentrations greater than soil screening values is depicted on Figure 7-12. The refined screening level risk calculation for SWMU 69 surface soil is presented in Table 7-36. As discussed in Section 7.9, risk estimates for surface soil were re-calculated using 95 percent UCL of the mean concentrations for those ecological COPCs having less than 70 percent non-detected results and a minimum of eight detected values (i.e., barium, chromium, cobalt, copper, mercury, vanadium, and zinc). It is acknowledged that terrestrial plants are immobile and many terrestrial invertebrates are relatively immobile; therefore, individuals are likely to be impacted by locations of maximum concentrations. However, as discussed in Section 7.9, evaluation of the 95 percent UCL of the mean exposure case is more indicative of the level of impact that might be expected at the population level. In addition to the re-calculation of risk estimates using 95 percent UCL of the mean concentrations, the SWMU 69 surface soil data were statistically compared to the background airfield soil data set contained within Addendum B of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Chemicals (Baker, 2010) in accordance with Navy guidance (NFESC, 2002). The risk evaluation also took into consideration the magnitude and spatial distribution of barium, chromium, cobalt, copper, mercury, selenium, vanadium, and zinc detections above soil screening values and/or background concentrations.

Barium was detected in fifty-two of fifty-two (52/52) surface soil samples at concentrations ranging from 9J mg/kg (69SB104-00) to 470J mg/kg (69SB126-00). Only the maximum detected concentration exceeds the soil screening value of 330 mg/kg (Figure 7-12). The Step 2 screening level risk estimate (HQ = 1.42; Table 7-30), derived using the maximum detected concentration, indicates that barium in SWMU 69 surface soil may present an unacceptable risk to terrestrial

invertebrates and plants. The refined risk estimate (HQ = 0.14; Table 7-36), derived using the 95 percent UCL of the mean concentration (46.96 mg/kg), indicates that barium presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 indicate that a hot spot of barium contamination may be present. While the maximum detected concentration in SWMU 69 surface soil (470J mg/kg) is elevated above the maximum and ULM background concentrations (284 mg/kg and 233 mg/kg, respectively), the arithmetic mean and 95 percent UCL of the mean concentration in SWMU 69 surface soil (41.8 mg/kg and 47.0 mg/kg, respectively) are approximately half the value of these parameters for the background data set (86.2 mg/kg and 112 mg/kg, respectively). Distributional statistics evaluating the right tail of the distributions (quantile test and slippage test) and the median of the distributions (Wilcoxon Rank Sum test) indicate that barium concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. Although there is a hot spot of contamination indicated at sample location 69SB126-00, based on the relatively low maximum HQ (1.42), 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations (HQ = 0.14), and remaining SWMU barium concentrations consistent with background levels, barium is not identified as an ecological COC for SWMU 69 surface soil, and no further evaluation is recommended.

Chromium was detected in fifty-two of fifty-two (52/52) surface soil samples at concentrations ranging from 4.2 mg/kg (69SB149-00) to 68 mg/kg (69SB123-00 and 69SB145-00). Three of the detected concentrations exceed the soil screening value of 57 mg/kg (Figure 7-12). The Step 2 screening level risk estimate (HQ = 1.19; Table 7-30), derived using the maximum detected concentration, indicates that chromium may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 0.46; Table 7-36), derived using the 95 percent UCL of the mean concentration (26.3 mg/kg), indicates that chromium presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 indicate that chromium concentrations in SWMU 69 surface soil are not elevated above background concentrations. The maximum, mean, and 95 percent UCL of the mean of detected chromium concentrations in SWMU 69 surface soil (68 mg/kg, 22.7 mg/kg, and 26.3 mg/kg, respectively) are less than the maximum, mean, and 95 percent UCL of the mean of background concentrations (101J mg/kg, 28.0 mg/kg, and 34.1 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and airfield background surface soil data sets support the descriptive comparison. Statistical tests evaluating the right tail of the distributions (quantile test and slippage test) and the mean of the distributions (Satterthwaite t-test) indicate that chromium concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. Based on a relatively low maximum HQ (1.19), 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, and indications that SWMU concentrations of chromium are consistent with background levels, chromium is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Cobalt was detected in fifty-two of fifty-two (52/52) surface soil samples at concentrations ranging from 0.61 mg/kg (69SB147-00) to 64.0 mg/kg (69SB125-00). Nine of the detected concentrations exceed the soil screening value of 13.0 mg/kg (Figure 7-12). The screening level risk estimate (HQ = 4.92; Table 7-30), derived using the maximum detected concentration, indicates that cobalt in SWMU 69 surface soil may present an unacceptable risk to terrestrial plants and invertebrates. The refined risk estimate (HQ = 0.93; Table 7-36), derived using the 95 percent UCL of the mean concentration (12.2 mg/kg), indicates that cobalt presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 for the SWMU 69 surface soil and background airfield soil data sets indicate that cobalt concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum, mean, and 95 percent UCL of the mean of detected cobalt concentrations in SWMU

69 surface soil (64 mg/kg, 10.0 mg/kg, and 12.2 mg/kg, respectively) are less than, or equivalent to, the maximum, mean, and 95 percent UCL of the mean of background concentrations (64 mg/kg, 16.6 mg/kg, and 26.5 mg/kg, respectively). Similarly, statistical tests evaluating the right tail of the distributions (quantile test and slippage test) and the median of the distributions (Wilcoxon Rank Sum test) indicate that cobalt concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. Based on the relatively low maximum HQ (4.92), 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, and indications that SWMU concentrations of cobalt are consistent with background levels, cobalt is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Copper was detected in fifty-two of fifty-two (52/52) surface soil samples collected at SWMU 69 at concentrations ranging from 3.0 mg/kg (69SB104-00) to 120 mg/kg (69SB128-00). Fourteen of the detected concentrations exceed the soil screening value of 70.0 mg/kg (Figure 7-12). The screening level risk estimate (HQ = 1.71; Table 7-30), derived using the maximum detected concentration, indicates that copper in SWMU 69 surface soil may present an unacceptable risk to terrestrial plants and invertebrates. The refined risk estimate (HQ = 0.82; Table 7-36), derived using the 95 percent UCL of the mean concentration (57.3 mg/kg), indicates that copper presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 show that copper concentrations in SWMU 69 surface soil are not elevated above background concentrations. The maximum, mean, and 95 percent UCL of the mean of detected copper concentrations in SWMU 69 surface soil (120 mg/kg, 50.5 mg/kg, and 57.3 mg/kg, respectively) are less than the maximum, mean, and 95 percent UCL of the mean of background concentrations (260J mg/kg, 95.1 mg/kg, and 115 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background airfield data sets (Gehan test, quantile test, and slippage test) also concluded that copper concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. Based on the relatively low maximum HQ (1.71), 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, and indications that SWMU concentrations of copper are consistent with background levels, copper is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Mercury was detected in thirty-six of forty-six (36/46) surface soil samples at concentrations ranging from 0.0086J mg/kg (69SB113-00) to 0.18 mg/kg (69SB125-00 and 69SB130-00). Seven detected concentrations exceed the soil screening value of 0.10 mg/kg (Figure 7-12). The Step 2 screening level risk estimate (HQ = 1.80; Table 7-30), derived using the maximum concentration, indicates that mercury in SWMU 69 surface soil may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 0.64; Table 7-36), derived using the 95 percent UCL of the mean concentration (0.06 mg/kg), indicates that mercury presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 indicate that mercury concentrations in SWMU 69 surface soil are slightly elevated above background concentrations. The maximum, arithmetic mean, and 95 percent UCL of the mean concentration in SWMU 69 surface soil (0.18 mg/kg, 0.05 mg/kg, and 0.06 mg/kg, respectively) are slightly elevated above the corresponding background parameters (0.12J mg/kg, 0.04 mg/kg, and 0.05 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background airfield surface soil data sets were contradictory. Statistical tests evaluating the right tail of the distributions (quantile test and slippage test) concluded that mercury concentrations in SWMU 69 surface soil are statistically elevated above background concentrations, while the statistical test evaluating the median of the distributions (Gehan test) indicates that mercury concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. The data suggest that hot spots of contamination are present at

sample locations 69SB125-00 (0.18 mg/kg), 69SB130-00 (0.18 mg/kg), and 69SB126-00 (0.17 mg/kg). However, based on the relatively low maximum HQ (1.80) and 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, mercury is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Selenium was detected in twelve of fifty-two (12/52) surface soil samples at concentrations ranging from 0.58J mg/kg (69SB144-00) to 2.1 mg/kg (69SB126-00). Each of the detected concentrations exceeds the soil screening value of 0.52 mg/kg (USEPA, 2007f; Figure 7-12). The Step 2 screening level risk estimate (HQ = 4.04; Table 7-30), derived using the maximum detected concentration, indicates that selenium in SWMU 69 surface soil may present an unacceptable risk to terrestrial invertebrates and plants. A refined risk estimate using the 95 percent UCL of the mean concentration could not be calculated because the frequency of non-detected results was greater than 70 percent. The descriptive statistics presented in Table 7-37 indicate that selenium concentrations in SWMU 69 surface soil are not elevated above background levels. The maximum and arithmetic mean selenium concentrations in SWMU 69 surface soil (2.1 mg/kg and 0.70 mg/kg, respectively) are less than corresponding background parameters (3.8J mg/kg and 0.58 mg/kg, respectively). Distributional statistics could not be performed because there were greater than 50 percent non-detected results in the combined SWMU 69 and background data sets (NFESC, 2002). Based on the relatively low maximum HQ (4.04) and indications based on descriptive statistics that selenium concentrations are within background levels, selenium is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

Vanadium was detected in fifty-two of fifty-two (52/52) surface soil samples at concentrations ranging from 9.0 mg/kg (69SB104-00) to 550 mg/kg (69SB132-00). Fifty detected concentrations exceed the soil screening value of 20.0 mg/kg (Figure 7-12). The Step 2 screening level risk estimate (HQ = 27.50; Table 7-30), derived using the maximum concentration, indicates that vanadium in SWMU 69 surface soil may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 8.59; Table 7-36), derived using the 95 percent UCL of the mean concentration (172 mg/kg), also indicates that vanadium may present an unacceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 indicate that a hot spot of vanadium is present at location 69SB132-00. This maximum detected concentration at this location (550 mg/kg) exceeds the maximum and ULM background concentrations (410 mg/kg and 367 mg/kg, respectively). The maximum SWMU 69 concentration is the only detection at SWMU 69 that exceeds the maximum background concentration. The arithmetic mean and 95 percent UCL of the mean SWMU 69 concentrations (146 mg/kg and 172 mg/kg, respectively) are less than the corresponding background parameters (176 mg/kg and 201 mg/kg, respectively). Likewise, statistical tests evaluating the right tail (quantile test and slippage test) and median (Wilcoxon Rank Sum test) of the distributions conclude that vanadium concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. Based on maximum and mean HQs indicating potential risk to terrestrial receptors and the presence of a hot spot of contamination at 69SB132-00, vanadium is identified as an ecological COC for SWMU 69 surface soil, and additional evaluation is recommended.

Zinc was detected in fifty-one of fifty-two (51/52) surface soil samples at concentrations ranging from 4.9 mg/kg (69SB149-00) to 200 mg/kg (69SB115-00). Only the maximum detected concentration exceeds the soil screening value of 120 mg/kg (Figure 7-12). The Step 2 screening level risk estimate (HQ = 1.67; Table 7-30), derived using the maximum detected concentration, indicates that zinc may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 0.46; Table 7-36), derived using the 95 percent UCL of the mean

concentration (55.2 mg/kg), indicates that zinc presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-37 indicate a hot spot of zinc at location 69SB115-00. This maximum detected concentration (200 mg/kg) exceeds the maximum and ULM background concentrations (140J mg/kg and 113 mg/kg, respectively), and is the only detection in excess of the maximum background concentration. The arithmetic mean and 95 percent UCL of the mean SWMJ 69 concentrations (33.7 mg/kg and 55.2 mg/kg, respectively) are less than the corresponding background parameters (47.2 mg/kg and 70.6 mg/kg, respectively). Likewise, statistical tests evaluating the right tail (quantile test and slippage test) and mean (two sample t-test) of the distributions concluded that zinc concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations. Although a hot spot of contamination is indicated, based on the relatively low maximum HQ (1.67) and 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, zinc is not identified as an ecological COC for SWMU 69 surface soil, and no additional evaluation is recommended.

In summary, vanadium is identified as an ecological COC for SWMU 69 surface soil based on maximum and mean HQs indicating potential risk to terrestrial receptors, as well as the presence of a hot spot of contamination at 69SB132-00. Although barium, chromium, cobalt, copper, mercury, selenium, and zinc were detected in SWMU 69 surface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs, and no additional evaluation is recommended. These seven metals are not recommended for additional evaluation based on statistical evaluations performed on the SWMU 69 surface soil and background airfield soil data sets.

7.10.9.2 Step 3a Risk Evaluation for Subsurface Soil

Section 7.10.6.2 presented the results of the Step 2 screening level risk calculation for SWMU 69 subsurface soil. Screening level risk estimates also were provided in Table 7-14. Cobalt, copper, mercury, selenium, and vanadium were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values. The spatial extent of detected ecological COPC concentrations greater than soil screening values is depicted on Figure 7-13. The refined risk evaluation for SWMU 69 surface soil is presented and discussed within the paragraphs that follow. The refined screening level risk calculation for SWMU 69 subsurface soil is presented in Table 7-38. As discussed in Section 7.9, risk estimates for subsurface soil were re-calculated using 95 percent UCL of the mean concentrations for those ecological COPCs having less than 70 percent non-detected results and a minimum of eight detected values (i.e., cobalt, copper, mercury, selenium, and vanadium). The refined risk evaluation for SWMU 69 subsurface soil is presented and discussed within the paragraphs that follow.

Cobalt was detected in each of 103 (103/103) subsurface soil samples at concentrations ranging from 0.38 mg/kg (69SB106-02) to 34.0 mg/kg (69SB125-02). Thirty of the detected concentrations exceed the soil screening value of 13.0 mg/kg (Figure 7-13). The screening level risk estimate (HQ = 2.62; Table 7-31), derived using the maximum detected concentration, indicates that cobalt in SWMU 69 subsurface soil may present an unacceptable risk to terrestrial plants and invertebrates. The refined risk estimate (HQ = 0.95; Table 7-38), derived using the 95 percent UCL of the mean concentration (12.4 mg/kg), indicates that cobalt presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-39 for the SWMU 69 subsurface soil and background airfield soil data sets indicate that cobalt concentrations in SWMU 69 subsurface soil are not elevated above background levels. The maximum detected cobalt concentration in SWMU 69 subsurface soil (34.0 mg/kg) is less than

the maximum background concentration (64.0 mg/kg) and the ULM background concentration (44.1 mg/kg). In addition, the mean and 95 percent UCL of the mean concentrations in SWMU 69 subsurface soil (9.0 mg/kg and 12.4 mg/kg, respectively) are approximately half the value of the background mean and 95 percent UCL of the mean concentrations (16.6 mg/kg and 26.5 mg/kg, respectively). Similarly, the statistical tests evaluating the right tail of the distributions (quantile test) and the median of the distributions (Gehan test) indicate that cobalt concentrations in SWMU 69 subsurface soil are not statistically elevated above background concentrations. Based on the relatively low maximum HQ (2.62), 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, and indications that SWMU concentrations of cobalt are consistent with background levels, cobalt is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Copper was detected in each of the 104 (104/104) subsurface soil samples collected at SWMU 69. Concentrations range from 8.1J mg/kg (69SB115-01) to 280 mg/kg (69SB150-02). Seventy of the detected concentrations exceed the soil screening value of 70.0 mg/kg (Figure 7-13). The screening level risk estimate (HQ = 4.00; Table 7-31), derived using the maximum detected concentration, indicates that copper in SWMU 69 subsurface soil may present an unacceptable risk to terrestrial plants and invertebrates. The refined risk estimate (HQ = 1.53; Table 7-38), derived using the 95 percent UCL of the mean concentration (107 mg/kg), also indicates that copper may present an unacceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-39 show that copper concentrations in SWMU 69 subsurface soil are not elevated above background concentrations. The maximum detected copper concentration in SWMU 69 subsurface soil (280 mg/kg) is slightly elevated above the maximum background concentration (260J mg/kg). However, the arithmetic mean and 95 percent UCL of the mean concentrations in SWMU 69 subsurface soil (88.0 mg/kg and 107 mg/kg, respectively) are less than the background arithmetic mean and 95 percent UCL of the mean concentrations (95.1 mg/kg and 115 mg/kg, respectively). Similarly, statistical tests evaluating the right tail of the distributions (quantile test) and the median of the distributions (Gehan test) indicate that copper concentrations in SWMU 69 subsurface soil are not statistically elevated above background concentrations. Based on site concentrations being representative of background conditions, copper is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Mercury was detected in eighty-two of ninety-two (82/92) subsurface soil samples at concentrations ranging from 0.01J mg/kg (69SB105-02) to 0.18 mg/kg (69SB110-01). Twelve detected concentrations exceed the soil screening value of 0.1 mg/kg (Figure 7-13). The Step 2 screening level risk estimate (HQ = 1.80; Table 7-31), derived using the maximum concentration, indicates that mercury in SWMU 69 subsurface soil may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 0.64; Table 7-38), derived using the 95 percent UCL of the mean concentration (0.064 mg/kg), indicates that mercury presents an acceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-39 indicate that mercury concentrations in SWMU 69 subsurface soil are slightly elevated above background concentrations. The maximum detected concentration, arithmetic mean, and 95 percent UCL of the mean in SWMU 69 subsurface soil (0.18 mg/kg, 0.06 mg/kg, and 0.06 mg/kg, respectively) are slightly elevated above corresponding background parameters (0.12J mg/kg, 0.04 mg/kg, and 0.05 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background airfield surface soil data sets were contradictory. Statistical tests evaluating the right tail of the distributions (quantile test) concluded that mercury concentrations in SWMU 69 subsurface soil are not statistically elevated above background concentrations, while the statistical test evaluating the median of the distributions (Gehan test) indicates that mercury concentrations in SWMU 69 subsurface soil are

statistically elevated above background concentrations. Based on the relatively low maximum HQ (1.80) and 95 percent UCL of the mean HQ indicating acceptable risk to receptor populations, mercury is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Selenium was detected in thirty-three of 104 (33/104) subsurface soil samples at concentrations ranging from 0.63J mg/kg (69SB145-02) to 2.2 mg/kg (69SB129-02). Each of the detected concentrations exceeds the soil screening value of 0.52 mg/kg (Figure 7-13). The Step 2 screening level risk estimate (HQ = 4.23; Table 7-31), derived using the maximum detected concentration, indicates that selenium in SWMU 69 subsurface soil may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 1.88; Table 7-38), derived using the 95 percent UCL of the mean concentration (0.98 mg/kg), also indicates that selenium may present an unacceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-39 indicate that selenium concentrations in SWMU 69 subsurface soil are not elevated above background levels. Specifically, the maximum detected selenium concentration (2.2 mg/kg) is less than the maximum background concentration (3.8J mg/kg). Distributional statistics could not be performed since selenium was not detected in greater than 70 percent of samples. Because SWMU concentrations are within background levels, selenium is not identified as an ecological COC for SWMU 69 subsurface soil, and no additional evaluation is recommended.

Vanadium was detected in each of 102 (102/102) subsurface soil samples at concentrations ranging from 48 mg/kg (69SB106-02) to 580 mg/kg (69SB127-01 and 69SB130-02). Each of the detected concentrations exceeds the soil screening value of 20 mg/kg (Figure 7-13). The Step 2 screening level risk estimate (HQ = 29.00; Table 7-31), derived using the maximum concentration, indicates that vanadium in SWMU 69 surface soil may present an unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate (HQ = 11.85; Table 7-38), derived using the 95 percent UCL of the mean concentration (237 mg/kg), also indicates that vanadium may present an unacceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-39 indicate that vanadium concentrations in SWMU 69 surface soil are elevated above background concentrations. Specifically, the maximum detected concentration in SWMU 69 subsurface soil (580 mg/kg) is elevated above the maximum and ULM background concentrations (410 mg/kg and 367 mg/kg, respectively). The arithmetic mean and 95 percent UCL of the mean concentrations in SWMU 69 subsurface soil (219 mg/kg and 237 mg/kg, respectively) also exceed the corresponding background parameters (176 mg/kg and 201 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background airfield surface soil data sets were contradictory. The statistical test evaluating the right tail of the distributions (quantile test) concludes that vanadium concentrations in SWMU 69 surface soil are not statistically elevated above background concentrations, while the statistical test evaluating the mean of the distributions (two sample t-test) indicates that vanadium concentrations in SWMU 69 surface soil are statistically elevated above background concentrations. Eleven of the detected SWMU 69 concentrations exceeded the ULM of the background concentration (367 mg/kg) and six of the detected SWMU 69 concentrations exceeded the maximum background detection (410 mg/kg). Based on both maximum and mean HQs indicating potential risk to terrestrial receptors, and descriptive and distributional statistics indicating that site concentrations are elevated above background, vanadium is identified as an ecological COC for SWMU 69 subsurface soil, and additional evaluation is recommended.

In summary, vanadium is identified as an ecological COC for SWMU 69 subsurface soil based on both maximum and mean HQs indicating potential risk to terrestrial receptors, as well as descriptive and distributional statistics indicating that site concentrations are elevated above

background. Although cobalt, copper, mercury, and selenium were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs based on the descriptive and/or distributional comparison of the SWMU 69 subsurface soil analytical data to background airfield soil analytical data, and no additional evaluation is recommended.

7.10.9.3 Drainage Ditch Sediment

Section 7.10.6.3 presented the results of the Step 2 screening level risk calculation for SWMU 69 sediment. Screening level risk estimates also were provided in Table 7-32. Barium, cadmium, chromium, copper, lead, nickel, vanadium, and zinc were detected and identified as ecological COPCs for drainage ditch sediment because maximum detected concentrations exceed sediment screening values. Beryllium and thallium also were detected and identified as ecological COPCs based on the lack of sediment screening values. Although not detected, antimony and tin were identified as ecological COPCs because maximum RLs exceed sediment screening values. The spatial extent of detected ecological COPC concentrations greater than freshwater sediment screening values is depicted on Figure 7-14. The refined screening level risk calculation for SWMU 69 sediment is presented in Table 7-40. As discussed in Section 7.9, risk estimates for sediment were recalculated using 95 percent UCL of the mean concentrations for those ecological COPCs having less than 70 percent non-detected results and a minimum of eight detected values (i.e., barium, beryllium, cadmium, chromium, copper, lead, nickel, vanadium, and zinc). It is acknowledged that aquatic plants and many benthic invertebrates are relatively immobile; therefore, individuals are likely to be impacted by locations of maximum concentrations. However, evaluation of the 95 percent UCL of the mean exposure case is more indicative of the level of impact that might be expected at the population level. In addition to the re-calculation of risk estimates using 95 percent UCL of the mean concentrations, the SWMU 69 sediment data were statistically compared to the background airfield drainage ditch sediment data set contained within Addendum C of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Chemicals (Baker, 2010) in accordance with Navy guidance (NFESC, 2002). Results of the statistical evaluations are presented within Table 7-41. The risk evaluation also took into consideration the magnitude and spatial distribution detections above sediment screening values and/or background concentrations. The refined risk evaluation for SWMU 69 sediment is presented and discussed within the paragraphs that follow.

Although not detected, antimony was identified as an ecological COPC in the Step 2 screening level risk calculation because the maximum RL (6.2 mg/kg) exceeds the sediment screening value of 2.0 mg/kg (HQ = 3.10; Table 7-32). However, as indicated in Table 7-26, the maximum RL is less than the maximum and ULM background concentrations (12.2J mg/kg and 8.90 mg/kg, respectively). Based on this comparison, it is unlikely that antimony is adversely impacting aquatic receptor populations within drainage ditch sediment at concentrations greater than background levels. Antimony also was not detected in upgradient SWMU 69 abiotic media (surface soil, subsurface soil [all depth intervals], and groundwater; Appendix B), indicating that this metal is not site-related. Based on the evaluation presented above, antimony is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Although not detected, tin was identified as an ecological COPC in the Step 2 screening level risk calculation because the maximum RL (62 mg/kg) exceeds the sediment screening value of 3.4 mg/kg (HQ = 18.24; Table 7-32). The sediment screening value used in the tin risk calculations was an AET value from Buchman (2008) based on tributyltin. Given that the AET value is reported as >3.4 mg/kg, use as a sediment screening value is extremely conservative since it does not represent a threshold effect concentration. Furthermore, the AET value is based on the most

toxic form of tin (USEPA, 2002b). An alternative value for tin, also based on tributyltin, was identified from the literature. Kristin et al. (1998) investigated the toxicity of tributyltin in sediment using spiked sediment toxicity tests with four freshwater benthic macroinvertebrate species (an oligochaete [*Tubifex tubifex*], a chironomid (*Chironomus riparius*], an amphipod [*Hyalella azteca*], and a mayfly [*Hexagonia* sp.]). *Hexagonia* sp. was the most sensitive benthic invertebrate tested. The test endpoint for this species was a median inhibition concentration (IC_{50}) based on growth. The reported IC_{50} value of 600 mg/kg (dry weight) resulted in a fifty percent reduction in the growth of the test organism when compared to a control. The maximum reporting limit for tin (62 mg/kg [151 mg/kg when expressed at tributyltin)] is below the *Hexagonia* sp. IC_{50} value reported by Kristin et al. (1998). Based on this comparison, it is unlikely that tin is adversely impacting aquatic receptor populations within drainage ditch surface sediment. Based on the evaluation presented above, tin is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Beryllium was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 0.098J mg/kg (69SD12) to 0.33J mg/kg (69SD07). The maximum concentration is slightly elevated above the maximum concentration reported for background airfield drainage ditch sediment (0.28 mg/kg; Table 7-26), and less than the background ULM concentration (0.36 mg/kg). Beryllium concentrations in SWMU 69 surface soil and subsurface soil were within background levels (Tables 7-37 and 7-39, respectively), indicating that this metal is not site-related. Based on these considerations, beryllium is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Thallium was detected in one of fourteen (1/14) drainage ditch sediment samples at a concentration of 0.11J mg/kg (69SD02). This metal was identified as an ecological COPC in Step 2 of the SERA based on the lack of a sediment screening value. As evidenced by Table 7-41, descriptive statistics indicate that thallium concentrations in drainage ditch sediment are not elevated above background levels. The maximum and mean concentrations in the sediment (0.11J mg/kg and 0.20 mg/kg) are less than these parameters in the background data set (1.6J mg/kg and 0.54 mg/kg, respectively). Based on site concentrations within the range of background levels, thallium is not identified as an ecological COC for SWMU 69 drainage ditch sediment, and no additional evaluation is recommended.

Barium, cadmium, chromium, copper, lead, nickel, vanadium, and zinc were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed sediment screening values. Barium was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 24J mg/kg (69SD04) to 140J mg/kg (69SD08). Each detected concentration exceeds the sediment screening value of 20 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 7.00; Table 7-32), derived using the maximum detected concentration, indicates that barium in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 4.43; Table 7-40), derived using the 95 percent UCL of the mean concentration (88.7 mg/kg), also indicates that barium may present an unacceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-41 for the SWMU 69 sediment and background airfield drainage ditch sediment data sets indicate that barium concentrations in SWMU 69 sediment are not elevated above background levels. Specifically, the maximum detected barium concentration in SWMU 69 sediment (140J mg/kg) is less than the maximum and ULM background concentrations (227 mg/kg and 214 mg/kg, respectively). Arithmetic mean and 95 percent UCL of the mean concentrations for SWMU 69 (70.0 mg/kg and 88.7 mg/kg, respectively) are also less than corresponding background parameters (109 mg/kg and 132 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (two sample t-test, quantile test, and

slippage test) also concluded that barium concentrations in SWMU 69 sediment are not elevated above background levels. Based on SWMU concentrations representative of background conditions, barium is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Cadmium was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 0.38 mg/kg (69SD04) to 24J mg/kg (69SD07). Nine detected concentrations exceed the sediment screening value of 1.0 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 24.24; Table 7-32), derived using the maximum detected concentration, indicates that cadmium in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 13.58; Table 7-40), derived using the 95 percent UCL of the mean concentration (13.4 mg/kg), also indicates that cadmium may present an unacceptable risk to aquatic receptor group populations. The descriptive and distributional statistics presented in Table 7-41 indicate that cadmium concentrations in SWMU 69 sediment are elevated above background levels. The maximum detected concentration in SWMU 69 sediment (24J mg/kg in 69SD07) is two orders of magnitude greater than the maximum and ULM background concentrations (0.32 mg/kg and 0.23 mg/kg, respectively). Statistical tests evaluating the mean/median of the distributions could not be performed because there were greater than 50 percent non-detected values in the combined SWMU and background data sets. The quantile test for the right tail of the distribution indicates that chromium is elevated above background levels. Based on maximum and mean HQs indicating potential risk to aquatic receptors, and SWMU concentrations in excess of background levels, cadmium is identified as an ecological COC for drainage ditch sediment, and additional evaluation is recommended. The spatial distribution of cadmium within the drainage ditch indicates that this metal has not migrated past the confluence of the eastern and southern sections of the ditch at ecologically important concentrations. Detections at the farthest downgradient sample locations (69SD13 [1.0 mg/kg] and 69SD14 [0.92 mg/kg]) are less than or equal to the sediment screening value.

Chromium was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 10 mg/kg (69SD12) to 99J mg/kg (69SD06). Three of the detected concentrations exceed the sediment screening value of 43.4 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 2.28; Table 7-32), derived using the maximum detected concentration, indicates that chromium in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 1.13; Table 7-40), derived using the 95 percent UCL of the mean concentration (48.9 mg/kg), also indicates that chromium may present an unacceptable risk to aquatic receptor group populations. The descriptive and distributional statistics presented in Table 7-41 indicated that chromium concentrations in SWMU 69 sediment are not elevated above background levels. While the maximum chromium concentration in SWMU 69 sediment (99J mg/kg) exceeds the maximum and ULM chromium concentrations in background sediment (68.8J mg/kg, and 65.0 mg/kg, respectively), the arithmetic mean and 95 percent UCL of the mean SWMU 69 concentrations (35.9 mg/kg and 48.9 mg/kg, respectively) are similar to the corresponding background parameters (36.4 mg/kg and 42.2 mg/kg, respectively). Two detections in SWMU 69 sediment exceeded the maximum background detection (99J mg/kg in 69SD06 and 72J mg/kg in 69SD07). Distributional statistics performed on the SWMU 69 and background data sets (two sample t-test, quantile test, and slippage test) concluded that chromium concentrations in SWMU 69 sediment are not elevated above background levels. Chromium detections in surface and subsurface soil were also within background concentrations, indicating that chromium is not a site-related chemical. Because SWMU concentrations are consistent with background levels and there is no indication that chromium is site-related, chromium is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Copper was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 38J mg/kg (69SD12) to 160J mg/kg (69SD07). Each detected concentration exceeds the sediment screening value of 31.6 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 5.06; Table 7-32), derived using the maximum detected concentration, indicates that copper in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 3.68; Table 7-40), derived using the 95 percent UCL of the mean concentration (116 mg/kg), also indicates that copper may present an unacceptable risk to aquatic receptor group populations. As evidenced by the descriptive statistics presented in Table 7-41, the maximum detected copper concentration in drainage ditch sediment (160J mg/kg) is less than the maximum background concentration (183 mg/kg) and ULM background concentration (164 mg/kg). Arithmetic mean and 95 percent UCL of the mean concentrations for the SWMU 69 data set (101 mg/kg and 116 mg/kg, respectively) are only slightly elevated above background arithmetic mean and 95 percent UCL of the mean concentrations (89.4 mg/kg and 105 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (i.e., two sample t-test, quantile test, and slippage test) had conflicting results. The two sample t-test and the slippage test concluded that copper concentrations in SWMU 69 sediment are not elevated above background levels, while the quantile test concluded that SWMU 69 copper concentrations are elevated. Based on the maximum detection in the background data set, the SWMU 69 maximum being less than the background ULM concentration, and the slippage and two-sample t-test results, copper concentrations within drainage ditch sediment are not elevated relative to background concentrations. As such, copper is not identified as an ecological COC, and no additional evaluation is recommended.

Lead was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 6.4 mg/kg (69SD04) to 680J mg/kg (69SD07). Five of the detected concentrations exceed the sediment screening value of 35.8 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 18.99; Table 7-32), derived using the maximum detected concentration, indicates that lead in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 9.86; Table 7-40), derived using the 95 percent UCL of the mean concentration (353 mg/kg), also indicates that lead may present an unacceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-41 indicate that lead concentrations in drainage ditch sediment are elevated above background levels. Maximum, arithmetic mean, and 95 percent UCL of the mean concentrations for the SWMU 69 data set (680J mg/kg, 116 mg/kg, and 353 mg/kg, respectively) are elevated above the corresponding background parameters (29.9 mg/kg, 9.02 mg/kg, and 11.1 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (Satterthwaite t-test, quantile test, and slippage test) also concluded that lead concentrations in SWMU 69 sediment are elevated above background levels. The magnitude of the exceedances in three adjacent sediment samples (69SD06, 69SD07, and 69SD08 [Figure 7-14]) is indicative of the presence of hot spots within the ditch. Based on maximum and mean HQs indicating potential risk to aquatic receptors, and indications that SWMU concentrations are elevated relative to background concentrations, lead is identified as an ecological COC for drainage ditch sediment, and additional evaluation is recommended. The spatial distribution of lead within the drainage ditch indicates that this metal has not migrated past the confluence of the eastern and southern sections of the ditch at ecologically important concentrations. Detections at the farthest downgradient sample locations (69SD13 [21 mg/kg] and 69SD14 [15 mg/kg]) are less than the sediment screening value.

Nickel was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 5.2 mg/kg in 69SD12 to 34J mg/kg in 69SD06. Two detected concentrations exceed the sediment screening value of 22.7 mg/kg (Figure 7-14). The screening level risk estimate (HQ =

1.50; Table 7-32), derived using the maximum detected concentration, indicates that nickel in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 0.95; Table 7-40), derived using the 95 percent UCL of the mean concentration (21.5 mg/kg), indicates that nickel presents an acceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-41 indicate that nickel concentrations in SWMU 69 sediment are slightly elevated above background concentrations. The maximum, arithmetic mean, and 95 percent UCL of the mean for the SWMU 69 sediment data set (34J mg/kg, 11.5 mg/kg, and 21.5 mg/kg, respectively) are equivalent to, or elevated above, their corresponding background parameters (17.7J mg/kg, 11.5 mg/kg, and 12.8 mg/kg, respectively). However, the distributional statistics performed on the SWMU 69 and background data sets (Gehan test, quantile test, and slippage test) concluded that nickel concentrations in drainage ditch sediment are not elevated above background concentrations. The two concentrations exceeding the screening value and background concentrations are not drastically elevated, and occur in two samples indentified as hot spots for lead and zinc (69SD06 and 69SD07). Nickel detections in surface and subsurface soil were within background concentrations (Tables 7-37 and 7-39), indicating that nickel is not a site-related chemical. Based on a relatively low mazimum HQ (1.50), mean HQ indicating acceptable risk, and no indication that nickel is site-related, nickel is not identified as an ecological COC, and no additional evaluation is recommended. It should be noted that any risk posed by nickel at locations 69SD06 and 69SD07 will be addressed with the remediation of lead and zinc.

Vanadium was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 67J mg/kg (69SD12) to 370J mg/kg (69SD09). Each detected concentration exceeds the sediment screening value of 57 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 6.49; Table 7-32), derived using the maximum detected concentration, indicates that vanadium in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 4.34; Table 7-40), derived using the 95 percent UCL of the mean concentration (247 mg/kg), also indicates that vanadium may present an unacceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-41 indicate that vanadium concentrations in SWMU 69 sediment are elevated above background levels. The maximum detected concentration (370J mg/kg) exceeds maximum and ULM background concentrations (230 mg/kg and 244 mg/kg, respectively). The arithmetic mean and 95 percent UCL of the mean SWMU 69 concentrations (203 mg/kg and 247 mg/kg, respectively) also exceed the corresponding background parameters (152 mg/kg and 170 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (Satterthwaite t-test, quantile test, and slippage test) were contradictory. The Satterthwaite t-test and quantile test concluded that vanadium concentrations in SWMU 69 sediment are elevated above background levels, while the slippage test concluded that concentrations in SWMU 69 sediment are not elevated above background. Overall, the statistical evaluation supports the conclusion that vanadium concentrations in SWMU 69 sediment are elevated relative to background conditions. Based on maximum and mean HQs indicating potential risk to aquatic receptors, and SWMU concentrations elevated relative to background concentrations, vanadium is identified as an ecological COC, and additional evaluation is recommended. The spatial distribution of vanadium within the drainage ditch indicates that this metal has migrated past the confluence of the eastern and southern sections of the ditch at ecologically important concentrations. Detections at the farthest downgradient sample locations (69SD13 [170J mg/kg] and 69SD14 [350J mg/kg]) exceed the sediment screening value. The concentration at 69SD14 also exceeds the ULM of the background concentration (244 mg/kg).

Zinc was detected in fourteen of fourteen (14/14) sediment samples at concentrations ranging from 40 mg/kg (69SD04) to 490J mg/kg (69SD07). Three of the detected concentrations exceed

the sediment screening value of 121 mg/kg (Figure 7-14). The screening level risk estimate (HQ = 4.05; Table 7-32), derived using the maximum detected concentration, indicates that zinc in drainage ditch sediment may present an unacceptable risk to aquatic receptor groups. The refined risk estimate (HQ = 2.56; Table 7-40), derived using the 95 percent UCL of the mean concentration (309 mg/kg), also indicates that zinc may present an unacceptable risk to aquatic receptor group populations. Descriptive and distributional statistics presented on Table 7-41 indicate hot spots of zinc contamination at the SWMU The maximum zinc concentration (490J mg/kg) exceeds the maximum and ULM background concentrations (203J mg/kg and 152 mg/kg, respectively). The arithmetic mean and 95 percent UCL of the mean SWMU 69 concentrations (135 mg/kg and 309 mg/kg, respectively) also exceed the corresponding background parameters (79.9 mg/kg and 93.5 mg/kg, respectively). However, distributional statistics performed on the SWMU 69 and background data sets (i.e., Satterthwaite t-test, quantile test, and slippage test; Table 7-41) indicate that zinc concentrations in SWMU 69 sediment are not elevated relative to background. These results indicate that while zinc in drainage ditch sediment is generally consistent with background concentrations, hot spots of contamination exist. These hot spots are at locations 69SD06 (450J mg/kg) and 69SD07 (490J mg/kg) (Figure 7-14). Based on maximum and mean HQs indicating potential risk to aquatic receptors, and the presence of hot spots with zinc concentrations in excess of background levels, zinc is identified as an ecological COC for drainage ditch sediment, and additional evaluation is recommended. The spatial distribution of zinc within the drainage ditch indicates that this metal has not migrated past the confluence of the eastern and southern sections of the ditch at ecologically important concentrations. Detections at the farthest downgradient sample locations (69SD13 [63 mg/kg] and 69SD14 [70 mg/kg]) are less than or equal to the sediment screening value.

In summary, cadmium, lead, vanadium, and zinc are identified as ecological COCs for SWMU 69 sediment. Although barium, beryllium, chromium, copper, nickel, and thallium were detected and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs, and no additional evaluation is recommended. A recommendation of no additional evaluation for these eight metals is based on one or more lines of evidence, including low magnitude of maximum detections above sediment screening values, refined risk estimates using 95 percent UCL of the mean concentrations, and/or the statistics presented in Table 7-41. No additional evaluation is also recommended for non-detected chemicals identified as ecological COPCs in Step 2 of the ERA.

7.10.9.4 Step 3a Risk Evaluation for Mammalian and Avian Dietary Exposures

Tables 7-33, 7-34, and 7-35 presented the results of the Step 2 screening level risk calculation for mammalian and avian dietary exposures to chemicals in surface, subsurface soil, and drainage ditch sediment, respectively. HQs for the refined risk calculations are summarized in Tables 7-42 (surface soil - mammalian), 7-43 (surface soil – avian), 7-44 (subsurface soil - mammalian), 7-45 (subsurface soil – avian), and 7-46 (sediment – avian omnivore). A discussion of the refined risk evaluation is presented and discussed within the subsections that follow.

7.10.9.4.1 Mammalian Dietary Exposures: Surface Soil

Section 7.10.6.4.1 presented the results of the Step 2 screening level risk calculation for terrestrial mammalian dietary exposures to chemicals in surface soil. Screening level risk estimates also were provided in Table 7-33. One metal (selenium) was detected in surface soil and identified as an ecological COPC for mammalian dietary exposures because the maximum exposure dose exceeds the NOAEL-based screening values established for the brown flower bat (HQ = 1.39). The refined dietary exposure dose for selenium (derived using the maximum chemical

concentration [not enough detections to calculate a 95 percent UCL], mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) is less than NOAEL-, MATC-, and LOAEL-based TRVs established for the brown flower bat (Table 7-42), indicating acceptable risk to small mammals. The descriptive statistics presented in Table 7-37 for selenium also show that concentrations in SWMU 69 surface soil are not elevated above background levels. Based on relatively low conservative Step 2 HQs, refined Step 3a HQs less than 1.0, and SWMU concentrations consistent with background concentrations, selenium is not identified as an ecological COC for mammalian dietary exposures, and no additional evaluation is recommended.

7.10.9.4.2 *Avian Dietary Exposures: Surface Soil*

Section 7.10.6.4.1 presented the results of the Step 2 screening level risk calculation for terrestrial avian dietary exposures to chemicals in surface soil. Screening level risk estimates also were provided in Table 7-33. Ten detected metals (barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc) were identified as ecological COPCs for avian receptors in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for the American robin, mourning dove, and/or red-tailed hawk. One detected metal (beryllium) also was identified as an avian ecological COPC based on the lack of a TRV, while one non-detected metal (tin) was identified as a COPC because the maximum exposure dose exceeds the NOAEL-based TRV. The results of the refined screening level risk calculation for avian dietary exposures to SWMU 69 surface soil (i.e., NOAEL-, MATC-, and LOAEL-based HQs) are presented in Table 7-43, and discussed in the sections that follow.

Tin was not detected but was identified as an ecological COPC for avian dietary exposures to chemicals in SWMU 69 surface soil because the maximum exposure dose exceeds the NOAEL-based TRV for the American robin (HQ = 1.26). The refined dietary exposure dose for tin (derived using the maximum reporting limit for soil data, mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) is less than NOAEL-, MATC-, and LOAEL-based TRVs established for the each of the avian receptors (American robin, mourning dove, and red-tailed hawk; Table 7-43), indicating acceptable risk to risk to avian omnivore, herbivore, and carnivore populations. Based on a relatively low conservative Step 2 NOAEL-based HQ (1.26) refined HQs indicating acceptable risk, and lack of detections in surface soil, tin is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 surface soil, and no additional evaluation is recommended.

Beryllium was detected and identified as a COPC for avian receptors based on a lack of TRV. Beryllium was detected in thirty-six of fifty-two (36/52) surface soil samples at concentrations ranging from 0.056J mg/kg (69SB118-00) to 0.29 mg/kg (69SB136-00). As evidenced by the descriptive statistics presented in Table 7-37, maximum, arithmetic mean, and 95 percent UCL of the mean beryllium concentrations in SWMU 69 surface soil (0.29 mg/kg, 0.12 mg/kg, and 0.14 mg/kg, respectively) are less than maximum, arithmetic mean, and 95 percent UCL of the mean background airfield soil concentrations (0.81 mg/kg, 0.29 mg/kg, and 0.34 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (i.e., quantile, slippage, and Gehan tests; Table 7-37) also show that beryllium concentrations in SWMU 69 surface soil are not elevated above background levels. Thus any risk posed by beryllium is within background levels. Based on SWMU concentrations within background levels, beryllium is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 surface soil, and no additional evaluation is recommended.

Barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc were detected in surface soil and identified as ecological COPCs for avian dietary exposures because maximum exposure doses exceed the NOAEL-based screening values established for one or more of the avian receptors evaluated by the ERA (American robin, mourning dove, and/or red-tailed hawk). Refined dietary exposure doses for barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc (derived using 95 percent UCL of the mean chemical concentrations [maximum concentration for selenium], mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) are less than NOAEL-, MATC-, and LOAEL-based TRVs established for each of the avian receptors (Table 7-43), indicating acceptable risk to avian herbivore, omnivore, and carnivore populations. As discussed in Section 7.10.9.1 and/or evidenced by the descriptive and distributional statistics presented in Table 7-37, chromium, copper, nickel, and selenium concentrations in SWMU 69 surface soil are not elevated relative to background concentrations. Based on refined HQs less than 1.0 and surface soil concentrations within background concentrations, chromium, copper, nickel, and selenium are not identified as ecological COCs, and no further evaluation is recommended.

Barium, cadmium, lead, mercury, and zinc concentrations in SWMU 69 surface soil were elevated relative to background concentrations at one or more locations. The greatest NOAEL-based HQs for barium, cadmium, lead, and zinc calculated under the conservative Step 2 exposure assumptions were relatively low (maximum 5.20 for chromium, all other values less than 5.00; Table 7-33). These relatively low HQs indicate the absence of hot spots of significant risk for avian receptors for these chemicals. Based on refined risk estimates indicating acceptable risk, and a no indication of hot spots of risk, barium, cadmium, lead, and zinc are not identified as ecological COCs for avian receptors, and no further evaluation is recommended.

While refined HQs for mercury were less than 1.0 for each of the avian receptors, the maximum NOAEL-based HQ for the American robin under the conservative Step 2 exposure assumptions was 34.51, indicating a potential hot spot of risk to avian omnivores. To further investigate potential risk from mercury, the maximum detected mercury concentration (0.18 mg/kg; 69SB125-00 and 69SB130-00) was used as an exposure point concentration to calculate HQs under the Step 3a refined exposure parameters (replacing the 95 percent UCL of the mean concentration used in Step 3a). The resulting NOAEL-based HQ for the American robin was 1.41, and MATC- and LOAEL-based HQs for the robin were less than 1.0; NOAEL-, MATC-, and LOAEL-based HQs for the remaining avian receptors were also less than 1.0. Based on the relatively low NOAEL-HQ and MATC- and LOAEL-HQs less than 1.0 for the most sensitive receptor calculated with the maximum site detection and refined exposure scenarios, mercury is not identified as an ecological COC for avian foodweb exposures. No additional evaluation is recommended.

Refined exposure doses for vanadium exceed NOAEL-, MATC-, and LOAEL-based TRVs established for the American robin and mourning dove (American robin: NOAEL-based HQ = 8.03; mourning dove: NOAEL-based HQ = 3.90). The statistical evaluation of the SWMU 69 and background airfield soil data sets presented in Section 7.10.9.1 concluded that a hot spot of vanadium contamination is present at location 69SB132-00. Based on maximum and mean HQs indicating potential risk, and the presence of a hot spot of surface soil contamination, vanadium is identified as an ecological COC for avian dietary exposures to surface soil, and additional evaluation is recommended.

In summary, vanadium is identified as an ecological COC for avian omnivore and herbivore dietary exposures to chemicals in SMWU 69 surface soil. Although detected and identified as

ecological COPCs in Step 2 of the SERA, beryllium, barium, cadmium, chromium, copper, mercury, lead, nickel, selenium, and zinc are not identified as ecological COCs, and no additional evaluation is recommended. In the case of these ten metals, a recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs and/or the descriptive and distributional statistics presented in Table 7-37. No additional evaluation also is recommended for the non-detected chemical (tin) identified as an ecological COPC in Step 2 of the SERA.

As discussed in Section 7.3.2.1, a conclusion of acceptable or unacceptable risk to terrestrial avian receptors also was applied to terrestrial amphibians and reptiles (i.e., the American robin, mourning dove, and red-tailed hawk were used as surrogates). Based on a conclusion of unacceptable risk to the American robin and mourning dove dietary exposures to vanadium in SWMU 69 surface soil, it is assumed that this metal also presents unacceptable risk to terrestrial amphibians and reptiles.

7.10.9.4.3 *Mammalian Dietary Exposures: Subsurface Soil*

Section 7.10.6.4.2 presented the results of the Step 2 screening level risk calculation for terrestrial mammalian dietary exposures to chemicals in subsurface soil. Screening level risk estimates also were provided in Table 7-34. One metal (selenium) was detected in subsurface soil and identified as an ecological COPC for mammalian dietary exposures because the maximum exposure dose exceeds the NOAEL-based screening values established for the brown flower bat. The refined dietary exposure dose for selenium (derived using 95 percent UCL of the mean chemical concentrations, mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) is less than NOAEL-, MATC-, and LOAEL-based TRVs established for the brown flower bat (Table 7-44), indicating acceptable risk to small mammals. The descriptive statistics presented in Table 7-39 for selenium also show that concentrations in SWMU 69 subsurface soil are not elevated above background levels. Based on refined HQs less than 1.0 and SWMU concentrations within background levels, selenium is not identified as an ecological COC for mammalian dietary exposures to subsurface soil, and no additional evaluation is recommended.

7.10.9.4.4 *Avian Dietary Exposures: Subsurface Soil*

Section 7.10.6.4.2 presented the results of the Step 2 screening level risk calculation for terrestrial avian dietary exposures to chemicals in subsurface soil. Screening level risk estimates also were provided in Table 7-34. Eight detected metals (chromium, copper, mercury, nickel, selenium, silver, vanadium, and zinc) were identified as ecological COPCs in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for the American robin, mourning dove, and/or red-tailed hawk. One detected metal (beryllium) also was identified as an ecological COPC based on the lack of a TRV, while one non-detected metal (tin) was identified as a COPC because the maximum exposure dose exceeds the NOAEL-based TRV. The results of the refined screening level risk calculation for avian dietary exposures to SWMU 69 subsurface soil (i.e., NOAEL-, MATC-, and LOAEL-based HQs) are presented in Table 7-45 and discussed in the sections that follow.

Tin was not detected in subsurface soil but was identified as an ecological COPC for avian dietary exposures to chemicals in SWMU 69 subsurface soil because the maximum exposure dose exceeds the NOAEL-based TRV for the American robin (HQ = 1.26). The refined dietary exposure dose for tin (derived using the maximum reporting limit of subsurface soil data, mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from,

central tendency estimates, and/or AUFs of 1.0) is less than NOAEL-, MATC-, and LOAEL-based TRVs established for the each of the avian receptors (American robin, morning dove, and red-tailed hawk; Table 7-45), indicating acceptable risk to risk to avian herbivore, omnivore, and carnivore populations. Based on a relatively low conservative Step 2 NOAEL-based HQ (1.26) and refined HQs indicating acceptable risk, tin is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 subsurface soil, and no additional evaluation is recommended.

Beryllium was detected and identified as a COPC for avian receptors based on a lack of TRV. Beryllium was detected in ninety-one of one hundred and four (91/104) subsurface soil samples at concentrations ranging from 0.055J mg/kg (69SB107-01) to 0.45 mg/kg (69SB150-02). As evidenced by the descriptive statistics presented in Table 7-39, maximum, arithmetic mean, and 95 percent UCL of the mean beryllium concentrations in SWMU 69 subsurface soil (0.45 mg/kg, 0.17 mg/kg, and 0.19 mg/kg, respectively) are less than maximum, arithmetic mean, and 95 percent UCL of the mean background airfield soil concentrations (0.81 mg/kg, 0.29 mg/kg, and 0.34 mg/kg, respectively). The distributional statistics performed on the SWMU 69 and background data sets (i.e., quantile and Gehan tests; Table 7-39) also show that beryllium concentrations in SWMU 69 subsurface soil are not elevated above background levels. Based on SWMU concentrations within background levels, beryllium is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 subsurface soil, and no additional evaluation is recommended.

Chromium, copper, mercury, nickel, selenium, silver, vanadium, and zinc were identified as ecological COPCs for terrestrial avian dietary exposures in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for one or more of the avian receptors evaluated by the ERA (American robin, mourning dove, and/or red-tailed hawk). Refined dietary exposure doses for chromium, copper, mercury, nickel, selenium, silver, and zinc (derived using 95 percent UCL of the mean chemical concentrations [maximum concentration for selenium and silver], mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) are less than NOAEL-, MATC-, and LOAEL-based TRVs for each of the avian receptors (Table 7-45), indicating acceptable risk to avian herbivore, omnivore, and carnivore populations. As discussed in Section 7.10.9.2 and/or evidenced by the descriptive and distributional statistics presented in Table 7-39, chromium, copper, nickel, selenium, and zinc concentrations in SWMU 69 subsurface soil are not elevated relative to background concentrations. Based on refined HQs less than 1.0 and subsurface soil concentrations within background concentrations, chromium, copper, nickel, selenium, and zinc are not identified as ecological COCs, and no further evaluation is recommended.

Mercury and silver concentrations in SWMU 69 subsurface soil were elevated relative to background concentrations at one or more locations. The greatest NOAEL-based HQ for silver calculated under the conservative Step 2 exposure assumptions was relatively low (HQ = 1.76 for the American robin; Table 7-34). This relatively low HQ indicates the absence of hot spots of significant risk for avian receptors from silver. Based on refined risk estimates, indicating acceptable risk and a no indication of hot spots of risk, silver is not identified as ecological COCs for avian receptors, and no further evaluation is recommended. While refined HQs for mercury were less than 1.0 for each of the avian receptors, the maximum NOAEL-based HQ for the American robin under the conservative Step 2 exposure assumptions was 34.51, indicating a potential hot spot of risk to avian omnivores. To further investigate potential risk from mercury, the maximum detected mercury concentration (0.18 mg/kg; 69SB110-01) was used as an exposure point concentration to calculate HQs under the Step 3a refined exposure parameters (replacing the 95 percent UCL of the mean concentration used in Step 3a). The resulting

NOAEL-based HQ for the American robin was 1.41, and MATC- and LOAEL-based HQs for the robin were less than 1.0; NOAEL-, MATC-, and LOAEL-based HQs for the remaining avain receptors were less than 1.0. Based on the relatively low NOAEL-HQ and MATC- and LOAEL-HQs less than 1.0 for the most sensitive receptor calculated with the maximum site detection and refined exposure scenarios, mercury is not identified as an ecological COC for avian foodweb exposures. No additional evaluation is recommended.

Refined exposure doses for vanadium exceed NOAEL-, MATC-, and LOAEL-based TRVs established for the American robin and mourning dove (American robin: NOAEL-based HQ = 11.08; mourning dove: NOAEL-based HQ = 5.37). The statistical evaluation of the SWMU 69 and background airfield soil data sets presented in Section 7.10.9.2 concluded that vanadium concentrations in subsurface soil exceed background levels. Based on maximum and mean HQs indicating potential risk, and SMWU concentrations in excess of background concentrations, vanadium is identified as an ecological COC for avian dietary exposures to subsurface soil, and additional evaluation is recommended.

In summary, vanadium is identified as an ecological COC for avian omnivore and herbivore dietary exposures to chemicals in SMWU 69 subsurface soil. Although detected and identified as ecological COPCs in Step 2 of the SERA, beryllium, chromium, copper, mercury, nickel, selenium, silver, and zinc are not identified as ecological COCs, and no additional evaluation is recommended. In the case of these eight metals, a recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs and/or the descriptive and distributional statistics presented in Table 7-39. No additional evaluation also is recommended for the non-detected chemical (tin) identified as an ecological COPC in Step 2 of the SERA.

As discussed in Section 7.3.2.1, a conclusion of acceptable or unacceptable risk to terrestrial avian receptors also was applied to terrestrial amphibians and reptiles (i.e., the American robin, mourning dove, and red-tailed hawk were used as surrogates). Based on a conclusion of unacceptable risk to the American robin and mourning dove dietary exposures to vanadium in SWMU 69 subsurface soil, it is assumed that this metal also presents unacceptable risk to terrestrial amphibians and reptiles.

7.10.9.4.5 Avian Omnivore Dietary Exposures: Drainage Ditch Sediment

Section 7.10.6.4.3 presented the results of the Step 2 screening level risk calculation for avian omnivore dietary exposures to chemicals in drainage ditch sediment. Screening level risk estimates also were provided in Table 7-35. Ten detected metals (cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc) were identified as ecological COPCs in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs (i.e., maximum HQs exceed 1.0). One detected metal (beryllium) also was identified as ecological COPC based on the lack of a TRV while one non-detected metal (tin) was identified as a COPC because the maximum exposure dose exceeds the NOAEL-based TRV. The results of the refined risk calculation drainage ditch sediment (i.e., NOAEL-, MATC-, and LOAEL-based HQs) are presented in Table 7-46 and discussed in the sections that follow.

Tin was not detected but was identified as an ecological COPC for avian dietary exposures to chemicals in SWMU 69 sediment because the maximum exposure dose exceeds the NOAEL-based TRV for the American robin (HQ = 2.45). The refined dietary exposure dose (derived using the maximum reporting limit of sediment data, mean receptor body weights, mean receptor food ingestion rates, BAFs based on, or modeled from, central tendency estimates, and/or AUFs of 1.0) also exceeded the NOAEL-based TRV (HQ = 1.10), but is less than MATC- and LOAEL-

based TRVs established for the American robin (Table 7-46). Descriptive statistics presented in Table 7-41 show that while not detected, the maximum RL for tin (62UJ mg/kg) exceeds the maximum detected background concentration (6.7J mg/kg). However, tin was rarely detected in historical sampling of source media. Tin was not detected in surface soil or subsurface soil collected during the 2010 Disturbed Soil Sampling Investigation or 2004 Phase II ECP. Tin was detected in only one of twenty-five (1/25) surface soil samples collected during the 2008 CMS Investigation, and was not detected in subsurface soil or groundwater. Based on the low frequency of detections of tin in source media and lack of detections in sediment, tin is unlikely to be present in sediment at ecologically significant concentrations. As such, tin is not identified as an ecological COC for SWMU 69 sediment, and no further evaluation is recommended.

Beryllium was detected and identified as a COPC for avian receptors based on a lack of TRV. Beryllium was detected in each of the fourteen sediment samples at concentrations ranging from 0.098J mg/kg (69SD12) to 0.33J mg/kg (69SD07). As evidenced by the descriptive statistics presented in Table 7-41, the maximum beryllium concentration in SWMU 69 sediment (0.33J mg/kg) exceeds the maximum airfield drainage ditch sediment background concentration (0.28 mg/kg) but is less than the ULM background airfield soil concentration (0.36 mg/kg). Arithmetic means of SWMU 69 and background data sets were equal (0.20 mg/kg). Distributional statistics could not be performed because there were greater than 50 percent non-detects in the combined SWMU and background data sets. Based on descriptive statistics, beryllium concentrations in SWMU 69 drainage ditch sediment are consistent with background concentrations. As such, beryllium is not identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 sediment, and no additional evaluation is recommended.

Cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc were identified as ecological COPCs for American robin dietary exposures in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs. Refined exposure doses (derived using 95 percent UCL of the mean chemical concentrations [maximum concentrations for selenium and silver due to infrequent detections], mean body weight, mean food ingestion rate, BAFs based on, or modeled from, central tendency estimates, a diet that reflects the omnivorous feeding behavior of the American robin, and an AUF of 1.0) for chromium, copper, mercury, nickel, selenium, silver, and zinc are less than or equal to NOAEL-, MATC-, and LOAEL-based TRVs (Table 7-46), indicating acceptable risk to avian omnivore populations. As discussed in Section 7.10.8.3 and/or evidenced by the descriptive and distributional statistics presented in Table 7-41, chromium, copper, mercury, nickel, selenium, and silver concentrations in SWMU 69 sediment are not elevated above background levels. Based on refined HQs less than or equal to 1.0 and SWMU concentrations within background levels, chromium, copper, mercury, nickel, selenium, and silver are not identified as ecological COCs for avian omnivore dietary exposures, and no additional evaluation is recommended.

Zinc concentrations in SWMU 69 sediment were elevated relative to background concentrations at one or more locations. The greatest NOAEL-based HQ for zinc calculated under the conservative Step 2 exposure assumptions was relatively low (2.58; Table 7-35). These relatively low HQs indicate the absence of hot spots of significant risk for avian omnivores from zinc. Based on refined risk estimates indicating acceptable risk and a no indication of hot spots of risk, zinc is not identified as an ecological COCs for avian omnivores, and no further evaluation is recommended.

The refined exposure dose for cadmium exceeds NOAEL-, MATC-, and LOAEL-based TRVs (NOAEL-based HQ = 4.98), indicating unacceptable risk to avian omnivore populations. As discussed in Section 7.10.9.3 and shown in Table 7-41, cadmium concentrations in SWMU 69

sediment are elevated above background levels. Based on maximum and mean HQs indicating potential risk to avian omnivores and SWM concentrations in excess of background levels, cadmium is identified as an ecological COC for avian omnivore dietary exposures, and additional evaluation is recommended.

The refined exposure dose for lead exceeds NOAEL-, MATC-, and LOAEL-based TRVs (NOAEL-based HQ = 3.38), indicating unacceptable risk to avian omnivore populations. As discussed in Section 7.10.9.3 and shown in Table 7-41, lead concentrations in SWMU 69 sediment are elevated above background levels. Based on maximum and mean HQs indicating potential risk to avian omnivores and SWM concentrations in excess of background levels, lead is identified as an ecological COC for avian omnivore dietary exposures, and additional evaluation is recommended.

The refined exposure dose for vanadium exceeds NOAEL-, MATC-, and LOAEL-based TRVs (NOAEL-based HQ = 11.56), indicating unacceptable risk to avian omnivore populations. As discussed in Section 7.10.9.3 and shown in Table 7-41, vanadium concentrations in SWMU 69 sediment are elevated above background levels. Based on maximum and mean HQs indicating potential risk to avian omnivores and SWM concentrations in excess of background levels, vanadium is identified as an ecological COC for avian omnivore dietary exposures, and additional evaluation is recommended.

In summary, cadmium, lead, and vanadium are identified as ecological COCs for avian omnivore dietary exposures. Screening level and refined exposure doses exceed the NOAEL-based screening value for the American robin, and sediment concentrations are elevated above background levels. Although beryllium, chromium, copper, mercury, nickel, selenium, silver, and zinc were detected in SWMU 69 sediment and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs for terrestrial dietary exposures, and no additional evaluation is recommended. These twelve metals were not identified as ecological COCs based on refined risk estimates, as well as descriptive and/or distributional statistics. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA (tin).

As discussed in Section 7.3.2.1, a conclusion of acceptable or unacceptable risk to terrestrial avian receptors also was applied to terrestrial amphibians and reptiles (i.e., the American robin was used as a surrogate). Based on a conclusion of unacceptable risk to the American robin dietary exposures to cadmium, lead, and vanadium in SWMU 69 drainage ditch sediment, it is assumed that these metals also present unacceptable risk to terrestrial amphibians and reptiles.

7.10.10 Uncertainties Associated With Step 3a of the BERA

Many of the uncertainties identified in Section 7.7 and 7.10.7 for the SERA (i.e. Steps 1 and 2 of the Navy ERA process) also apply to the refined risk calculation and evaluation (i.e. Step 3a of the BERA). Uncertainties identified in Section 7.9.2 for Step 3a of the BERA for 2008 CMS data also apply to Step 3a of the BERA for 2010 Disturbed Soil Sampling Investigation data. Additional uncertainties specific to the refined risk calculation for 2010 data for SWMU 69 are identified below:

Cadmium, lead, vanadium, and zinc were identified as ecological COCs in drainage ditch sediment. While the spatial distribution of cadmium, lead, and zinc suggests that migration past the farthest downgradient sample location (69SD14) is not occurring, vanadium concentrations at the farthest downgradient sample location exceeded both the sediment screening value and

background concentrations. There is the potential for vanadium to have migrated downgradient of the SWMU. As discussed in Section 2.2, surface water flow in the drainage ditch along the southern border of SWMU 69 is to the southeast past Day Tank 2437 fuel storage area, where it comingles with runoff from the fuel storage area, the Aircraft Hydrant Refueling System, and the adjacent taxiway. It should be noted that beyond the point at which multiple sources are contributing to the drainage way (i.e., beyond Day Tank 2437 fuel storage area), it is not possible to contribute contamination present in the drainage ditch to a specific SWMU.

As stated in Section 7.10.7, surface water was not collected from the drainage ditch. Cadmium, lead, vanadium, and zinc were identified as sediment COCs and may serve as a secondary source of contamination for surface water when water is present in the ditch (e.g., following precipitation events). However, it should be noted that the remediation of contaminated sediment will result in the removal of potential source areas for surface water contamination. As such, no separate evaluation of surface water is recommended.

7.10.11 Step 3a Decision Point and Recommendations: 2010 Data

Table 7-47 presents a summary of the ecological COPCs identified in Step 2 of the SERA for the 2010 Disturbed Soil Sampling Data Investigation, as well as the ecological COCs identified in Step 3a of the BERA. Recommendations for each media and dietary exposure pathway are presented in the sections that follow.

7.10.11.1 Surface Soil

Based on the refined media-specific risk evaluation presented in Section 7.10.9.1, vanadium is identified as an ecological COC for SWMU 69 surface soil (Table 7-47). The maximum and 95 percent UCL of the mean concentrations in SWMU 69 surface soil exceed the soil screening values, and a hot spot of contamination is indicated at location 69SB132-00 (550 mg/kg). Although barium, chromium, cobalt, copper, mercury, selenium, and zinc were detected and identified as ecological COPCs in Step 2 of the SERA, these chemicals are not identified as ecological COCs in Step 3a of the BERA. These inorganics were eliminated from further evaluation based on statistical evaluations performed on the SWMU 69 and background airfield soil data sets, which showed that SWMU 69 surface soil concentrations for these seven metals are not elevated above background levels (Table 7-36).

7.10.11.2 Subsurface Soil

Based on the refined media-specific risk evaluation presented in Section 7.10.9.2, vanadium is identified as an ecological COC for SWMU 69 subsurface soil (Table 7-47). The maximum and 95 percent UCL of the mean concentrations in SWMU 69 subsurface soil exceed the soil screening values, and SWMU concentrations are elevated relative to background levels at one or more locations. Although cobalt, copper, mercury, and selenium were detected and identified as ecological COPCs in Step 2 of the SERA (Section 7.6.2.2 and Table 7-31), these four chemicals were not identified as ecological COCs in Step 3a of the BERA. These inorganics were eliminated from further evaluation based on statistical evaluations performed on the SWMU 69 and background airfield soil data sets, which showed that SWMU 69 surface soil concentrations for these metals are not elevated above background levels (Table 7-38).

7.10.11.3 Drainage Ditch Sediment

Based on the refined risk evaluation presented in Section 7.10.9.3, cadmium, lead, vanadium, and zinc are identified as ecological COCs for sediment (Table 7-47). Maximum and mean HQs indicated potential risk to aquatic receptors, and SWMU sediment concentrations exceed background levels. Although barium, beryllium, chromium, copper, nickel, and thallium, were detected in drainage ditch sediment and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs. A recommendation of no additional evaluation for these inorganics is based on one or more lines of evidence, including low magnitude of maximum detections above sediment screening values, refined risk estimates using 95 percent UCL of the mean concentrations (Table 7-40), descriptive, and/or distributional statistics (Table 7-41). Antimony and tin were eliminated due to the absence of these chemicals in SWMU 69 media.

7.10.11.4 Mammalian Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.10.9.4.1, no detected chemicals were identified as ecological COCs for mammalian dietary exposures to chemicals in SWMU 69 surface soil. Although selenium was detected in SWMU 69 surface soil and identified as an ecological COPC in Step 2 of the SERA, it is not identified as an ecological COC for mammalian dietary exposures based on refined exposure doses less than NOAEL-based TRVs (Table 7-42) and the descriptive statistics presented in Table 7-37.

7.10.11.5 Avian Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.10.9.4.2, vanadium was identified as an ecological COC for avian dietary exposures to chemicals in SWMU 69 surface soil. Maximum and refined exposure doses exceed NOAEL-based TRVs for avian omnivores and herbivores, and SWMU concentrations exceed background concentrations at one or more locations. Although barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc were detected in SWMU 69 surface soil and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs were not identified as ecological COCs for avian dietary exposures. The recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs (Table 7-33) and/or the descriptive and distributional statistics presented in Table 7-37.

7.10.11.6 Amphibian and Reptile Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.10.9.4.2 for avian dietary exposures to surface soil, vanadium was identified as an ecological COC for amphibian and reptile dietary exposures to chemicals in SWMU 69 surface soil. As indicated in the previous section, maximum and refined exposure doses exceed NOAEL-based TRVs for avian omnivores and herbivores, and SWMU concentrations exceed background concentrations at one or more locations. Although barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc were detected in SWMU 69 surface soil and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs were not identified as ecological COCs for avian (and assumed amphibian and reptile) dietary exposures. The recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs (Table 7-33) and/or the descriptive and distributional statistics presented in Table 7-37.

7.10.11.7 Mammalian Dietary Exposures: Subsurface Soil

Based on the refined risk evaluation presented in Section 7.10.9.4.3, no detected chemicals were identified as ecological COCs for mammalian dietary exposures to chemicals in SWMU 69 subsurface soil. Although selenium was detected in SWMU 69 subsurface soil and identified as an ecological COPC in Step 2 of the SERA, it is not identified as an ecological COC for mammalian dietary exposures based on refined exposure doses less than NOAEL-based TRVs (Table 7-44) and the descriptive statistics presented in Table 7-39.

7.10.11.8 Avian Dietary Exposures: Subsurface Soil

Based on the refined risk evaluation presented in Section 7.10.9.4.4, vanadium was identified as an ecological COCs for avian dietary exposures to chemicals in SWMU 69 subsurface soil. Maximum and refined exposure doses exceed NOAEL-based TRVs for avian omnivores and herbivores, and SWMU concentrations exceed background concentrations at one or more locations. Although beryllium, chromium, copper, mercury, nickel, selenium, silver and zinc were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs were not identified as ecological COCs for avian dietary exposures. The recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs (Table 7-34) and/or the descriptive and distributional statistics presented in Table 7-39.

7.10.11.9 Amphibian and Reptile Dietary Exposures: Subsurface Soil

Based on the refined risk evaluation presented in Section 7.10.9.4.4 for avian dietary exposures to subsurface soil, vanadium was identified as an ecological COCs for amphibian and reptile dietary exposures to chemicals in SWMU 69 subsurface soil. As described in the previous section, maximum and refined exposure doses exceed NOAEL-based TRVs for avian omnivores and herbivores, and SWMU concentrations exceed background concentrations at one or more locations. Although beryllium, chromium, copper, mercury, nickel, selenium, silver and zinc were detected in SWMU 69 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs were not identified as ecological COCs for avian (and assumed amphibian and reptile) dietary exposures. The recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs (Table 7-34) and/or the descriptive and distributional statistics presented in Table 7-39.

7.10.11.10 Avian Omnivore Dietary Exposures: Drainage Ditch Sediment

Based on the refined risk evaluation presented in Section 7.9.1.4.5, cadmium, lead, and vanadium were identified as ecological COCs for avian dietary exposures to chemicals in drainage ditch sediment. Maximum and refined exposure doses exceed NOAEL-based TRVs for avian omnivores, and SWMU concentrations exceed background concentrations at one or more locations. Although beryllium, chromium, copper, mercury, nickel, selenium, silver, and zinc were detected in SWMU 69 drainage ditch sediment and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs are not identified as ecological COCs for avian dietary exposures. Tin was not identified as an ecological COC because this SVOC was not detected in any other site media. Beryllium, chromium, copper, mercury, nickel, selenium, silver, and zinc were not identified as ecological COCs based on refined risk estimates (Table 7-46), descriptive statistics, and/or distributional statistics (Table 7-41).

7.10.11.11 Amphibian and Reptile Dietary Exposures: Drainage Ditch Sediment

Based on the refined risk evaluation presented in Section 7.9.1.4.5 for avian dietary exposures to drainage ditch sediment, cadmium, lead, and vanadium were identified as ecological COCs for amphibian and reptile dietary exposures to chemicals in drainage ditch sediment. As discussed in the previous section, maximum and refined exposure doses exceed NOAEL-based TRVs for avian omnivores, and SWMU concentrations exceed background concentrations at one or more locations. Although beryllium, chromium, copper, mercury, nickel, selenium, silver, and zinc were detected in SWMU 69 drainage ditch sediment and identified as ecological COPCs in Step 2 of the SERA, these chemicals and the non-detected COPCs are not identified as ecological COCs for avian (and assumed amphibian and reptile) dietary exposures. Tin was not identified as an ecological COC because this SVOC was not detected in any other site media. Beryllium, chromium, copper, mercury, nickel, selenium, silver, and zinc were not identified as ecological COCs based on refined risk estimates (Table 7-46), descriptive statistics, and/or distributional statistics (Table 7-41).

7.11 Combined Conclusions for 2008 and 2010 Investigations

This section summarizes the combined decision points and recommendations of the ERAs conducted on the 2008 CMS Investigation data (Section 7.9.3) and 2010 Disturbed Soil Sampling Investigation data (Section 7.10.11). COCs identified in each investigation are identified and a final COC list for the SWMU is presented in Table 7-48. Because of the soil disturbances at the SWMU, the current location of soils that were sampled historically (as part of the 2004 Phase II ECP and 2008 CMS Investigation) are unknown. These soils may have been buried or displaced by the utility work at the SWMU (Section 7.1). As such, chemicals identified as COCs based on the ERA for 2008 CMS Investigation data that were not also identified as COCs based on the most recent data (2010 Disturbed Soil Sampling Data) are not retained in the final COC list for SWMU 69. CAOs for the COCs are developed in Section 7.12.

7.11.1 Surface Soil

Surface soil was collected as part of the 2008 CMS Investigation and 2010 Disturbed Soil Sampling Investigation. These data were used to evaluate potential risk to terrestrial plants and invertebrates at the SWMU. Based on Step 3a of the ERA for 2008 CMS Investigation data, barium, lead, and zinc are identified as ecological COCs in surface soil (Section 7.9.1.1). Based on Step 3a of the ERA for 2010 Disturbed Soil Investigation data, vanadium is identified as an ecological COC in surface soil (Section 7.10.9.1).

Because barium, lead, and zinc were not identified as ecological COCs based on the most recent SWMU data (2010 data), it is concluded that current site conditions do not pose a risk to lower trophic level terrestrial receptors from these chemicals. As such, barium, lead, and zinc are not included in the final COC list for SWMU 69.

Vanadium is identified as a final COC for SWMU 69 surface soil and additional evaluation in the form of corrective measures is recommended. Vanadium concentrations in SWMU 69 surface soil were consistent with background concentrations with the exception of a hot spot of vanadium contamination at sample location 69SB132-00 (550 mg/kg; Figure 7-12).

7.11.2 Subsurface Soil

Subsurface soil was collected as part of the 2008 CMS Investigation and 2010 Disturbed Soil Sampling Investigation. These data were used to evaluate potential risk to terrestrial plants and invertebrates at the SWMU. Based on Step 3a of the ERA for 2008 CMS Investigation data, no chemicals were identified as ecological COCs in subsurface soil (Section 7.9.1.2). Based on Step 3a of the ERA for 2010 Disturbed Soil Investigation data, vanadium is identified as an ecological COC in subsurface soil (Section 7.10.9.2).

Vanadium is identified as a final COC for SWMU 69 subsurface soil, and additional evaluation in the form of corrective measures is recommended. Vanadium concentrations in the 2010 data set were indicated to pose potential risk to terrestrial plants and invertebrates at each of the 102 sample locations (Figure 7-13). However, only eleven of the detected SWMU 69 concentrations exceeded the ULM of the background concentration (367 mg/kg) and six exceeded the maximum background detection (410 mg/kg).

7.11.3 Groundwater

Groundwater was sampled as part of the 2008 CMS Investigation and data were used to evaluate potential risk to receptors in the downgradient estuarine wetland system. Based on Step 3a of the ERA for 2008 CMS Investigation data, no chemicals are identified as COCs for groundwater (Section 7.9.1.3). Because no COCs were identified in 2008, groundwater was not evaluated further in the 2010 Disturbed Soil Sampling Investigation. No further evaluation of groundwater is recommended.

7.11.4 Sediment

Sediment was not present at the site during the 2008 CMS Investigation, and surface soil was not sampled from the drainage ditch during that investigation. Sediment from the drainage ditch was collected as part of the 2010 Disturbed Soil Sampling Investigation, and data were used to evaluate potential risk to benthic plants and invertebrates within the drainage ditch. Based on Step 3a of the ERA for 2010 investigation data, cadmium, lead, vanadium, and zinc are identified as COCs for drainage ditch sediment (Section 7.10.9.3).

Cadmium, lead, vanadium, and zinc are identified as final COCs for SWMU 69 sediment, and additional evaluation in the form of corrective measures is recommended. Concentrations of cadmium, lead, vanadium, and zinc in SWMU 69 sediment exceed both sediment screening values (Figure 7-14) and background levels at one or more locations. While cadmium, lead, and vanadium concentrations are elevated above background concentrations at multiple locations, elevated zinc concentrations are limited to two hot spots: 69SD06 (450J mg/kg) and 69SD07 (490J mg/kg). Based on the spatial distribution of the data, cadmium, lead, and zinc have not migrated past the confluence of the southern and eastern portions of the drainage ditch as ecologically important concentrations (Section 7.10.9.3).

7.11.5 Dietary Exposures to Surface Soil

Surface soil was collected as part of the 2008 CMS Investigation and 2010 Disturbed Soil Sampling Investigation. These data were used to evaluate potential risk to terrestrial flying mammals and avian omnivores, herbivores, and carnivores that may forage at the SWMU. Avian receptors also served as surrogates to evaluate potential risk to amphibians and reptiles. Based on Step 3a of the ERA for 2008 CMS Investigation data, barium, cadmium, lead, and zinc are

identified as ecological COCs for avian (and assumed amphibian and reptile) dietary exposures to surface soil (Section 7.9.1.4.2). Based on Step 3a of the ERA for 2010 Disturbed Soil Investigation data, vanadium is identified as an ecological COCs for avian (and assumed amphibian and reptile) dietary exposures to surface soil (Section 7.10.9.4.2). No chemicals were identified as ecological COCs for terrestrial flying mammals in the 2008 or 2010 investigations (Sections 7.9.1.4.1 and 7.10.9.4.1).

Because barium, cadmium, lead, and zinc were not identified as ecological COCs based on the most recent SWMU data (2010 data), it is concluded that current site conditions do not pose a risk to upper trophic level terrestrial receptors from these chemicals. As such, barium, cadmium, lead, and zinc are not included in the final COC list for SWMU 69.

Vanadium is identified as a final COC for SWMU 69 avian, amphibian, and reptile dietary exposures to surface soil, and additional evaluation in the form of corrective measures is recommended. Avian omnivores were the most sensitive of the evaluated avian receptors to vanadium. Avian omnivores are also the feeding guild representative of the endangered yellow shouldered blackbird, which may forage at the SWMU. The vanadium concentration at sample location 69SB132-00 was indicated to pose potential risk to individual avian omnivores in excess of background levels.

7.11.6 Dietary Exposures to Subsurface Soil

Surface soil was collected as part of the 2008 CMS Investigation and 2010 Disturbed Soil Sampling Investigation. These data were used to evaluate potential risk to terrestrial flying mammals and avian omnivores, herbivores, and carnivores that may forage at the SWMU. Avian receptors also served as surrogates to evaluate potential risk to amphibians and reptiles. Based on Step 3a of the ERA for 2008 CMS Investigation data, no chemicals were identified as COCs for subsurface soil dietary exposures (Section 7.9.1.4.4). Based on Step 3a of the ERA for 2010 Disturbed Soil Investigation data, vanadium is identified as an ecological COCs for avian (and assumed amphibian and reptile) dietary exposures to subsurface soil (Section 7.10.9.4.4). No chemicals were identified as ecological COCs for terrestrial flying mammals in the 2008 or 2010 investigations (Sections 7.9.1.4.3 and 7.10.9.4.3).

Vanadium is identified as final COCs for SWMU 69 avian, amphibian, and reptile dietary exposures to subsurface soil, and additional evaluation in the form of corrective measures is recommended. Avian omnivores were the most sensitive of the evaluated avian receptors to vanadium. As stated previously, avian omnivores are also the feeding guild representative of the endangered yellow shouldered blackbird, which may forage at the SWMU. The vanadium concentrations at eleven sample locations were indicated to pose potential risk to individual avian omnivores in excess of background levels.

7.11.7 Dietary Exposures to Sediment

Sediment was not present at the site during the 2008 CMS Investigation, and surface soil was not sampled from the drainage ditch during that investigation. As such, potential risk to avian omnivores that may forage in the drainage ditch was not evaluated with 2008 data. The 2010 Disturbed Soil Sampling Investigation sediment data was used to evaluate potential risk to avian omnivores that may forage within the drainage ditch. It should be noted that this feeding guild is representative of the endangered yellow shouldered blackbird, which may forage at the SWMU. Avian receptors also served as surrogates to evaluate potential risk to amphibians and reptiles.

Step 3a of the 2010 data evaluation identified cadmium, lead, and vanadium as COCs for avian omnivores to sediment (Section 7.10.9.4.5).

Cadmium, lead, and vanadium are identified as final COCs for SWMU 69 avian omnivore, amphibian, and reptile dietary exposures to sediment, and additional evaluation in the form of corrective measures is recommended. As stated previously, avian omnivores are the feeding guild representative of the endangered yellow shouldered blackbird, which may forage at the SWMU. Cadmium concentrations at six locations (69SD03, 69SD06, 69SD07, 69SD08, 69SD09, and 69SD10) are indicated to pose potential risk to individual avian omnivores in excess of background levels. Lead concentrations at three locations (69SD06, 69SD07, and 69SD08) are indicated to pose potential risk to individual avian omnivores in excess of background levels. Vanadium concentrations at three locations (69SD05, 69SD09, and 69SD14) are indicated to pose potential risk to individual avian omnivores in excess of background levels.

7.12 Development of Ecological Corrective Action Objectives

This section presents the methodology used to develop surface soil, subsurface soil, and drainage ditch sediment CAOs protective of ecological receptors. Because ecological COCs were not identified for groundwater (Table 7-48), CAOs were not developed for this media.

7.12.1 Methodology for CAO Development

Vanadium was identified as an ecological COC for terrestrial invertebrate and plant exposures to chemicals in SWMU 69 surface soil and subsurface soil. Vanadium was also identified as an ecological COC for avian (and assumed amphibian and reptile) dietary exposures to chemicals in surface soil and subsurface soil. Cadmium, lead, vanadium, and zinc were identified as ecological COCs for aquatic plant and invertebrate exposures to chemicals in drainage ditch sediment. Finally, cadmium, lead, and vanadium also were identified as ecological COCs for avian (and assumed amphibian and reptile) dietary exposures to chemicals in drainage ditch sediment. The sections that follow present the methodology used to develop risk- and background-based soil and drainage ditch sediment CAOs for these chemical-receptor-pathway dietary exposures. Final CAOs are identified in Section 7.12.2.

7.12.1.1 Risk-Based CAOs for Terrestrial Plant and Invertebrate Exposures to COCs in Surface Soil

Vanadium was identified as an ecological COCs for terrestrial plants and invertebrates. The soil screening values for vanadium (20 mg/kg; Table 7-4), was selected as the surface soil CAO protective of these terrestrial receptor groups.

7.12.1.2 Risk-Based CAOs for Avian Dietary Exposures to COCs in Surface Soil

Vanadium was identified as an ecological COC for avian (and assumed amphibian and reptile) dietary exposures to chemicals in surface soil. The Step 3a risk calculations presented in Table 7-43 show that the American robin (avian omnivore) represents the most sensitive avian receptor for dietary exposures to vanadium. Therefore, a CAO was derived based on potential risk to avian omnivores; this CAO will also be protective of other avian feeding guilds (herbivores and carnivores). A CAO for American robin dietary exposures to vanadium in surface soil was established by setting the dietary intake equation presented in Section 7.5.2.2.2 equal to the NOAEL-based TRV:

$$TRV_x = \frac{[[\sum_i[(FIR_j)(FC_{xi})(PDF_i)]]+[(FIR_j)(SC_x)(PDS)]][AUF_j]}{BW_j}$$

where:

TRV_x	=	NOAEL-based TRV for chemical x (mg/kg-BW/day)
BW	=	Body weight (kg, wet weight)
FIR	=	Food ingestion rate (kg/day, dry-weight)
FC_{xi}	=	Concentration of chemical x in food item i (mg/kg dry weight basis)
PDF_i	=	Proportion of diet composed of food item i (unitless, dry weight basis)
SC_x	=	Concentration of chemical x in surface soil (mg/kg dry weight basis)
PDS	=	Proportion of diet composed of surface soil (unitless, dry weight basis)
AUF_j	=	Area Use Factor (unitless)

Input parameters used for TRV_x, BW, FIR, PDF_i (earthworms and plants), PDS, and AUF are summarized below. The values selected for these parameters are identical to the values used to estimate American robin dietary intakes in Step 3a of the BERA.

- Avian NOAEL-based Toxicity Reference Value (*TRV*): 0.344 mg/kg-BW/day (Table 7-6)
- American robin body weight (*BW*): 0.0785 kg (Table 7-17)
- American robin food ingestion rate (*FIR*): 0.01033 kg/day-dry weight (Table 7-17)
- Proportion of American robin diet comprised of food item i (PDF_i): 0.83 for earthworms and 0.073 for plants (Table 7-18)
- Proportion of American robin diet comprised of soil (*PDS*): 0.087 (Table 7-18)
- Area use factor (*AUF*): 1.0 (Table 7-17)

An iterative process is used to solve the equation for SC. This process identifies the concentration of the chemical in the soil that corresponds to an HQ value of 1.0 for the American robin (i.e. the value resulting in a dietary intake equal to the NOAEL-TRV. This SC_x value is then identified as the CAO for that chemical. Food concentrations (FC_{xi}) were derived using the soil-to-plant and soil-to-invertebrate BAFs presented in Table 7-19. As these concentrations are based on the concentration of chemicals in the soil, each substitution of a chemical concentration in soil into the dietary intake equation during the interative process resulted in a new plant and invertebrate tissue concentration. This approach is consistent with the USEPA's guidance for developing wildlife Eco-SSLs for upper trophic level receptors (USEPA, 2005a).

Based on the iterative process, the CAO for vanadium was identified as 21.4 mg/kg.

7.12.1.3 Risk-Based CAOs for Terrestrial Plant and Invertebrate Exposures to COCs in Subsurface Soil

Vanadium was identified as an ecological COC for terrestrial plants and invertebrates. The soil screening value for vanadium (20 mg/kg; see Table 7-4) was selected as the subsurface soil CAO protective of these terrestrial receptor groups.

7.12.1.4 Risk-Based CAOs for Avian Dietary Exposures to COCs in Subsurface Soil

Vanadium was identified as an ecological COC for avian (and assumed amphibian and reptile) dietary exposures to chemicals in subsurface soil. As for surface soil, the Step 3a risk calculations presented in Table 7-45 showed that the American robin (avian omnivore) represents the most sensitive avian receptor for dietary exposures to vanadium. Therefore, the CAO was derived based on potential risk to avian omnivores; this CAO will also be protective of other avian feeding guilds (herbivores and carnivores). The CAO for American robin dietary exposures to vanadium in subsurface soil was established through use of the iterative process described in Section 7.12.1.2. The CAO for vanadium was identified as 21.4 mg/kg.

7.12.1.5 Risk-Based CAOs for Aquatic Plant and Invertebrate Exposures to COCs in Sediment

Cadmium, lead, vanadium, and zinc were identified as ecological COCs for plants, invertebrates, and amphibians within the drainage ditch system at SWMU 69. Sediment screening values for these four metals (0.99 for cadmium, 35.8 mg/kg for lead, 57.0 mg/kg for vanadium, and 121 mg/kg for zinc; Table 7-29) were selected as sediment CAOs protective of these aquatic receptor groups.

7.12.1.6 Risk-Based CAOs for Avian Omnivore Dietary Exposures to COCs in Sediment

Cadmium, lead, and vanadium were identified as ecological COCs for avian (and assumed amphibian and reptile) dietary exposures to chemicals in SWMU 69 sediment. The CAOs for American robin dietary exposures to cadmium, lead, and vanadium were established through the use of the iterative process described in Section 7.12.1.2. Cadmium and lead parameters used in the calculations were as follows:

- Toxicity reference value for chemical x (TRV_x): 1.47 mg/kg-BW/day for cadmium, 1.63 mg/kg-BW/day for lead (Table 7-6)

- Soil-to-plant and soil-to-invertebrate BAFs for cadmium and lead are presented in Table 7-19.

Based on the iterative process, the CAOs for cadmium, lead, and vanadium were identified as 1.8 mg/kg, 96 mg/kg, and 21.4 mg/kg, respectively.

7.12.1.7 Background-Based Surface Soil, Subsurface Soil, and Drainage Ditch Sediment CAOs

ULM concentrations, calculated as the mean plus two times the standard deviation, for airfield soil data (Addendum B of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010b) were used as background-based CAOs for vanadium in surface soil and subsurface soil (367 mg/kg). The ULM concentrations for airfield drainage ditch sediment (Addendum C of the above referenced document) were used as background-based COAs for cadmium, lead, vanadium, and zinc in SWMU 69 sediment (0.22

mg/kg for cadmium, 19.38 mg/kg for lead, 241.1 mg/kg for vanadium, and 148.46 mg/kg for zinc).

7.12.2 Identification of Final Corrective Action Objectives

Table 7-49 presents the CAOs developed for SWMU 69 surface soil. As evidenced by Table 7-49, the risk-based CAOs for vanadium (20 mg/kg for plants and invertebrates and 21.4 mg/kg for avian omnivores), are below the background-based CAO (367 mg/kg). Therefore, the background-based CAO was identified as the final CAO for vanadium in SWMU 69 surface soil. This approach is consistent with the Navy policy for use of Background Chemical Levels (CNO, 2004), which states that "*The action level for the remediation of sites should be risk based, should not be below background levels, and should target the risk associated with the COC or contaminant concentration exceeding background chemical levels*".

Table 7-50 presents the CAOs developed for SWMU 69 subsurface soil. As for surface soil, the risk-based CAOs for vanadium (i.e., 20 mg/kg for plants and invertebrates and 21.4 mg/kg avian omnivores), are below the background-based CAO (367 mg/kg). Therefore, the background-based CAO was identified as the final CAO for vanadium in SWMU 69 subsurface soil. As discussed in the preceding paragraphs, this approach is consistent with Navy policy.

Table 7-51 provides a summary of the cadmium, lead, vanadium, and zinc CAOs developed for SWMU 69 sediment. The risk-based CAOs for cadmium (i.e., 0.99 mg/kg for plants and invertebrates and 1.8 mg/kg avian omnivores) and lead (35.8 mg/kg for plants and invertebrates and 96 mg/kg avian omnivores) exceed the background-based CAOs for sediment (0.22 mg/kg for cadmium and 19.38 mg/kg for lead. As such, the minimum risk-based CAOs were selected as final CAOs for cadmium and lead (0.99 [rounded to 1.0] mg/kg for cadmium and 35.8 mg/kg for lead). The risk-based CAOs for vanadium (57 mg/kg for plants and invertebrates and 21.4 mg/kg for avian omnivores) and zinc (121 mg/kg for plants and invertebrates) were less than background-based CAOs (241.1 [rounded to 241] mg/kg for vanadium and 148.46 [rounded to 148] mg/kg for zinc). As such, the background-based CAOs were identified as the final CAOs for vanadium and zinc. As discussed in the preceding paragraphs, this approach is consistent with Navy policy.

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8.0 HUMAN HEALTH RISK ASSESSMENT AND DEVELOPMENT OF CAOs

8.1 Introduction

This section presents the human health risk assessment (HHRA) for SWMU 69 – Aircraft Parking Area, located at NAPR, Ceiba, Puerto Rico. The baseline HHRA was conducted in accordance with the Risk Assessment Guidance for Superfund (RAGS), Part A, Human Health Evaluation Manual (USEPA, 1989), and the most recent updates, such as RAGS Part D (USEPA, 2001), Part E (USEPA, 2004), and Part F (USEPA, 2009). The HHRA considers the most likely routes of potential human exposure for both current and future risk scenarios at SWMU 69. Should the results of the HHRA conclude that potential exposure to environmental media at SWMU 69 is considered to pose unacceptable levels of risk and hazard to human receptors, medium- and chemical-specific CAOs will be calculated for comparison to the site data to determine if and where potential cleanup may occur.

The HHRA for SWMU 69 was originally presented in the Draft CMS for SWMU 69 (Baker, 2008). That HHRA evaluated surface soil, subsurface soil, and groundwater data. There were no human health risk-based COCs identified in the original HHRA. However, as discussed in Section 1.0, the Draft CMS was retracted on December 3, 2008 following disturbances to the SWMU (e.g., trenching and surface scraping activities) that significantly altered the physical conditions of the site and potentially redistributed chemical concentrations identified in the original HHRA. A Disturbed Soil Sampling Investigation was conducted in 2010 to recharacterize the site.

The HHRA is presented in two parts. In Section 8.3 (Revised Original HHRA), the HHRA methodology is described, and soil and groundwater data collected during the 2008 CMS field investigation are re-evaluated: (a) to incorporate updates to screening and toxicity values, exposure assessment methodologies, and exposure parameters used in the original HHRA and (b) to support the decision to limit the analysis of 2010 data to inorganics (based on the lack of organic COCs identified from the 2008 data). In Section 8.4 (2010 Disturbed Soil Sampling Investigation HHRA), surface soil, subsurface soil, and sediment data collected as part of the Disturbed Soil Sampling Investigation are evaluated. Additionally, 2008 groundwater data are included in the 2010 Disturbed Soil Sampling Investigation HHRA to present a total site risk. In order to address potential risks at the SWMU as a whole, the conclusions drawn from the Revised Original HHRA, as well as those from the 2010 Disturbed Soil Sampling Investigation HHRA are collectively summarized in Section 8.5 (Combined Conclusions for 2008 and 2010 Investigations).

8.2 Land Use and Potentially Exposed Receptors

To focus on developing practicable and cost-effective corrective measures alternatives and to streamline the environmental cleanup process, USEPA guidance ("Land Use in the CERCLA Remedy Selection Process," [USEPA, 1995]) and U.S. Department of Defense (Longuemare, 1997) direct that CAOs should reflect the reasonably anticipated land use.

SWMU 69 (Aircraft Parking Area) is located in the northern portion of NAPR, on the western end of the Ofstie Airfield on the northern aircraft parking area, as shown on Figure 2-2. SWMU 69 consists of a portion of the northern aircraft parking apron (approximately 7 acres) and an expanded concrete apron area (approximately 10 acres) also used for aircraft parking. Interviews identified the area as an aircraft apron, and stated that numerous past spills of POL and hazardous materials occurred at the site, and that light aircraft maintenance was also conducted in this area.

Ownership of the airfield parcel (Ofstie Airfield) was transferred from the United States Navy to the Puerto Rico Ports Authority on February 7, 2008. The Ports Authority has developed the airfield into a regional airport. As such, future property use of this site is expected to remain industrial. Based on this, potential human exposure would be limited to industrial or commercial property use, now and in the future.

Considering the expected future property use of SWMU 69 and the potential human receptors/exposure pathways listed in Attachment II of the RCRA §7003 Administrative Order on Consent for NAPR (USEPA, 2007), the following human receptors are considered potentially exposed to site environmental media. For the continued industrial/commercial land use scenario at this site, the industrial worker is used to characterize potential future exposure to contaminated soil and groundwater. The assumption of USEPA's default industrial/commercial exposure scenario accounts for long term exposure (workers are assumed to be at the site eight hours per work day for 25 years) and is used to reflect future land use. Specifically, an industrial worker could be exposed to soil (defined as 0 to 10 feet) and volatiles in groundwater emitted through soil into buildings in the vicinity of SWMU 69. The construction worker is also used to characterize potential future exposure to contaminated soil and groundwater. Construction workers that may perform excavation and construction at the site could be exposed to soil (0 to 10 feet) and shallow groundwater at SWMU 69. (Note that analytical results from subsurface soil samples collected from the 9 to 11 feet bgs interval were included in the total soil data set used in the HHRA because 10 feet bgs is included in this interval. Refer to Appendix G.) It is also conservatively assumed that adult and/or youth trespassers or an on-site worker may gain access to the site and could be exposed to contaminated soil. As noted in Section 8.1, in addition to soil data, sediment data were collected during the 2010 Disturbed Soil Sampling Investigation. Therefore, potential exposure to sediment is also considered for the trespasser and on-site worker receptors as part of the evaluation of data in the 2010 Disturbed Soil Sampling Investigation HHRA.

Future residential land use is conservatively assumed for SWMU 69, although it is not included in the RCRA §7003 Administrative Order on Consent (USEPA, 2007) as a likely scenario given expected future land use. The site is part of a regional airfield and is not conducive in its current setting to residential use. However, this scenario is used to evaluate unrestricted land use and provide the most conservatively protective risk estimation.

8.3 Revised Original Human Health Risk Assessment

This section presents the HHRA methodology and the results of the Revised Original HHRA prepared for this CMS. The HHRA considers the most likely routes of potential human exposure for both current and future risk scenarios. The Revised Original HHRA is comprised of seven sections. Section 8.3.1 presents the Selection of Chemicals of Potential Concern, which evaluates the site investigation data and identifies COPCs across the site with regard to potential health effects. Sections 8.3.2 and 8.3.3 present the Exposure Assessment and Toxicity Assessment, respectively. The Risk Characterization, including a discussion of potential human health effects, is presented in Section 8.3.4. Section 8.3.5 presents a comparison with background levels. Section 8.3.6 outlines the potential sources of uncertainty encountered in the process of performing a risk assessment, and their potential effects on the estimation of human health risks. Section 8.3.7 presents the summary and conclusions of the Revised Original HHRA. Additionally, Section 8.4 presents the 2010 Disturbed Soil Sampling Investigation HHRA,

Section 8.5 presents the Combined Conclusions for 2008 and 2010 Investigations, Section 8.6 presents the development of CAOs, as applicable, and Section 8.7 presents the references.

8.3.1 Selection of Chemicals of Potential Concern

8.3.1.1 Data Evaluation

The data used in the Revised Original HHRA are presented in full in Appendix G. A statistical analysis, including the minimum, maximum, mean, standard deviation and 95% UCL, was run for applicable data sets (i.e., soil and groundwater COPCs). The statistical summary of data used in the HHRA is located in Appendix H. Data utilized in the HHRA is discussed in the paragraphs below. For duplicate samples, the higher of the two concentrations was used, not both. Unfiltered groundwater data were used to estimate exposure concentrations, since groundwater samples were collected using low-flow purging/sampling techniques. However, USEPA RAGS Part A guidance also states that filtered groundwater data can provide useful information for understanding chemical transport within an aquifer. As appropriate, filtered groundwater data will be qualitatively evaluated in relationship to corresponding unfiltered groundwater data. The following paragraphs describe the data used in the HHRA for SWMU 69.

Sampling activities at SWMU 69 were conducted under three separate investigations: a Phase II ECP investigation in 2004, CMS field investigation in 2008, and Disturbed Soil Sampling Investigation in 2010. The Phase II ECP field investigation was conducted in 2004 and involved the collection of five surface soil samples (designated 15E-SS01 through 15E-SS05; collected from the 0.0 to 1.0-foot depth interval) and five subsurface soil samples (designated 15E-SB01-01 through 15E-SB04-01 [collected from the 1.0 to 3.0-foot depth interval] and 15E-SB05-02 [collected from the 3.0 to 5.0-foot depth interval). Each surface and subsurface soil sample was analyzed for Appendix IX VOCs, SVOCs, and metals, as well as TPH DRO and GRO. Sample locations are depicted on Figure 2-3. A description of the Phase II ECP field investigation and associated analytical results were previously presented in the Final Phase I/II Environmental Condition of Property (NAVFAC Atlantic, 2005). It is noted that the quality of the analytical data obtained during the Phase II ECP field investigations is questionable due to the lack of independent, third party data validation. Based on the lack of validation, the surface and subsurface soil data were deemed unacceptable for use in the HHRA. However, these data are presented in Tables 6-5 and 6-6 and Appendix B of this report.

The CMS field investigation (see Section 4.0) was conducted from April 29, 2008 to May 3, 2008 and involved the collection of surface soil, subsurface soil, and groundwater. A total of twenty-five surface soil samples (designated 69SB01-00 through 69SB24-00 and 69SB27-00), ten subsurface soil samples (designated 69SB07-01, 69SB07-05, 69SB08-01, 69SB08-05, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05, 69SB27-01, and 69SB27-05), collected from the 1.0-3.0-foot and 9.0 to 11.0-foot depth intervals), and seven groundwater samples (designated 69SB07, 69SB08, 69SB11, 69SB12, and 69SB25 through 69SB27). Surface soil samples were collected from the 0.0 to 1.0-foot depth interval, while subsurface soil was collected from either the 1.0 to 3.0-foot depth interval (69SB07-01, 69SB08-01, 69SB11-01, 69SB12-01, and 69SB27-01) or the 9.0 to 11.0-foot depth interval (designated 69SB07-05, 69SB08-05, 69SB11-05, 69SB12-05, and 69SB27-05). Sampling locations are depicted on Figures 4-1 and 4-2. Each surface and subsurface soil sample was analyzed for Appendix IX VOCs, SVOCs, and metals. Groundwater samples also were analyzed for Appendix IX VOCs and SVOCs, as well as total and dissolved Appendix IX metals.

The 2010 Disturbed Soil Sampling Investigation data are discussed in Section 8.4.

8.3.1.2 COPC Selection

COPCs are those chemicals having the greatest potential to cause adverse human health effects if receptors come in contact with site media. For each environmental medium, COPCs were selected in accordance with USEPA's RAGS, Volume I, Human Health Evaluation Manual (Part A), Interim Final, (USEPA, 1989). Although some of the inorganic analytes occur above the risk-based screening values, but below background concentrations, no metals were eliminated from the risk evaluation based on their occurrence at background levels. The final site recommendations were based on results of the HHRA and comparisons with the background levels as appropriate for the metals.

8.3.1.2.1 COPC Selection Criteria

The COPCs were selected by comparing the maximum concentrations detected in environmental samples to risk-based screening levels. Chemicals exceeding screening levels were retained as COPCs for further evaluation; chemicals detected at concentrations below these criteria were not evaluated unless other circumstances (frequency of exposure detected in other media, same chemical class [i.e., PAHs] or documented usage) warrant the re-inclusion and further evaluation of chemicals selected as COPCs. The risk-based screening levels used in selecting chemicals as COPCs in the HHRA for SWMU 69 were the USEPA Regional Screening Levels (RSLs) (USEPA, 2010a), which are described in greater detail below.

In conjunction with concentration comparisons to the USEPA RSLs, a comparison to concentrations detected in field and laboratory blanks was conducted by a third-party data validator, to ensure that only site-related contaminants are evaluated in the quantitative estimation of human health effects. Metals were also compared to corresponding background screening concentrations. A description of actual background screening concentrations used can be found later in this section.

The toxicity of a chemical detected in a given environmental medium, as well as the history of site-related activities are other important criteria applied in selecting COPCs at SWMU 69. Therefore, in conjunction with concentration comparisons to USEPA RSLs, evaluations of toxicity and site history were considered to determine whether chemicals eliminated by a direct comparison to RSL values should be re-included as COPCs. Each of the aforementioned criteria is discussed in the paragraphs that follow.

USEPA Regional Screening Levels – The RSLs were developed to support the risk assessment screening process, while improving consistency across Regions and incorporating updated guidance in a timely manner. The RSL Table was developed with the Department of Energy's Oak Ridge National Laboratory (ORNL) under an Interagency Agreement as an update of the individual screening tables that had previously been maintained by Regions III, IV, and IX. As recommended by the USEPA, these RSLs are to replace all other screening values.

The RSL Table contains risk-based screening levels derived from standardized equations (representing ingestion, dermal contact, and inhalation exposure pathways), calculated using the latest toxicity values, default exposure assumptions, and physical and chemical properties. The screening levels contained in the RSL Table are generic; they are calculated without site-specific information. RSLs should be viewed as Agency guidelines, not legally enforceable standards. The RSLs for potentially carcinogenic chemicals are based on a target Incremental Lifetime Cancer Risk (ILCR) of $1x10^{-06}$. The RSLs for noncarcinogens are based on a target HQ of 1.0. However, in order to account for cumulative risk from multiple chemicals in a medium, the

noncarcinogenic RSLs will be divided by a factor of ten, yielding a target HQ of 0.1. For potential carcinogens, the toxicity criteria applicable to the derivation of RSL values are oral Cancer Slope Factors (CSFs) and inhalation unit risk (IUR) factors; for noncarcinogens, they are chronic oral reference doses (RfDs) and inhalation reference concentrations (RfCs). These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. The RSL table is updated periodically to reflect such changes. The November 2010 version of the RSL table (USEPA, 2010a) was used in the Revised Original HHRA.

In this HHRA, constituents in groundwater are compared to tapwater RSLs. Constituents identified in soil are compared to residential soil RSLs. It should be noted that although future on-site residential land use was conservatively used for screening criteria, it is not considered reasonably anticipated at SWMU 69.

Background or Naturally Occurring Levels - Generally, a comparison to naturally occurring levels applies only to inorganic analytes, because the majority of organic chemicals are not naturally occurring. Background samples are collected from areas that are not influenced by site contamination. The background data used for comparison purposes in this HHRA are taken from the Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010), for NAPR. The criterion used for comparison with site-related metals is the ULM, which is calculated as the mean plus two times the standard deviation of the mean. Note that the ULMs used in the HHRA were calculated using background data sets taken from the Revised Final Summary Report (Baker, 2010) following the same methodologies used in the data analyses for the HHRA (e.g., treatment of duplicate samples). Therefore, sample concentrations for metals in airfield total soil and groundwater were compared to the ULM of the corresponding background data sets. It is important to note that while this comparison is presented as part of the COPC selection for convenience, no metals were eliminated from the risk evaluation based on comparison to background screening concentrations.

8.3.1.2.2 Use of Surrogate Chemicals for Missing Screening Values

If a screening value for a constituent was not available from the RSL table, the constituent was evaluated using the screening values for a surrogate chemical, if appropriate and available. Soil and water screening values for phenanthrene were not available from the RSL table. Pyrene was selected as a surrogate chemical because of its structural similarity. Soil screening values for acenaphthylene, benzo(g,h,i)perylene, and total chromium were not available from the RSL tables. Acenaphthene was selected as a surrogate chemical for acenaphthylene, and pyrene was selected as a surrogate chemical for benzo(g,h,i)perylene during the COPC selection process based on structural similarity. Trivalent chromium was selected as a surrogate chemical for total chromium as there is no history of hexavalent chromium production operations at SWMU 69.

8.3.1.2.3 Selection of COPCs

The following paragraphs present the rationale for selection of COPCs. Tables 8-1 through 8-3 present the selection of COPCs for the 2008 CMS investigation data. Constituents retained as COPCs are indicated by the shaded cells in the tables. These tables also include exposure concentrations for COPCs, which are discussed further in Section 8.3.2, Exposure Assessment. Information is presented in these tables only for those constituents detected at least once in the medium of interest. Sample locations, analytical results, and corresponding figures for the surface soil, subsurface soil, and groundwater samples collected during the 2008 CMS investigation are presented in Section 6.0 and appendices of this CMS Report.

Surface Soil

The data and COPC selection summary for surface soil samples collected at SWMU 69 are presented in Table 8-1. A figure depicting spatial extent of surface soil COPC concentrations greater than residential soil RSLs is not included for this 2008 data set. As previously discussed, the physical conditions of the site were significantly altered, and chemical concentrations present in this medium were potentially redistributed.

One VOC, trans-1,4-dichloro-2-butene, was detected in the surface soil at a concentration above its residential soil RSL. Therefore, it was retained as a total soil COPC.

The carcinogenic PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected in the surface soil at maximum concentrations above residential soil RSLs and were retained as COPCs for surface soil. Benzo(k)fluoranthene and chrysene were detected at concentrations below corresponding residential soil RSLs. However, these carcinogenic PAHs were re-included as COPCs for surface soil because of the potential additive toxic effects of carcinogenic PAHs. Di-n-octyl phthalate currently has no screening criteria available; therefore, it was retained as a surface soil COPC as a conservative measure.

Arsenic, cadmium, cobalt, and vanadium were detected in surface soil at concentrations exceeding corresponding residential soil RSLs and were retained as surface soil COPCs. Lead was detected at a maximum concentration that exceeded its residential soil Action Level and was retained as a surface soil COPC. Detected concentrations of arsenic, cadmium, chromium, and lead exceeded corresponding background screening concentrations. It should be noted that all detected concentrations of cobalt and vanadium were less than the background concentration.

Total Soil

The existing SWMU 69 surface soil (0-1 foot bgs) and subsurface soil (1-11 feet bgs) data sets were combined to create one total soil column (0-11 feet bgs) data set. The data and COPC selection summary for total soil samples collected at SWMU 69 are presented in Table 8-2. A figure depicting spatial extent of total soil COPC concentrations greater than residential soil RSLs is not included for the 2008 data set. As previously discussed, the physical conditions of the site were significantly altered and chemical concentrations present in the shallow subsurface soil (specifically, down to 24 inches bgs) were potentially redistributed.

One VOC, trans-1,4-dichloro-2-butene, was detected in the total soil at a concentration above its residential soil RSL. Therefore, it was retained as a total soil COPC.

The carcinogenic PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected in the total soil at maximum concentrations above residential soil RSLs and were retained as COPCs for total soil. Benzo(k)fluoranthene and chrysene were detected at concentrations below corresponding residential soil RSLs. However, these carcinogenic PAHs were re-included as COPCs for total soil because of the potential additive toxic effects of carcinogenic PAHs. Di-n-octyl phthalate currently has no screening criteria available; therefore, it was retained as a total soil COPC as a conservative measure.

Arsenic, cadmium, cobalt, and vanadium were detected in total soil at concentrations exceeding corresponding residential soil RSLs and were retained as total soil COPCs. Lead was detected at

a maximum concentration that exceeded its residential soil Action Level and was retained as a total soil COPC. Detected concentrations of arsenic, cadmium, and lead exceeded corresponding background screening concentrations, while only the maximum detected concentration of vanadium exceeded its background screening concentration. It should be noted that all detected concentrations of cobalt were less than the background concentration.

Groundwater

Table 8-3 summarizes the COPC selection performed for constituents detected in groundwater samples collected at SWMU 69. The spatial extent of groundwater COPC concentrations greater than tapwater RSLs is depicted on Figure 8-1. It is not expected that groundwater conditions were affected by the soil disturbances. Note that only those detected concentrations of total inorganics exceeding corresponding tapwater RSLs are shown on the figure.

There were no VOCs detected in the groundwater at concentrations above corresponding tapwater RSLs. Therefore, VOCs were not retained as COPCs for groundwater.

There were no SVOCs detected in the groundwater at concentrations above corresponding tapwater RSLs. Therefore, SVOCs were not retained as COPCs for groundwater.

Of the unfiltered (total) inorganic constituents detected in groundwater, arsenic, cobalt, and vanadium were retained as COPCs since the detected concentrations exceeded the corresponding tapwater RSL. Arsenic, cobalt, and vanadium were detected at concentrations below corresponding background screening concentrations. Table 8-3 also shows that there is a good correlation between the total and dissolved groundwater analytical results.

8.3.1.2.4 Summary of COPCs

- *Surface Soil*: Trans-1,4-dichloro-2-butene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, di-n-octyl phthalate, arsenic, cadmium, cobalt, lead, and vanadium.

- *Total Soil*: Trans-1,4-dichloro-2-butene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, di-n-octyl phthalate, arsenic, cadmium, cobalt, lead, and vanadium.

- *Groundwater*: Arsenic, cobalt, and vanadium.

8.3.2 Exposure Assessment

The exposure assessment estimates the magnitude of actual and/or potential human exposure, the frequency and duration of those exposures, and the pathways (i.e., inhalation, ingestion, and dermal contact) by which people are potentially exposed. To determine whether human exposure could occur at SWMU 69 in the absence of remedial action, an exposure assessment that identifies potential exposure pathways and receptors was conducted. The following four elements were considered to determine whether a complete exposure pathway was present (USEPA, 1989):

- A source and potential mechanism of chemical release
- An environmental retention or transport medium
- A point of potential human contact with the contaminated medium; and
- A human exposure route (e.g., ingestion) at the contact point

The exposure scenarios discussed in this report represent USEPA's Reasonable Maximum Exposure (RME). Relevant equations for assessing intakes and exposure parameters were obtained from RAGS Part A (USEPA, 1989), Exposure Factors Handbook (USEPA, 1997a), RAGS Part E Supplemental Guidance for Dermal Risk Assessment (USEPA, 2004), RAGS Part F Supplemental Guidance for Inhalation Risk Assessment (USEPA, 2009), Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2002a), and Standard Default Exposure Factors, Interim Final (USEPA, 1991). Exposure parameters used in this HHRA are provided in Table 8-4.

8.3.2.1 Potential Human Receptors

NSRR underwent operational closure on March 31, 2004. On April 1, 2004, NSRR was re-designated as NAPR. The current primary mission of NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal of the property. It is assumed that long-term plans for the facility would be similar to those that had been in place prior to closure with land use also generally the same. Based on information available regarding the physical features, site setting, site historical activities, and current and expected land uses, seven potential human receptors have been selected for evaluation. These include:

- Current/Future On-site Adult Trespasser
- Current/Future On-site Youth (6-16 years) Trespasser
- Current/Future On-site Adult Worker
- Future Adult Resident
- Future Young Child (1-6 years) Resident
- Future Industrial/Commercial Adult Worker
- Future Construction Worker

As discussed in Section 8.2, for the continued industrial/commercial land use scenario at this site, the industrial/commercial worker and construction worker will be used to characterize potential future exposure to contaminated soil and groundwater. The future industrial/commercial worker is included in the RCRA § 7003 Administrative Order on Consent (USEPA, 2007) as a potential human receptor under expected usage conditions (i.e., expected future land usage being similar to the land usage patterns currently in place). In anticipation of excavation of soil during redevelopment of the site, it is considered possible that subsurface soil could be brought to the surface and exposure to this medium could occur in the future. At NAPR, it is considered that soil up to 10 feet bgs could be exposed during construction activities. Note that analytical results from subsurface soil samples collected from the 9 to 11 feet bgs interval were included in the total soil data set used in the HHRA because 10 feet bgs is included in this interval (refer to Appendix G). Therefore, potential exposures to surface soil (0 to 1 foot bgs), total soil (0 to 11 feet bgs), and volatiles in groundwater emitted through soil into buildings were evaluated for industrial workers. Potential exposure to surface soil, total soil, and shallow groundwater at SWMU 69 were evaluated for construction workers that may perform excavation and construction at the site. It was conservatively assumed that construction workers may be directly exposed to groundwater following excavation because groundwater at SWMU 69 is relatively

shallow at some locations (i.e., approximately 10 feet bgs). Potential exposures to surface soil and total soil were evaluated for adult on-site workers that may perform maintenance or groundskeeping activities at SWMU 69 now or in the future. Additionally, potential exposures to surface soil and total soil were evaluated for adult and/or youth trespassers that may gain access to the site now or in the future and could be exposed to these environmental media. Construction workers, industrial/commercial workers, on-site workers, and trespasser receptors are listed in the RCRA §7003 Administrative Order on Consent (USEPA, 2007).

Future residential land use is conservatively assumed for SWMU 69. Future residential adult and young child receptors are evaluated in this HHRA, although residential receptors are not included as potential human receptors in the RCRA §7003 Administrative Order on Consent (USEPA, 2007). Additionally, the industrial setting of the SWMU (i.e., airport property) precludes its use as a residential site. However, a future residential exposure scenario is included for conservative comparison with other exposure scenarios. A residential land use is also used to evaluate unrestricted land use. Potential exposures to all media (surface soil, total soil, and groundwater) were conservatively evaluated for future residents.

As shown in Table 8-3, three VOCs (2-hexanone, acetone, and chloromethane) were detected in groundwater at concentrations below corresponding tapwater RSLs, indicating that potential exposure to vapors volatilizing directly from water into a shower or trench is not of concern. The VOCs were also compared against vapor intrusion screening levels following methodology presented in USEPA's Draft Subsurface Vapor Intrusion Guidance (USEPA, 2002b) to evaluate the potential for exposure to volatiles in groundwater emitted through soil into buildings. Updated vapor intrusion screening values were calculated for each VOC using the residential air RSL (adjusted as appropriate for noncarcinogens), dimensionless Henry's Law Constant presented in the RSL chemical specific parameter table, and the groundwater to indoor air attenuation factor of 0.001 presented in Table 2s in the 2002 vapor intrusion guidance. As shown below, all VOCs were detected at concentrations below their respective vapor intrusion screening levels. Therefore, it is not necessary to quantitatively evaluate the inhalation of VOCs in groundwater (either directly or indirectly) in this HHRA.

VOC	Maximum Concentration (µg/L)	Vapor Intrusion Screening Level (µg/L)
Acetone	15 J	2,200,000
Chloromethane	1.5 J	26
2-Hexanone	1.1 J	814

As previously noted, metals detected in site media were retained for risk estimation, although they could reflect background conditions.

Specifically, the following potential human exposure receptors and exposure pathways were retained for quantitative evaluation in this HHRA.

Current/Future On-Site Adult and Youth (Ages 6-16 Years) Trespassers

- Ingestion of Soil
- Dermal Contact with Soil
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Current/Future On-Site Adult On-Site Workers

- Ingestion of Soil
- Dermal Contact with Soil
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Adult and Young Child (Ages 1-6 Years) Residents

- Ingestion of Soil and Groundwater
- Dermal Contact with Soil and Groundwater
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Adult Industrial/Commercial Workers

- Ingestion of Soil
- Dermal Contact with Soil
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Construction Workers

- Ingestion of Soil and Groundwater
- Dermal Contact with Soil and Groundwater
- Inhalation of Fugitive Dusts/Volatiles from Soil

8.3.2.2 Conceptual Site Model

Development of a conceptual site model of potential exposure is critical in evaluating exposures for the human receptors. The conceptual site model considers all reasonable current and future potential exposures and media of concern under a no-action scenario. Current and potential future exposure scenarios for SWMU 69 are summarized in the conceptual site model in Figure 8-2 of this HHRA. Current receptor exposure scenarios at SWMU 69 may consist of trespassers and on-site workers. Future receptor exposure scenarios at this site may consist of trespassers, on-site workers, residents, industrial/commercial workers, and construction workers.

Potential chemical release mechanisms from affected media include transport of chemicals associated with historical hazardous material spills to the surface of the aircraft parking apron and expanded aircraft parking apron via surface run-off to surface and subsurface soil. Contaminated surface and subsurface soil also represent potential sources for the release of chemicals to downgradient surface soil, subsurface soil, and groundwater, as well as surface water and sediment within the drainage ditch. Potential contaminant release mechanisms also include leaching to underlying groundwater and advective transport in the direction of groundwater flow. Potentially affected media at SWMU 69 may include one or more of the following: surface soil, subsurface soil, and groundwater.

8.3.2.3 Quantification of Exposure

Exposure to contaminants is quantified using 1) data from the site (i.e., concentrations of contaminants) and 2) determining human exposure to the environmental media. The chemical concentrations used in the estimation of chronic daily intakes (CDIs) and dermally absorbed doses (DADs) for each medium are considered representative of the types of potential exposures

encountered by each receptor throughout the time of exposure. A discussion of site data and human exposure at SWMU 69 is presented in the following sections.

8.3.2.4 Data Analysis

USEPA recommends using the average concentration to represent "a reasonable estimate of the concentration likely to be contacted over time" (USEPA, 1989). This concentration, commonly termed the exposure point concentration (EPC), is a conservative estimate of the average chemical concentration in an environmental medium at hazardous waste sites. The EPC is determined for each individual exposure unit within a site. An exposure unit is the area throughout which a receptor moves and encounters an environmental medium for the duration of the exposure. Unless there is site-specific evidence to the contrary, an individual receptor is assumed to be equally exposed to media within all portions of the exposure unit over the time frame of the risk assessment (USEPA, 2002c).

USEPA's most recent guidance, Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (USEPA, 2002c), provides tools to calculate upper confidence limits to be used as EPCs in risk assessments. The USEPA 2002 guidance recommends the use of the software package, ProUCL (USEPA, 2010b and 2010c), to calculate upper confidence limits for use in risk assessments. ProUCL Version 4.00.05 (current at the time the calculations were performed) was used in this HHRA to calculate 95% UCLs.

The ProUCL software has been developed by USEPA to compute an appropriate 95% UCL of the unknown population mean. All upper confidence limit computation methods contained in the USEPA guidance documents are available in ProUCL, Version 4.00.05. ProUCL 4.00.05 contains statistical methods to address various environmental issues for both full data sets without nondetects and for data sets with nondetects (also known as left-censored data sets).

The 95% UCL on the mean concentration was used as the EPC for each COPC identified for a receptor group where the number of detected concentrations was four or more and where eight or more samples are available in the dataset. For the soil exposure pathway evaluation for SWMU 69, COPCs were selected from both surface soil (0 to 1 foot bgs) and total soil (0 to 11 feet bgs). EPCs were subsequently calculated for surface soil and total soil COPCs, and the higher of the two EPCs for each COPC was used in the risk calculations to produce a conservative risk estimate. For COPCs having less than four detected concentrations or less than eight samples in the dataset, the maximum detected concentration was used as the EPC for that data grouping. Concerning the surface soil COPC data sets, the maximum detected concentrations were used as EPCs for trans-1,4-dichloro-2-butene, benzo(k)fluoranthene, and di-n-octyl phthalate because there were less than four detected concentrations in the data sets. The groundwater COPC data sets contained only seven sample points (refer to Table 8-3), and as such, the maximum detected concentrations were used as the EPCs. Although it is preferred that the maximum detected concentration not be used as the EPC, the uncertainty added to the risk assessment errs on the side of conservativeness. Note that as a contaminant plume was not identified and no extreme fluctuations in COPC concentrations were observed (i.e., minimum and maximum detections were within one order of magnitude), all groundwater data were combined into one data set.

Measured concentrations were used in the HHRA for most EPCs. However, modeled concentrations were used as EPCs when evaluating inhalation exposures to particulates in air. Ambient air EPCs (resulting from particulate emissions from soil) were modeled based on the measured soil concentrations. A site-specific particulate emission factor (PEF) was calculated for

use in intake calculations for construction workers. Climate Zone 9 (based on Miami, FL) and a seven acre aerial extent of site contamination were used in the site-specific PEF calculation.

The computational output from the ProUCL calculations performed for each COPC is presented in Appendix H. The equations for estimating intakes due to direct exposures to site-related chemicals for the various identified pathways are presented in Appendix I. The calculation of the site-specific PEF is included in Appendix J (Risk Calculation Spreadsheets).

It should be noted that estimated concentrations also were used to calculate the 95% UCL, such as "J" qualified (estimated) data. Reported concentrations qualified with an "R" (rejected) were not used in the statistical evaluation. For further discussion of data qualifications specific to this investigation, laboratory data validation summaries can be found in Section 6.4 of this report.

8.3.2.5 Exposure Input Parameters

Table 8-4 presents the exposure parameters used in the estimation of potential CDIs/DADs for COPCs retained for each receptor identified below. When USEPA exposure parameters are not available, best professional judgment and site-specific information are used to derive a conservative and defensible value. The following paragraphs present the rationale for the RME assumptions for each receptor group evaluated in the HHRA. RME is defined as the highest exposure that is reasonably expected to occur at a site.

Current/Future Adult and Youth Trespassers

This scenario assumes that current adult and youth (6 - 16 years) trespassers could come into contact with soil at SWMU 69. Therefore, these receptors were evaluated for potential exposure to soil via ingestion, dermal contact, as well as inhalation of volatiles and/or fugitive dust. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-4.

A 70 kilogram (kg) adult and a 45 kg youth (USEPA, 1997a) were assumed to have exposure durations (EDs) of 24 years (USEPA, 1991) and 11 years (professional judgment, represents youths from 6 to 16 years of age), respectively. Exposure times (ETs) were estimated to be 2 hours per day (USEPA, 1997a) in relationship to inhalation of fugitive dusts. An ingestion rate (IR) of 100 milligrams per day (mg/day) for surface soil was assumed for both the youth and the adult (USEPA, 1991), with a conservative assumption of 100 percent fraction ingested from the source (professional judgment). The exposure frequency (EF) was assumed to be 52 events/year, based on anticipated exposures of one day/week/year (professional judgment). Averaging times (ATs) of 8,760 days for adults and 4,015 days for youths for noncarcinogens, and 25,550 days for carcinogens were also used (USEPA, 1989).

The USEPA recommended weighted soil to skin adherence factor (AF) of 0.07 milligrams per square centimeter (mg/cm^2) for the residential adult (USEPA, 2004) was used for the adult trespasser for soil. This is based on the 50th percentile weighted AF for gardeners, which is the activity determined to represent a reasonable, high-end contact activity. The USEPA recommended weighted 0.2 mg/cm^2 AF for the young child was conservatively used for the youth trespasser for soil and is based on the 95th percentile weighted AF for children playing at a day care center or in wet soil (USEPA, 2004). Skin surface areas of 3,200 square centimeters (cm^2) for the youth (25% of the total body surface area of 12,900 cm^2 for youths ages 7-17) and 5,700 cm^2 for the adult (USEPA 1997a) were assumed for the soil scenarios.

Dermal absorption (ABS) values have been empirically determined for very few chemicals. USEPA (2004) provides recommended values for a limited number of chemicals and recommends treating dermal exposure to other compounds qualitatively in the uncertainty section or quantitatively using default values on a site-specific basis. RAGS Part E (USEPA, 2004) offers ABS values for a few organic and inorganic constituents, and these have been used in this HHRA. As cited in Exhibit 3-4 of RAGS Part E, the ABS for arsenic is set at 0.03 and for cadmium at 0.001 (USEPA, 2004). In the absence of USEPA Region II-specific guidance on dermal ABS for metals, ABS from all metals in soil except for arsenic and cadmium have been assumed to be 0.01 (Virginia Department of Environmental Quality [VDEQ], 2011) based on the following rationale. RAGS Part E states that for metals, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value (USEPA, 2004). However, the guidance does allow for quantitative evaluation using default ABS values as an interim measure as long as uncertainties are presented and discussed. Therefore, in order to maintain a conservative approach and to account for dermal contact exposure pathway, an ABS value greater than zero (0) was assumed in this HHRA.

Current/Future Adult On-Site Workers

This scenario assumes that current/future adult on-site workers could come into contact with soil at SWMU 69. This receptor would be involved in landscaping/maintenance activities on the property grounds and not exposed to groundwater. Therefore, this receptor was evaluated for potential exposure to soil (using the most conservative EPCs of the surface soil and total soil COPCs via ingestion, dermal contact, and inhalation of fugitive dust in soil. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-4.

The IR for a 70 kg adult on-site worker exposed to soil was assumed to be 100 mg/day (USEPA, 2002a) and the fraction ingested was assumed to be 100 percent (professional judgment). An EF of 250 days per year (USEPA, 2004) for soil was used in conjunction with an ED of 25 years (USEPA, 2004). An ET of 8 hours/day (professional judgment) assuming a typical 8 hour work day was used to evaluate inhalation of fugitive dusts from soil. An AT of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds while an AT of 9,125 days was used for noncarcinogens.

There is a potential for on-site workers to absorb COPCs by dermal contact. A skin surface area of 3,300 cm^2 for an adult (USEPA, 2004) assumed to wear a short-sleeved shirt, long pants, and shoes, was used to evaluate dermal contact with soil. The USEPA recommended weighted AF of 0.2 mg/cm^2 (USEPA, 2004) was used for the on-site worker for soil. Dermal absorption values were applied as previously discussed.

Future Adult and Young Child Residents

This scenario assumes that future adult and young child (1-6 years) residents could come into contact with soil and groundwater at SWMU 69. Therefore, these receptors were evaluated for potential exposure to soil (using the most conservative EPCs of the surface soil and total soil COPCs), via ingestion and dermal contact, as well as inhalation of fugitive dust and/or volatiles in soil. While groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007), it is conservatively assumed that the shallow groundwater could be used for potable purposes in the future. Therefore, future residents were evaluated for potential exposure to groundwater via ingestion and dermal contact. Inhalation of volatiles while showering was not evaluated since the only VOCs detected in groundwater (2-hexanone, acetone, and chloromethane) did not exceed their Tapwater RSLs. Likewise, exposure to volatiles in

groundwater via vapor intrusion into a home was not evaluated since 2-hexanone, acetone, and chloromethane did not exceed the generic screening levels for vapor intrusion. Exposures to organic and total inorganic COPCs were evaluated. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-4.

Future adult and young child residents could contact soil during outdoor recreational activities in the area immediately surrounding their homes. A 70 kg adult and a 15 kg child (USEPA, 1997a) were assumed for exposure durations of 24 years and 6 years (USEPA, 1991), respectively. The exposure time was conservatively assumed to be 24 hours per day (professional judgment) for soil exposures. The IR for soil and sediment was assumed to be 200 mg/day for the young child and 100 mg/day for the adult (USEPA, 1991), with a 100 percent fraction ingested from source, over 350 days/year (USEPA, 2004) for soil and groundwater. The EF was assumed to be 52 events/year (professional judgment) for sediment exposure. ATs of 8,760 days for adults and 2,190 days for children for non-carcinogens, and 25,550 days for carcinogens were also used (USEPA, 1989).

The USEPA recommended weighted AFs of 0.07 mg/cm^2 for the adult and 0.2 mg/cm^2 for the young child were used for soil (USEPA, 2004). An AF of 0.3 mg/cm^2 was used for sediment for both adult and child residents and is based on contact with wet sediment (VDEQ, 2011). Dermal absorption values were applied as previously discussed. Skin surface areas of 2,800 cm^2 for the young child and 5,700 cm^2 for the adult (USEPA, 2004) were assumed for the soil and sediment scenarios.

A groundwater ingestion rate of 1 liter per day (L/day) was used for children and 2 L/day for adults (USEPA 1989). This value assumes that residents obtain all of their drinking water from the same source for the exposure duration. Groundwater ETs of 0.58 hours/day for the adult and 1.0 for the child (USEPA, 2004) were used. Equations and estimated, chemical-specific permeability constant (K_p) values presented by USEPA (USEPA, 2004) were used to estimate the absorption of organic COPCs by skin exposed to groundwater. Skin surface areas of 6,600 cm^2 for the young child and 18,000 cm^2 for the adult (USEPA, 2004) were assumed for the showering/bathing exposure scenario. Most of the same assumptions used for estimating exposures to soil (i.e., exposure duration, exposure frequency, body weight, and carcinogenic and noncarcinogenic averaging times) were also applied to the evaluation of ingestion, dermal, and inhalation exposures to groundwater.

Future Adult Industrial/Commercial Workers

This scenario assumes that future adult industrial/commercial workers could come into contact with soil at SWMU 69. Therefore, this receptor was evaluated for potential exposure to soil (using the most conservative EPCs of the surface soil and total soil COPCs) via ingestion, dermal contact, and inhalation of volatiles and/or fugitive dust. Exposure to volatiles in groundwater via vapor intrusion into a building was not evaluated for the future industrial/commercial worker because there were no volatiles that exceeded the generic screening levels for vapor intrusion. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-4.

The IR for industrial/commercial workers exposed to soil was assumed to be 100 mg/day (USEPA, 2002a), and the fraction ingested was assumed to be 100 percent (professional judgment). An EF of 250 days per year (USEPA, 2004) for soil was used in conjunction with an ED of 25 years (USEPA, 2004). An ET of 8 hours/day (professional judgment) assuming a typical 8 hour work day) was also used in relationship to inhalation of fugitive dusts from soil.

An AT of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds while an AT of 9,125 days was used for noncarcinogenic exposures.

There is a potential for industrial/commercial workers to absorb COPCs by dermal contact. A skin surface area of 3,300 cm^2 for an adult (USEPA, 2004) assumed to wear a short-sleeved shirt, long pants, and shoes, was used to evaluate dermal contact with soil. An AF of 0.2 mg/cm^2 was used for soil and is based on the 50th percentile weighted AF for utility workers, which is the activity determined by USEPA to represent a reasonable, high-end contact activity (USEPA, 2004). Dermal absorption values were applied as previously discussed.

Future Adult Construction Workers

Potential exposures to soil COPCs may occur to construction workers while performing soil excavation and construction activities at SWMU 69. Soil exposure pathways evaluated include ingestion, dermal contact, and inhalation of fugitive dust (using the most conservative EPCs of the surface soil and total soil COPCs). Exposure to groundwater at SWMU 69 via ingestion and dermal contact was also evaluated as a conservative measure. The shallow groundwater aquifer was measured at approximately 10 feet bgs as noted in Section 4.0. Exposure to volatiles in groundwater via inhalation while in a trench was not evaluated for the future construction worker because there were no volatiles that exceeded the generic screening levels for vapor intrusion. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-4.

Exposure to soil was assumed to occur for 8 hours per day (professional judgment assuming a typical 8 hour work day), 250 days per year (USEPA, 2004), for a construction period of 1 year (professional judgment conservatively assuming duration of a construction project). The USEPA default value for the soil IR of 330 mg/day (USEPA, 2002a) and a 100 percent fraction ingested from source (professional judgment) were also assumed for a 70 kg construction worker (USEPA, 1997a). A skin surface area of 3,300 cm^2 for an adult (USEPA, 2004) assumed to wear a short-sleeved shirt, long pants, and shoes, was used to evaluate dermal contact with soil and groundwater. Soil to skin adherence factors of 0.3 mg/cm^2 (USEPA, 2002a) was used for soil, and dermal absorption values were applied as previously discussed. The ATs of 365 days for noncarcinogens and 25,550 days for carcinogens, respectively, were also used (USEPA, 1989). A site-specific PEF of 2.99×10^{06} was calculated for the construction worker scenario (refer to Appendix J).

During excavation activities, the possibility exists that future construction workers may come in contact with shallow groundwater. To quantify the groundwater exposure it is conservatively assumed that 20% of their time (i.e., an EF of 50 days/year) will be spent in an open hole filled with groundwater at which time they can accidentally ingest small quantities of water and be immersed from the waist down for an assumed duration of two hours. An ingestion rate of 0.02 L/day (VDEQ, 2011) for groundwater was used to represent a construction worker accidentally ingesting groundwater during excavation activities. Other relevant exposure parameters are the same as those discussed above for soil (e.g., exposure duration, body weight, skin surface area).

8.3.3 Toxicity Assessment

An important component of the HHRA process is the relationship between the dose of a compound (amount to which an individual or population is potentially exposed) and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated. Standard RfDs

and/or CSFs have been developed for many of the COPCs. This section provides a brief description of these parameters.

8.3.3.1 Reference Doses

The RfDs are developed for chronic and/or subchronic human exposure to chemicals and are based solely on the noncarcinogenic effects of chemical substances. These values are defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of adverse effects during a lifetime. The RfD is expressed as dose per unit body weight per unit time (mg/kg/day). For the inhalation route, an RfC was utilized. The RfC is expressed as milligrams per cubic meter (mg/m^3). Quantitative indices of toxicity are presented in Table 8-5 for the identified COPCs for both the 2008 Revised Original HHRA and the 2010 Disturbed Soil Sampling Investigation HHRA.

8.3.3.2 Carcinogenic Slope Factors

CSFs are used to estimate an upper bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (USEPA, 1989). This factor is reported in units of proportion (of a population) affected per mg/kg/day and is derived through an assumed low-dosage, linear multistage model and an extrapolation from high to low dose-responses determined from animal studies. The slope factor represents the upper 95th percent confidence limit on the increased cancer risk from a lifetime exposure to an agent. CSFs can also be derived from USEPA promulgated unit risk values for air and/or water. CSFs derived from unit risks cannot, however, be applied to environmental media other than the medium considered in the unit risk estimate. For the inhalation route, an IUR was utilized. The IUR is expressed as the inverse of micrograms per cubic meter $(\mu g/m^3)^{-1}$.

Slope factors are also accompanied by weight-of-evidence classifications, which designate the strength of the evidence that the COPC is a potential human carcinogen.

Quantitative indices of toxicity and USEPA weight-of-evidence classifications are presented in Table 8-5 for the identified COPCs for both the 2008 Revised Original HHRA and the 2010 Disturbed Soil Sampling Investigation HHRA.

The hierarchy (USEPA, 2003) for choosing these toxicity values was:

- Tier 1 – Integrated Risk Information System (IRIS) (USEPA, 2011a)
- Tier 2 – USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) (database of values developed on a chemical-specific basis when requested by USEPA's Superfund program)
- Tier 3 – Other Toxicity Values (includes additional USEPA and non-USEPA sources of toxicity information)

IRIS is the generally preferred source of human health toxicity values. IRIS generally contains RfDs, RfCs, CSFs, drinking water unit risk values, and IUR values that have gone through a peer review and USEPA consensus review process. IRIS normally represents the official Agency scientific position regarding the toxicity of the chemicals based on the data available at the time of the review.

The second tier is USEPA's PPRTVs. Generally, PPRTVs are derived for one of two reasons. First, the Superfund Health Risk Technical Support Center (STSC) reviews the toxicity values in the Health Effects Assessment Summary Table (HEAST) (USEPA, 1997b), which is now a Tier 3 source. As the reviews are completed, those toxicity values will be removed from HEAST, and any new toxicity value developed in such a review becomes a PPRTV and placed in the PPRTV database. Second, Regional Superfund Offices may request a PPRTV for contaminants lacking a relevant IRIS value. The STSC uses the same methodologies for both situations.

The third tier includes other sources of information. These sources should provide toxicity information based on similar methods and procedures as those used for Tiers 1 and 2, contain values which are peer reviewed, are available to the public, and are transparent about the methods and processes used to develop the values. Tier 3 sources include, but are not limited to, the following:

- The California Environmental Protection Agency (Cal EPA) toxicity values;
- The Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels; and
- HEAST toxicity values.

8.3.3.3 Dermal Absorption Efficiency

The following discussion is presented to provide general information regarding the use of administered dose to estimate absorbed dose when assessing potential dermal exposures. Many of the RfDs and CSFs are derived from oral toxicological studies based on administered dose, and do not account for the amount of a substance that can penetrate exchange boundaries after contact (e.g., absorbed dose). As a result, there is very little information available regarding dermal toxicity criteria. Therefore, in order to account for a difference in toxicity between an administered dose and an absorbed dose, the RfDs and CSFs (that were based on an administered dose) were adjusted, as described by the USEPA (USEPA, 1989), using experimentally-derived oral absorption efficiencies. The adjustment for the oral RfD that would correspond to a dermally absorbed dose is represented by multiplying the RfD by an oral absorption efficiency. The adjustment for the oral CSF that would correspond to the dermally absorbed dose is represented by dividing the CSF by oral absorption efficiency. Recommended oral absorption efficiencies for those compounds/analytes with chemical-specific dermal absorption factors were obtained from RAGS Part E (USEPA, 2004). The oral absorption efficiencies were obtained from sources such as the National Center for Environmental Assessment (NCEA), IRIS, ATSDR toxicological profiles, toxicology publications, toxicology references, and USEPA Regional Offices. In some instances, published information is not available to determine the absorption efficiency. On these occasions, adjustments to the toxicity value are not conducted (e.g., an absorption efficiency of 100% was assumed) (USEPA, 2004).

8.3.3.4 Mutagenic Mode of Action Chemicals

For chemicals that USEPA has determined to be carcinogenic via a mutagenic mode of action (MMOA) (marked with an "M" in the RSL table [USEPA, 2010a]), special adjustments are applied in estimating cancer risks. The carcinogenic PAHs benzo(a)pyrene and dibenz(a,h)anthracene are listed in USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005) as having a MMOA and were selected as COPCs in SWMU 69 surface soil and total soil. USEPA's 2005 Supplemental Guidance recommends the application of generic age-dependent adjustment factors (ADAFs) to adjust cancer risk for receptors whose exposure includes early life. Additionally, it is recommended that

the ADAFs be applied to other carcinogenic PAHs when assessing early life exposure for PAHs. As such, recommended default ADAFs are incorporated in the calculation of risk for the applicable receptors for all carcinogenic PAHs selected as COPCs in this HHRA. The following ADAFs are used: 10 for age 0 to 2 years, 3 for age 2 to 16 years, and no adjustment for ages 16 and up (USEPA, 2005). These adjustments are incorporated in the risk calculations presented in Appendix J.

8.3.4 Risk Characterization

The risk characterization combines the selected COPCs, the exposure assessment, and the toxicity assessment to produce a quantitative estimate of current and future potential human health risks associated with SWMU 69. Sections 8.3.4.1 and 8.3.4.2 discuss the USEPA methodologies used for quantifying and characterizing carcinogenic and noncarcinogenic human health risks. ILCRs and Hazard Indices (HIs) are calculated to characterize potential human health effects. These terms are defined in the sections that follow. ILCRs and HIs are estimated for current and future receptors exposure scenarios that were identified in Section 8.3.2, and are discussed in Section 8.3.4.3.

8.3.4.1 Quantification and Characterization of Carcinogenic Risks

Quantitative risk calculations for potentially carcinogenic compounds estimate inferentially (versus probabilistically) the potential ILCR for an individual in a specified population. This unit of risk refers to a potential cancer risk that is above the background cancer risk in unexposed individuals. For example, an ILCR of 1 x 10^{-06} indicates that an exposed individual has an increased probability of one in one million of developing cancer subsequent to exposure, over the course of their lifetime.

The potential lifetime ILCR for an individual was estimated from the following relationship:

$$ILCR = \sum_{i=1}^{n} (CDI_i \, or DAD_i) \times CSF_i$$

Where the CSF_i is expressed as $(mg/kg/day)^{-1}$ for compound i, and the CDI_i and DAD_i is expressed as mg/kg/day for compound i. Since the units of CSF are (mg chemical/kg body weight/day) $^{-1}$ and the units of intake or dose are milligram (mg) chemical/kg body weight/day, the ILCR value is dimensionless. The aforementioned equation was derived assuming that cancer is a non-threshold process and that the potential excess risk level is proportional to the cumulative intake over a lifetime.

As put forth in RAGS Part F (USEPA, 2009), for evaluation of the inhalation pathway, the potential lifetime ILCR for an individual was estimated from the following relationship:

$$ILCR = \sum_{i=1}^{n} EC_i \times IUR_i \times 10^3 \, \mu g / mg$$

IUR is expressed as $(\mu g/m^3)^{-1}$ for compound i, and the exposure concentration (EC) is expressed in mg/m^3 for compound i. The ILCR value here is also dimensionless such that the inhalation risks can be summed with the ingestion and dermal contact risks to yield a total risk over all potential pathways.

For quantitative estimation of risk, it is assumed that cancer risks from various exposure routes are additive. Estimated ILCR values will be compared to 1 x 10^{-06} to 1 x 10^{-04}, which represents the target risk range of ILCR values considered by the USEPA to represent an acceptable (i.e., de minimis) risk (USEPA, 1990).

8.3.4.2 Quantification and Characterization of Noncarcinogenic Risks

Noncarcinogenic compounds assume that a threshold toxicological effect exists. Therefore, the potential for noncarcinogenic effects are calculated by comparing (i.e., dividing) CDI_i and DAD_i levels with RfDs for each COPC.

Noncarcinogenic effects are estimated by calculating the HQ for individual chemicals and the HI for overall chemicals and pathways by the following equation:

$$HI = \sum_{i=1}^{n} HQ_i$$

$$where: HQ_i = \frac{(CDI_i or DAD_i)}{RfD_i} \text{ (ingestion/dermal contact)}$$

and

$$HQ_i = \frac{(EC_i)}{RfC_i} \text{ (inhalation)}$$

An HQ is the ratio of the daily intake or absorbed dose to the reference dose. CDI_i is the chronic daily intake (mg/kg/day) of contaminant i; DAD_i is the dermally absorbed dose (mg/kg/day) of contaminant i, and RfD_i is the reference dose (mg/kg/day) of the contaminant i over a prolonged period of exposure. Since the units of RfD are mg/kg/day and the units of CDI/DAD are mg/kg/day, the HQ and HI are dimensionless. The RfC is expressed as mg/m^3 for compound i, and the EC is expressed in mg/m^3 for compound i. The HQ value here is also dimensionless such that the inhalation risks can be summed with the ingestion and dermal contact risks to yield a total risk over all potential pathways.

To account for the additivity of noncarcinogenic risk following exposure to numerous chemicals, the HI, which is the sum of all the HQs, will be calculated. A ratio of 1.0 is used for comparison to the HQ and HI (USEPA, 1990). Ratios less than 1.0 indicate that adverse noncarcinogenic health effects are unlikely. Ratios greater than 1.0 indicate that adverse noncarcinogenic health effects may occur at that exposure level. However, this does not mean that adverse effects will definitely occur, since the RfD incorporates safety and modifying factors to ensure that it is well below that dose for which adverse effects have been observed. This procedure assumes that the risks from exposure to multiple chemicals are additive, an assumption that is probably valid for compounds that have the same target organ or cause the same toxic effect.

8.3.4.3 Potential Human Health Effects

The estimated carcinogenic risks (i.e., ILCRs) and noncarcinogenic risks (i.e., HIs) provide a basis for site-specific risk management decisions. The conservative nature of the analysis and the uncertainty inherent in the risk assessment were considered when interpreting the results. The

uncertainty associated with the risk estimations is discussed in Section 8.3.6. These results are presented in Tables 8-6 through 8-12. All calculation spreadsheets used for estimating potential carcinogenic and noncarcinogenic risks for receptors are presented in Appendix J. RAGS Part D tables are presented in Appendix K.

Current/Future Adult and Youth Trespassers

As shown in Tables 8-6 and 8-7, the total site ILCRs calculated for the adult and youth trespassers (6.8×10^{-07} and 5.4×10^{-07}) to soil at SWMU 69 fell below USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. However, the total site HIs (1.5 for the adult trespasser and 3.2 for the youth trespasser) were greater than USEPA's target hazard level of 1.0, primarily as a result of potential exposure to vanadium in soil (approximately 99% risk contribution to the total site HI).

As shown on Table 8-6, the soil HI for the adult trespasser was 1.5, and the HI for vanadium in soil was 1.48. Similarly, as shown on Table 8-7, the soil HI for the youth trespasser was 3.17, and the HI for vanadium in soil was 3.15.

Current/Future On-Site Worker

As shown in Table 8-8, the total site ILCR for the current/future on-site worker was 3.8×10^{-06}, which is within the USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. The current/future on-site worker was evaluated for exposure to soil at SWMU 69. The total site HI (10) was greater than USEPA's target hazard level of 1.0 primarily as a result of potential exposure to vanadium in soil (approximately 99% risk contribution to the total site HI). The soil HI was 10, and the HI for vanadium in soil was 9.94.

Future Adult and Young Child Residents

As shown in Tables 8-9 and 8-10, the total site ILCRs calculated for adult and young child residential exposures (6.1×10^{-05} and 5.5×10^{-05}, respectively) to soil and groundwater at SWMU 69 were within USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. However, the total lifetime risk (1.2×10^{-04}) is greater than USEPA's target risk range. The exceedance of the total lifetime risk is primarily due to carcinogenic PAHs and arsenic in soil and arsenic in groundwater.

The total site HIs (14 for the adult and 88 for the child) were greater than USEPA's target hazard level of 1.0 primarily as a result of vanadium in soil and groundwater (greater than 91% combined risk contributions to the total site HIs for the adult and child). The HI for cobalt in groundwater (2.35) was also greater than 1.0 for the child receptor but did not contribute significantly (approximately 4%) to the total site HI. The individual HQs for adult and young child exposure to all other noncarcinogenic COPCs in soil and groundwater were less than 1.0. It should be noted that vanadium and cobalt concentrations in SWMU 69 groundwater were below corresponding background screening values.

As shown on Table 8-9, the soil HI for the adult resident was 10.01, and the HI for vanadium in soil was 9.97. The groundwater HI was 4.3, and the HI for vanadium in groundwater was 3.24. Similarly, as shown on Table 8-10, the soil HI for the young child resident was 77.21, and the HI for vanadium in soil was 76.25. The groundwater HI was 10.37, and the HI for vanadium in groundwater was 7.9. As previously mentioned, vanadium concentrations in SWMU 69 groundwater were below the background screening value.

Lead was identified as a COPC in both surface and total soil (maximum concentration detected in surface soil). As a conservative measure, potential human health risk from exposure to lead in soil was evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model for lead (USEPA, 2010d). The arithmetic mean for lead in surface soil (57.51 mg/kg) was used as the EPC, as recommended in the IEUBK guidance. The lead concentration in surface soil was used as the EPC because it was more conservative than the arithmetic mean in total soil. All other variables used in the model were default parameters recommended for use in the model when only one variable is being changed. The USEPA considers remediation necessary if a 5% probability or greater exists that the predicted child blood level will exceed 10 micrograms per deciliter (µg/dl) (a level of concern to protect sensitive populations [neonates, infants, and children]) as a result of contact with lead-containing media at the site. As shown on Figure 8-3**,** there is a less than 1% probability that the predicted child blood level will exceed 10 (µg/dl. Therefore, this indicates that exposure to lead in soil at SWMU 69 does not constitute a risk to human health.

Future Industrial/Commercial Worker

As shown in Table 8-11, the total site carcinogenic risk for the future industrial/commercial worker was 3.8×10^{-06}, which is within the USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. The total site HI (10) was greater than USEPA's target hazard level of 1.0 primarily as a result of potential exposure to vanadium in soil (approximately 99% risk contribution to the total site HI). The soil HI was 10, while the HQ for vanadium in total soil was 9.94. The individual HQs for industrial/commercial worker exposure to all other noncarcinogenic COPCs in soil were less than 1.0. As previously discussed, exposure to volatiles in groundwater via vapor intrusion was not evaluated for the future industrial/commercial worker because there were no volatiles that exceeded the generic screening levels for vapor intrusion.

Future Construction Worker

As shown in Table 8-12, the total site carcinogenic risk for the future construction worker was 6.0×10^{-07}, which falls below the USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. The construction worker was evaluated for exposures to soil and groundwater. The total site HI (20.7) was greater than USEPA's target hazard level of 1.0 primarily as a result of potential exposure to vanadium in soil (approximately 98% risk contribution to total site HI). The soil HI was 20.21, while the HI for vanadium in soil was 19.97. The individual HQs for construction worker exposure to all other noncarcinogenic COPCs in soil and groundwater were less than 1.0. Exposure to groundwater did not contribute significantly to total site risks for this receptor.

8.3.5 Comparison to Background Levels

As part of the COPC selection process, the maximum detected concentrations of metals in environmental media sampled at SWMU 69 during the 2008 CMS investigation (specifically, surface soil, total soil, and groundwater) were compared to compared to the ULMs calculated using background data sets taken from the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010), for NAPR. As previously discussed, metals were not eliminated as COPCs based on comparison to background concentrations. Therefore, it is possible that risks resulting from potential exposures to metals could represent background conditions. As such, risks associated with metals within background levels have been estimated so that the portion of the total site risk (specific to SWMU 69 and the Revised Original HHRA) that is attributable to background concentrations can be estimated and used in risk management decisions. Risks from background concentrations were calculated using

the same methodologies and exposure parameters that were used in this HHRA. Estimated risks associated with metals within background levels are presented in Appendix L.

Vanadium was detected in all media sampled at SWMU 69, and contributed predominantly to the total site HIs for all receptors. Vanadium was detected at maximum concentrations above its background screening value in total soil, while it was detected at concentrations below background in surface soil and groundwater. Table 8-13 presents a comparison of the estimated HIs for vanadium associated with background to those specific to the 2008 CMS investigation.

8.3.5.1 Soil

COPCs were selected from both surface soil (0 to 1 foot bgs) and total soil (0 to 11 feet bgs) for the soil exposure pathway evaluation for SWMU 69. EPCs were subsequently calculated for surface soil and total soil COPCs, and the higher of the two EPCs for each COPC was used in the risk calculations to produce a conservative risk estimate. Specifically, the EPC for vanadium used in the risk calculations was from total soil (since the 95% UCL for vanadium in total soil was greater than that in surface soil). Therefore, for comparison of site-specific risks to background risks from vanadium in soil, the total soil background data set for vanadium was used.

As shown in Table 8-2, the maximum detected vanadium concentration in total soil was greater than its background screening value. Vanadium was detected at 4 of 35 concentrations above its background screening value of 367 mg/kg (specifically, 390 mg/kg at 9 to 11 feet bgs in 69SB07-05, 380 mg/kg at 1 to 3 feet bgs in 69SB08-01, 460J mg/kg at 9 to 11 feet bgs in 69SB08-05, and 430 mg/kg at 9 to 11 feet bgs in 69SB27-05). All remaining total soil concentrations were less than background.

As discussed in Section 8.3.4.3 and shown in Tables 8-6 through 8-12, the total soil HIs exceeded USEPA's acceptable hazard level of 1.0 for all receptor scenarios. These exceedances were due primarily to potential exposure to vanadium in SWMU 69 total soil. However, as shown in Table 8-13, potential exposure to background levels of vanadium contributed approximately 99% of the risk from exposure to SWMU 69 total soil for all receptors. As such, the difference between the site-specific HI and background vanadium HI is below USEPA's acceptable hazard value of 1.0 in all cases. Therefore, the contribution of risks from vanadium in SWMU 69 total soil to overall risk from site-related activities is below the target hazard level.

8.3.5.2 Groundwater

As shown in Table 8-3, the maximum detected total vanadium concentration in groundwater (6.9 µg/L) was well below its background screening value (485 µg/L). As discussed in Section 8.3.4.3 and shown in Tables 8-9 and 8-10, the groundwater HIs were greater than USEPA's target hazard level of 1.0 for the future residential receptor scenarios primarily as a result of potential exposure to total vanadium in groundwater.

As shown in Table 8-13, the background-specific vanadium HIs were greater than the site-specific vanadium HIs for the adult and child resident receptors scenarios. Therefore, 100% of the HIs for vanadium in SWMU 59 groundwater can be attributed to background, and the contribution to overall risks attributable to site-related impacts is below the target hazard level.

8.3.6 Sources of Uncertainty

Uncertainties are encountered throughout the risk assessment process. This section discusses the sources of uncertainty inherent in the following elements of the HHRA performed for SWMU 69:

- Sampling and analysis
- Selection of COPCs
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Comparison to background levels

Table 8-14 summarizes the potential effects of certain uncertainties on the estimation of human health risks. Uncertainties associated with this risk assessment are discussed in the following paragraphs.

8.3.6.1 Sampling and Analysis

The development of a risk assessment depends on the reliability of, and uncertainties associated with, the analytical data available to the risk assessor. These, in turn, are dependent on the operating procedures and techniques applied to the collection of environmental samples in the field and their subsequent analyses in the laboratory. To minimize the uncertainties associated with sampling and analysis at SWMU 69, USEPA-approved sampling and analytical methods were employed. Samples were taken from locations specified in the approved Work Plan along with the necessary QA/QC samples. The data were validated and found to meet the data quality objectives and all validation criteria.

Analytical data are limited by the precision and accuracy of the methods of analysis, which are reflected by the relative percent difference of duplicate analyses and the percent recovery of spikes, respectively. In addition, the statistical methods used to compile and analyze the data (mean concentrations, detection frequencies) are subject to the overall uncertainty in data measurement. Furthermore, chemical concentrations in environmental media fluctuate over time and with respect to sampling location. Analytical data must be sufficient to consider the temporal and spatial characteristics of contamination at the site with respect to exposure.

Uncertainty exists also in the fact that contamination may or may not be fully delineated. And so, having a complete data set impacts the representativeness of exposure concentrations derived from the data.

8.3.6.2 Selection of COPCs

Soil and groundwater COPCs were selected based on comparisons of the maximum detected concentration with USEPA RSLs for residential soil (surface and total soil) and tapwater (groundwater). The application of the residential RSL values to soil and groundwater COPC selections provide a list of COPCs that are very conservative for NAPR and specifically, SWMU 69. Although future on-site residential land use was conservatively used for screening criteria, it is not considered reasonably anticipated at SWMU 69. It is assumed that long-term plans for the facility (continued use of the area as an airfield by the Puerto Rico Ports Authority) would be similar to those that had been in place prior to closure with land use also generally the same.

The RSLs were derived using conservative, USEPA-promulgated default values, and the most recent toxicological criteria available. RfDs and CSFs have been combined with "standard" exposure scenarios to calculate the RSLs. Actual exposure scenarios and parameters may differ from those used to calculate the RSL. All noncarcinogenic RSLs were divided by 10 to account for potential additive effects. This adjustment corresponds to assuming an HQ of 0.1, rather than 1.0. This adds additional conservatism to the COPC selection process.

COPC selection is based on the detected concentrations of analytes, not their detection limits. This criterion introduces some uncertainty when analytes in site-specific environmental media have maximum detection limits in excess of the RSLs. For SWMU 69, the only analyte with a maximum detection limit above its RSL is total and dissolved arsenic in groundwater (see Table 8-3). In the case of arsenic, the detection limits of all of the samples exceed the tapwater RSL. In other words, conventional analytical techniques cannot produce detection levels less than the RSL for this analyte. Although it cannot be ascertained if arsenic was in fact present or not in some of the samples, the uncertainty added to the HHRA is minimized by the fact that the maximum detected concentration of arsenic was quantitatively evaluated.

8.3.6.3 Exposure Assessment

In performing exposure assessments, uncertainties arise from two main sources. First, uncertainties arise in estimating the fate of a compound in the environment, including estimating release and transport in a particular environmental medium. Second, uncertainties arise in the estimation of chemical intakes resulting from contact by a receptor with a particular medium.

To estimate an intake, certain assumptions must be made about exposure events, exposure durations, and the corresponding assimilation of constituents by the receptor. Exposure parameters have been generated by the scientific community and have been reviewed by the USEPA. The USEPA has published an Exposure Factors Handbook (USEPA, 1997a), which contains the best and latest values. These exposure parameters have been derived from a range of values generated by studies of limited numbers of individuals. It is assumed that all potential receptors remain on or near the site throughout the exposure periods and that their exposures to chemicals from the site are all uniform. In all instances, values used in this risk assessment, scientific judgments, and conservative assumptions agree with those of the USEPA.

The use of a RME approach, designed to avoid underestimating daily intakes, was employed throughout this risk assessment. The use of 95% UCL estimates of the arithmetic mean versus maximum values as the concentration term in estimating the CDI or DAD for soil exposure scenarios reduces the potential for underestimating exposure. In some cases, the data did not support the calculation of a 95% UCL due to an insufficient number of samples in the data set or a low frequency of detection. In those instances, the maximum detected concentration was used as the EPC. While it is not ideal to use a single data point to represent average intake, use of the maximum COPC concentration does err on the side of conservatism.

As discussed in Section 8.3.2.5, in the absence of USEPA Region II-specific guidance on dermal ABS for metals, an ABS of 0.01 was assumed for all metals in soil except for arsenic and cadmium. However, as acknowledged in RAGS Part E, there is a great deal of uncertainty associated with the evaluation of the dermal contact pathway for potential exposure to metals. RAGS Part E states that for metals, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value (USEPA, 2004). However, the guidance does allow for quantitative evaluation using default ABS values as an

interim measure as long as uncertainties are presented and discussed. Therefore, in order to maintain a conservative approach and to account for dermal contact exposure pathway, an ABS value greater than zero (0) was assumed. Under this conservative assumption, risk estimates from dermal exposure to vanadium were responsible for a large percentage of the elevated HIs for soil. This is likely an overestimate of the true risk, since the dermal exposure pathway is assumed by USEPA guidance to more reasonably contribute only a small percentage to the total HI.

8.3.6.4 Toxicological Assessment

In making quantitative estimates of the toxicity of varying dosages of compounds to human receptors, uncertainties arise from two sources. First, data on human exposure and the subsequent effects are usually insufficient, if they are at all available. Human exposure data usually lack adequate concentration estimations and suffer from inherent temporal variability. Therefore, animal studies are often used and new uncertainties arise from the process of extrapolating animal results to humans. Second, to obtain observable effects with a manageable number of experimental subjects, high doses of a compound are often used. In this situation, a high dose means that high exposures are used in the experiment with respect to most environmental exposures. Therefore, when applying the results of the animal experiment to human exposures, the effects at the high doses must be extrapolated to approximate effects at lower doses.

In extrapolating effects from high doses in animals to low doses in humans, scientific judgment and conservative assumptions are employed. In selecting animal studies for use in dose-response calculations, the following factors are considered:

- Studies are preferred where the animal closely mimics human pharmacokinetics.
- Studies are preferred where dose intake most closely mimics the intake route and duration for humans.
- Studies are preferred which demonstrate the most sensitive response to the compound in question.

For compounds believed to cause threshold effects (i.e., noncarcinogens), safety factors are employed in the extrapolation of effects from animals to humans and from high doses to low doses. In deriving carcinogenic potency factors, the 95% UCL value is promulgated by the USEPA to prevent underestimation of potential risk.

All potential toxic endpoints for human receptors have been addressed to the extent allowed by the data evaluated from the most recent toxicological/epidemiological studies used to derive the cancer slope factors and reference doses. Therefore, any uncertainties associated with toxic endpoints are directly correlated to the information obtained from, and reliability of those studies.

As noted in Section 8.3.4, potential exposure to vanadium in site media comprised almost 100% of the total site risk. The vanadium oral RfD (7.0×10^{-5} mg/kg-day) presented on the USEPA RSL table (USEPA, 2010a) and used in this baseline HHRA is a very conservative value. Few human data are available with which to gauge the toxicity of vanadium via ingestion, and in rodents, orally administered vanadium has low obvious toxicity (ATSDR, 2009). It is important to note that there are no toxicity criteria for vanadium published in IRIS (USEPA, 2011a). The oral RfD presented on the USEPA RSL table (USEPA, 2010a) is a PPRTV, which is the second tier in USEPA's hierarchy of resources for toxicity criteria. While PPRTVs are reviewed by the

STSC, they have not undergone the full USEPA peer review/consensus review vetting process. While the use of such values is suitable for calculation of screening values (i.e., RSLs), they are not always appropriate for use in a baseline risk assessment. However, in order to allow for the evaluation of vanadium concentrations in SWMU 69 and NAPR background media, the PPRTV RfD for vanadium was used. The use of such a toxicity value in a baseline risk assessment is very conservative and likely overestimates risk.

Di-n-octyl phthalate in surface soil and total soil was also retained as a COPC because there were no screening criteria for that chemical. There were also no toxicity criteria with which to quantitatively evaluate potential exposure. However, it is not likely that this would underestimate risk because the majority of COPCs have very conservative toxicity criteria and were evaluated quantitatively. Furthermore, this HHRA uses conservative exposure parameters to quantitatively evaluate potential exposure to site-related COPCs.

8.3.6.5 Risk Characterization

The risk characterization bridges the gap between potential exposure and the possibility of systemic or carcinogenic human health effects, ultimately providing impetus for the remediation of the site or providing a basis for no remedial action.

Uncertainties associated with risk characterization include the assumption of chemical additivity and the inability to predict synergistic or antagonistic interactions between COPCs. These uncertainties are inherent in any inferential risk assessment. USEPA promulgated inputs to the quantitative risk assessment and toxicological indices are calculated to be protective of the human receptor and to err conservatively, so as to not underestimate the potential human health risks.

8.3.6.6 Comparison to Background Levels

As previously discussed, inorganics were not eliminated as COPCs based on comparison to background concentrations. Therefore, it is possible that risks presented from metals could represent background conditions rather than site-related. In particular, vanadium was detected in all media sampled at SWMU 69 during the 2008 CMS investigation. Vanadium was the primary risk driver for all receptors evaluated in the Revised Original HHRA.

As discussed in Section 8.3.1.2.3, vanadium concentrations in surface soil and groundwater were less than corresponding background screening values. Vanadium concentrations in total soil did exceed corresponding background screening values, but for each medium it was only one concentration (specifically, the maximum) that exceeded background.

Furthermore, as demonstrated in Section 8.3.5, the site-specific risks calculated for vanadium in SWMU 69 groundwater were less than those calculated from background concentrations. Site-specific risks calculated for vanadium in SWMU 69 soil were slightly greater than those calculated for background concentrations. However, the differences between the site-specific and background HIs were well below USEPA's target hazard level of 1.0 and as such, the contribution of risks from vanadium in SWMU 69 soil to overall risk from site-related activities is below the target hazard level.

Based on the rationale presented above, it is likely that site-related risks from exposure to vanadium are overestimated.

8.3.7 Summary and Conclusions of the Revised Original HHRA (2008 Data)

The risk assessment evaluated the exposure of potential receptor populations including adult and youth trespassers, adult on-site worker, adult and child residents, industrial/commercial workers, and construction workers to soil and groundwater data obtained from the 2008 CMS investigation.

The cumulative carcinogenic risk for each medium for the adult and child residential receptors calculated were within USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. However, the total lifetime carcinogenic risk (sum of the cumulative carcinogenic risks for the adult and child receptors) for the future residential receptor exceeded the range. The exceedance of the total lifetime risk for the future residential receptor is primarily due to carcinogenic PAHs and arsenic in soil and arsenic in groundwater. As previously discussed, future residential land use was used to evaluate unrestricted land use at SWMU 69 and provide the most conservatively protective risk estimation, although it is highly unlikely that housing would be built on this site.

Noncarcinogenic risks were greater than the USEPA's target hazard level for the future residential adult and child primarily due to vanadium in soil and groundwater. Although SWMU 69 total site HIs were greater than USEPA's target level of 1.0, after refinement of total site risks addressing the contribution of background vanadium levels, 100% of the site-specific risks from vanadium in groundwater can be attributed to background. In the case of exposure to soil, potential exposure to background levels of vanadium contributed approximately 99% of the risk. Therefore, vanadium concentrations in soil are also considered representative of background and not site-related. The HI for cobalt in groundwater was also greater than 1.0 for the child receptor but did not contribute significantly (less than 3%) to the total site HI. It is also important to note that potable use of SWMU 69 groundwater is a very conservative risk estimation measure. Groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007), and this is not expected to change in the future. Therefore, consumption of this groundwater is not expected to occur. For these reasons and the fact that the site will remain industrial, no human health COCs are identified, and no further actions are recommended for site media based on risk to future residential receptors.

The estimated carcinogenic risks from all media were within or below USEPA's target risk range for the remaining receptors (i.e., current/future trespassers, current/future on-site workers, future construction workers, and future industrial/commercial workers). However, noncarcinogenic risks were greater than target limits for these receptors primarily due to vanadium in soil. Potential exposure to vanadium in soil was the primary driver for risk to the adult and youth trespassers, adult on-site workers, construction workers, and industrial/commercial workers. After refinement of total site risks addressing the contribution of background vanadium levels, 99% of the site-specific risks from vanadium can be attributed to background. Therefore, vanadium concentrations in soil are considered representative of background and not site-related. There were no carcinogenic or noncarcinogenic risks calculated that exceeded USEPA's target risk range/hazard level from groundwater exposure for the future construction worker receptor. For these reasons, no human health COCs are identified, and no further actions are recommended for site media based on risk to trespassers, on-site workers, construction workers, and industrial/commercial workers.

8.4 2010 Disturbed Soil Sampling Investigation HHRA

This section describes the changes in site conditions subsequent to the 2008 CMS field investigation, updates the CSM, and presents the results of the 2010 Disturbed Soil Sampling Investigation HHRA.

As discussed in Sections 1.0 and 2.3 of this report, following the 2008 CMS field investigation at SWMU 69, in support of the conversion of the airfield to a commercial facility, significant areas of soil up to a depth of 24 inches bgs associated with site were disturbed by contractors. Based on observations made October 2, 2008, the vegetation along the eastern and southern sides of the apron was disturbed, a trench was dug approximately 10 feet off the eastern and southern edges of the concrete, some scraping of surface soils was apparent, some of the scraped soils were pushed down slope away from the apron towards the southern drainage ditch, and scraped soil piles were present at various locations within the site. The altered site conditions made possible the migration of soil into the drainage ditches and further downgradient.

In 2008, the drainage area was dry and overgrown with terrestrial plant species and showed no indication of hydric soils or hydrophytic vegetation. However, in 2010, an accumulation of water at the headwaters of the ditch system was noted, apparently caused by vegetative debris that impedes flow in the channel. This is likely the result of the cessation of maintenance activities within the drainage ditch and resulting blockage of culverts by vegetation.

8.4.1 Selection of Chemicals of Potential Concern

8.4.1.1 Data Evaluation

The data used in the 2010 Disturbed Soil Sampling Investigation HHRA are presented in full in Appendix G and discussed in the paragraphs below. A statistical analysis, including the minimum, maximum, mean, standard deviation and 95% UCL, was run for applicable data sets (i.e., soil and sediment COPCs). The statistical summary of data used in the 2010 Disturbed Soil Sampling Investigation HHRA is located in Appendix H. Data used in this HHRA were managed as discussed in Section 8.3.1.1.

A disturbed soil sampling investigation was conducted from August 3, 2010 to August 6, 2010 (surface and subsurface soil collection) and on November 5, 2010 (sediment collection). The investigation focused on recharacterization of the site following disturbances to soil in 2008, which resulted in the retraction of the Draft CMS on December 3, 2008. The 2010 Disturbed Soil Sampling Investigation HHRA is based upon the data collected from this investigation and represents baseline conditions subsequent to soil disturbance.

A total of fifty-two surface soil samples (designated 69SB101-00 through 69SB152-00; collected from the 0.0 to 1.0-foot depth interval) and one hundred four subsurface soil samples (designated 69SB101-01 through 69SB152-01 and 69SB101-02 through 69SB152-02; from the 1.0 to 2.0-foot and 2.0 to 3.0-foot depth intervals, respectively) were collected. Fourteen drainage ditch sediment samples (designated 69SD01 through 69SD14) were collected from the portion of the drainage ditch within the SWMU boundary, depicted on Figure 4-2. All soil and sediment samples were analyzed for Appendix IX metals.

It should be noted that 2008 groundwater data and 2008 subsurface soil data from below 24 inches bgs (except 69SB27) are included in the 2010 Disturbed Soil Sampling Investigation HHRA to present a total site risk. These data are considered applicable to the 2010 HHRA based

on the following rationale. Documentation indicates that soil was disturbed up to 24 inches bgs. As such, groundwater, encountered at approximately 10 feet bgs, would not have been affected by the soil disturbance activities and represents the most recent, usable data with which to evaluate current site conditions. Similarly, subsurface soil from below 24 inches bgs would not have been affected by the soil disturbance activities. Therefore, it is included with the 2010 data to better approximate a total soil column of 0 to 11 feet bgs.

Boring 69SB27 (2008 investigation) was located outside of the disturbed area south of the expanded concrete apron area on the other side of the drainage ditch and was not included in the 2010 Disturbed Soil Sampling Investigation HHRA. One surface soil sample and two subsurface soil samples (1-3 feet bgs and 9-11 feet bgs) were collected from this location in 2008. In addition, surface soil samples 69SB01, 69SB02, and 69SB03 (2008 investigation) were located within the disturbed area adjacent to the eastern end of the expanded concrete apron and were not included in the 2010 Disturbed Soil Sampling Investigation HHRA. These three locations were not re-sampled in 2010 since they were outside of the area proposed for excavation in the CMS prior to disturbance of the site. Analytical results from 69SB01, 69SB02, 69SB03, and 69SB27 indicate that contamination is not present. Although low levels of PAHs and metals were detected in one or more of the soil samples, the concentrations are not such that they would alter the magnitude of the exposure point concentrations used in the HHRA. Therefore, the re-inclusion of these data would have no effect on the overall outcome of the HHRA.

8.4.1.2 COPC Selection

8.4.1.2.1 COPC Selection Criteria

COPC selection methodology is as described in Section 8.3.1.2.2. The USEPA November 2011 RSLs (USEPA, 2011b) were used as the primary risk-based screening criteria. Constituents identified in soil and sediment are compared to residential soil RSLs. It should be noted that although future on-site residential land use was conservatively used for screening criteria, it is not considered reasonably anticipated at SWMU 69. Sample concentrations for metals in airfield surface soil, total soil, and freshwater drainage ditch sediment were compared to the ULMs calculated using background data sets taken from the Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010) and following the same methodologies used in the data analyses for the HHRA (e.g., treatment of duplicate samples). As previously discussed, the background comparison is presented as part of the COPC selection for convenience; no metals were eliminated from the risk evaluation based on comparison to background screening concentrations. Surrogate chemicals presented in Section 8.3.1.2.2 were used as appropriate.

8.4.1.2.2 Selection of COPCs

The following paragraphs present the rationale for selection of COPCs. Tables 8-15 through 8-17 present the selection of COPCs for the 2010 Disturbed Soil Sampling Investigation HHRA.

Surface Soil

The data and COPC selection summary for surface soil samples collected at SWMU 69 during 2010 disturbed soil sampling investigation are presented in Table 8-15. The spatial extent of surface soil COPC concentrations greater than residential soil SLs is depicted on Figure 8-4. Note that only those detected concentrations exceeding corresponding residential soil SLs are

shown on the figure (i.e., those COPCs retained based on lack of screening/toxicity criteria are not included).

Arsenic, cobalt, thallium, and vanadium were detected in surface soil at concentrations exceeding corresponding residential soil RSLs and were retained as surface soil COPCs. Detected concentrations of arsenic, cobalt, and vanadium exceeded corresponding background screening concentrations. All detected concentrations of thallium were less than the background concentration.

Total Soil

The surface soil (0-1 foot bgs) and subsurface soil (1-11 feet bgs) data sets from the 2010 disturbed soil sampling investigation plus subsurface soil greater than 24 inches bgs from the 2008 CMS investigation were combined to create one total soil column (0-11 feet bgs) data set. The data and COPC selection summary for total soil samples are presented in Table 8-16. The spatial extent of surface soil COPC concentrations greater than residential soil SLs is depicted on Figure 8-5. Note that only those detected concentrations exceeding corresponding residential soil SLs are shown on the figure (i.e., those COPCs retained based on lack of screening/toxicity criteria are not included).

Arsenic, cobalt, thallium, and vanadium were detected in total soil at concentrations exceeding corresponding residential soil RSLs and were retained as total soil COPCs. Detected concentrations of arsenic, cobalt, and vanadium exceeded corresponding background screening concentrations. All detected concentrations of thallium were less than the background concentration.

Groundwater

Table 8-17 summarizes the COPC selection (as compared with the November 2011 RSLs) performed for constituents detected in groundwater samples collected at SWMU 69. The spatial extent of groundwater COPC concentrations greater than tapwater RSLs is depicted on Figure 8-1. It is not expected that groundwater conditions were affected by the soil disturbances. Note that only those detected concentrations of total inorganics exceeding corresponding tapwater RSLs are shown on the figure.

Of the unfiltered (total) inorganic constituents detected in groundwater, arsenic, barium, and cobalt were retained as COPCs since the detected concentrations exceeded the corresponding tapwater RSL. Arsenic, barium, and cobalt were detected at concentrations below corresponding background screening concentrations. Table 8-17 also shows that there is a good correlation between the total and dissolved groundwater analytical results.

Sediment

The data and COPC selection summary for sediment samples collected at SWMU 69 during 2010 disturbed soil sampling investigation are presented in Table 8-18. The spatial extent of sediment COPC concentrations greater than residential soil SLs is depicted on Figure 8-6. Note that only those detected concentrations exceeding corresponding residential soil SLs are shown on the figure (i.e., those COPCs retained based on lack of screening/toxicity criteria are not included).

Arsenic, cadmium, cobalt, thallium, and vanadium were detected in total soil at concentrations exceeding corresponding residential soil RSLs and were retained as sediment COPCs. Lead was

detected at a maximum concentration exceeding its residential soil action level and was retained as sediment COPC. Detected concentrations of arsenic, cadmium, lead, and vanadium exceeded corresponding background screening concentrations. All detected concentrations of cobalt and thallium were less than corresponding background concentrations.

8.4.1.2.3 Summary of COPCs

- *Surface Soil*: Arsenic, cobalt, thallium, and vanadium.
- *Total Soil*: Arsenic, cobalt, thallium, and vanadium.
- *Groundwater:* Arsenic, barium, and cobalt.
- *Sediment*: Arsenic, cadmium, cobalt, lead, thallium, and vanadium.

8.4.2 Exposure Assessment

8.4.2.1 Potential Human Receptors

Exposure assessment methodologies are described in Section 8.3.2. Based on updated information regarding the physical features subsequent to the soil disturbance activities, the same seven potential human receptors (refer to Section 8.3.2.1) were selected for evaluation in the 2010 Disturbed Soil Sampling Investigation HHRA. The exposure pathways described in Section 8.3.2.1 were retained for quantitative evaluation in this HHRA. In addition to the exposure pathways described in Section 8.3.2.1, potential exposures to sediment were evaluated for adult on-site workers that may perform maintenance or groundskeeping activities at SWMU 69 and adult and/or youth trespassers that may gain access to the site now or in the future. Potential exposures to sediment were also conservatively evaluated for future residents. As previously discussed, 2008 groundwater data and 2008 subsurface soil data from below 24 inches bgs are included in the 2010 HHRA to present a total site risk. In summary, the following potential human exposure receptors and exposure pathways were retained for quantitative evaluation in the 2010 Disturbed Soil Sampling Investigation HHRA.

Current/Future On-Site Adult and Youth (Ages 6-16 Years) Trespassers

- Ingestion of Soil and Sediment
- Dermal Contact with Soil and Sediment
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Current/Future On-Site Adult On-Site Workers

- Ingestion of Soil and Sediment
- Dermal Contact with Soil and Sediment
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Adult and Young Child (Ages 1-6 Years) Residents

- Ingestion of Soil, Sediment, and Groundwater
- Dermal Contact with Soil, Sediment, and Groundwater
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Adult Industrial/Commercial Workers

- Ingestion of Soil and Groundwater

- Dermal Contact with Soil
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Construction Workers

- Ingestion of Soil, Sediment, and Groundwater
- Dermal Contact with Soil, Sediment, and Groundwater
- Inhalation of Fugitive Dusts/Volatiles from Soil

The revised conceptual site model depicting the 2010 Disturbed Soil Sampling Investigation HHRA is presented in Figure 8-7. Potential chemical release mechanisms from affected media include transport of chemicals associated with historical hazardous material spills to the surface of the aircraft parking apron and expanded aircraft parking apron via surface run-off to surface and subsurface soil. Contaminated surface and subsurface soil also represent potential sources for the release of chemicals to downgradient surface soil, subsurface soil, and groundwater, as well as surface water and sediment within the drainage ditch. Potential contaminant release mechanisms also include leaching to underlying groundwater and advective transport in the direction of groundwater flow. Potentially affected media at SWMU 69 may include one or more of the following: surface and subsurface soil, groundwater, sediment.

8.4.2.2 Data Analysis

ProUCL Version 4.00.05 (current at the time the calculations were performed) was used in this HHRA to calculate 95% UCLs. The 95% UCL on the mean concentration was used as the EPC for each COPC as described in Section 8.3.2.4. It should be noted that the maximum detected concentration was identified as the EPC for thallium in the surface soil and sediment data sets because there were less than four detections in the data sets. However, thallium was not quantitatively evaluated due to lack of toxicity criteria (refer to Section 8.4.6.1 for additional discussion). For the soil exposure pathway evaluation for SWMU 69, the EPCs for each COPC were selected as described in Section 8.3.2.4. Ambient air concentrations used as EPCs were modeled based on the measured soil concentrations when evaluating inhalation exposures to particulates in air, and the site-specific PEF was calculated as described in Section 8.3.2.4.

The computational output from the ProUCL calculations performed for each COPC is presented in Appendix H. The equations for estimating intakes due to direct exposures to site-related chemicals for the various identified pathways are presented in Appendix I. The calculation of the site-specific PEF is included in Appendix J (Risk Calculation Spreadsheets).

It should be noted that estimated concentrations also were used to calculate the 95% UCL, such as "J" qualified (estimated) data. Reported concentrations qualified with an "R" (rejected) were not used in the statistical evaluation. For further discussion of data qualifications specific to this investigation, laboratory data validation summaries can be found in Section 6.4 of this report.

8.4.2.3 Exposure Input Parameters

Exposure parameters used in the 2010 Disturbed Soil Sampling Investigation HHRA are provided in Table 8-4. In addition to the exposure parameters for soil and groundwater used the Revised Original HHRA, those specific to sediment exposure are listed in Table 8-4. The IRs and skin surface areas for sediment were those used soil for each receptor (refer to Section 8.3.2.5). An AF of 0.3 mg/cm^2 was used for sediment and is based on contact with wet sediment (VDEQ, 2011). Dermal absorption values were applied as discussed in Section 8.3.2.5. Other parameters

(e.g., body weight, exposure duration, exposure frequency, and averaging times) applied across all media were used in the sediment exposure evaluation. Also, the future adult industrial/commercial worker was evaluated for potential exposure to groundwater via ingestion at a rate of 1 liter of groundwater per work day. The exposure parameters associated with this scenario are included in Table 8-4.

8.4.3 Toxicity Assessment

Quantitative indices of toxicity (i.e., RfDs, RfCs, CSFs, IURs) are presented in Table 8-19 for the COPCs identified for the 2010 Disturbed Soil Sampling Investigation HHRA.

8.4.4 Risk Characterization

USEPA methodologies used for quantifying and characterizing carcinogenic and noncarcinogenic human health risks are discussed in Sections 8.3.4.1 and 8.3.4.2. ILCRs and HIs are estimated for current and future receptors exposure scenarios that were identified in Section 8.4.2 for the 2010 Disturbed Soil Sampling Investigation HHRA. The conservative nature of the analysis and the uncertainty inherent in the risk assessment were considered when interpreting the results. The uncertainty associated with the risk estimations from the 2010 Disturbed Soil Sampling Investigation HHRA is discussed in Section 8.4.6. These results are presented in Tables 8-20 through 8-26 and discussed below. All calculation spreadsheets used for estimating potential carcinogenic and noncarcinogenic risks for receptors are presented in Appendix J. RAGS Part D tables are presented in Appendix K.

Current/Future Adult and Youth Trespassers

As shown in Tables 8-20 and 8-21, the total site ILCRs calculated for the adult and youth trespassers (8.9×10^{-07} and 5.9×10^{-07}) exposure to soil and sediment at SWMU 69 fell below USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. The total site HIs calculated for the adult and youth trespassers (0.06 and 0.09) were also below the USEPA target level of 1.0.

Current/Future On-Site Worker

As shown in Table 8-22, the total site ILCR for the current/future on-site worker was 4.2×10^{-06}, which is within the USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. The current/future on-site worker was evaluated for exposure to soil and sediment at SWMU 69. The total site HI (0.28) was less than USEPA's target hazard level of 1.0.

Future Adult and Young Child Residents

As shown in Tables 8-23 and 8-24, the total site ILCRs calculated for adult and young child residential exposures (1.1×10^{-05} and 1.1×10^{-05}, respectively) to soil, groundwater, and sediment at SWMU 69 were within USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. The total lifetime risk (2.2×10^{-05}) for the future resident is also within the USEPA's target risk range.

The total site HIs (1.4 for the adult and 4.6 for the child) were greater than USEPA's target hazard level of 1.0 primarily as a result of total cobalt in groundwater. The individual HQs for adult and young child exposure to all other noncarcinogenic COPCs in soil, sediment, and groundwater were less than 1.0. As previously noted, cobalt concentrations in SWMU 69 groundwater were below the background screening value.

As shown on Table 8-23, the soil HI for the adult resident was 0.18. The groundwater HI was 1.14 (note that the HI for cobalt in groundwater was 1.01). The sediment HI was 0.03. Similarly, as shown on Table 8-24, the soil HI for the young child resident was 1.67. However, the contributing chemicals, arsenic, cobalt, thallium, and vanadium, each had individual HQs less than 1.0 (0.14, 0.54, 0.42, and 0.57 respectively). The groundwater HI was 2.67 (note that the HI for cobalt in groundwater was 2.35). As previously mentioned, cobalt concentrations in SWMU 69 groundwater were below the background screening value. The sediment HI was 0.27.
Lead was identified as a COPC in sediment. As a conservative measure, potential human health risk from exposure to lead in sediment was evaluated using the IEUBK Model for lead (USEPA, 2010d). The arithmetic mean for lead in sediment (116 mg/kg) was used as the EPC, as recommended in the IEUBK guidance. As there is not a separate module with which to evaluate lead in sediment in the IEUBK Model, the sediment EPC was entered into the soil lead exposure module. All other variables used in the model were default parameters recommended for use in the model when only one variable is being changed. The USEPA considers remediation necessary if a 5% probability or greater exists that the predicted child blood level will exceed 10 µg/dl (a level of concern to protect sensitive populations [neonates, infants, and children]) as a result of contact with lead-containing media at the site. As shown on Figure 8-8**,** there is a less than 1% probability that the predicted child blood level will exceed 10 µg/dl. Therefore, this indicates that exposure to lead in sediment at SWMU 69 does not constitute a risk to human health.

Future Industrial/Commercial Worker

As shown in Table 8-25, the total site carcinogenic risk for the future industrial/commercial worker was 4.9 x 10^{-06}, which is within the USEPA's target risk range of 1 x 10^{-06} to 1 x 10^{-04}. The total site HI (0.54) was less than USEPA's target hazard level of 1.0. The industrial/commercial worker was evaluated for exposures to soil and groundwater. As previously discussed, exposure to volatiles in groundwater via vapor intrusion was not evaluated for the future industrial/commercial worker because there were no volatiles that exceeded the generic screening levels for vapor intrusion.

Future Construction Worker

As shown in Table 8-26, the total site carcinogenic risk for the future construction worker was 3.6 x 10^{-07}, which falls below the USEPA's target risk range of 1 x 10^{-06} to 1 x 10^{-04}. The construction worker was evaluated for exposures to soil and groundwater. The total site HI (0.6) was less than USEPA's target hazard level of 1.0. .

8.4.5 Comparison to Background Levels

As previously discussed, metals (specific to SWMU 69 and the 2010 Disturbed Soil Sampling Investigation HHRA) were not eliminated as COPCs based on comparison to background concentrations. Therefore, it is possible that risks presented from metals could represent background conditions.

8.4.5.1 Soil

COPCs were selected from both surface soil (0 to 1 foot bgs) and total soil (0 to 11 feet bgs) for the soil exposure pathway evaluation for the 2010 Disturbed Soil Sampling Investigation HHRA. EPCs were subsequently calculated for surface soil and total soil COPCs, and the higher of the

two EPCs for each COPC was used in the risk calculations to produce a conservative risk estimate.

Twenty-eight of fifty-two concentrations of arsenic in surface soil exceeded the airfield background screening value, while 44 of 161 concentrations of arsenic in total soil exceeding the corresponding airfield background screening value. Only one concentration of cobalt in surface soil (1/52) and total soil (1/160) exceeded the corresponding airfield background screening value. Concentrations of vanadium in surface soil exceeded airfield background screening values in 3 of 52 samples and in 15 of 159 total soil samples. Detected concentrations of thallium did not exceed the corresponding airfield background screening value.

Although concentrations of arsenic, cobalt, and vanadium in soil exceeded corresponding background screening values, site risks from these metals did not exceed USEPA's target risk criteria for the receptors evaluated in the HHRA.

8.4.5.2 Groundwater

Total arsenic, barium, and cobalt were detected in groundwater at concentrations that exceeding corresponding tapwater RSLs. As discussed in section 8.4.4, groundwater HIs were below the USEPA's target risk criteria for all receptors evaluated in the HHRA except the future adult and child residents, primarily due to cobalt. However, total arsenic, barium, and cobalt were detected at concentrations less than corresponding background screening values. Therefore, risks from these metals in SWMU 69 groundwater would also be below background risks from those metals.

8.4.5.3 Sediment

Six of fourteen concentrations of arsenic in sediment exceeded the background screening value. All cadmium concentrations (14 of 14) exceeded the corresponding background screening value. Nine of fourteen concentrations of lead exceeded the background screening value. Three of fourteen concentrations of vanadium in sediment exceeded the corresponding background screening value. No concentrations of cobalt or thallium exceeded their corresponding backgrounds screening values.

While concentrations of arsenic, cadmium, lead, and vanadium exceeded corresponding background screening values, site risks from these metals did not exceeded USEPA's target risk criteria for the receptors evaluated in the HHRA.

8.4.6 Sources of Uncertainty

Uncertainties encountered in the 2010 Disturbed Soil Sampling Investigation HHRA for SWMU 69 are essentially the same as those encountered in the Revised Original HHRA, which are discussed in Section 8.3.6 and summarized in Table 8-14. Uncertainties specific with this risk assessment are discussed in the following paragraphs.

8.4.6.1 Selection of COPCs

Sediment COPCs were selected based on comparisons of the maximum detected concentration with USEPA RSLs for residential soil. The application of the residential RSL values to sediment COPC selections provide a list of COPCs that are very conservative for NAPR and specifically, SWMU 69. Although future on-site residential land use was conservatively used for screening criteria, it is not considered reasonably anticipated at SWMU 69. It is assumed that long-term

plans for the facility (continued use of the area as an airfield by the Puerto Rico Ports Authority) would be similar to those that had been in place prior to closure with land use also generally the same.

8.4.6.2 Exposure Assessment

Surface water was not present in the drainage ditch during either the 2004 Phase II ECP investigation or the 2008 CMS investigation. As such, surface water samples were not collected and that exposure pathway was not evaluated. Surface water was subsequently observed in the drainage ditch during the 2010 Disturbed Soil Sampling Investigation but was not sampled. Surface water in the drainage ditch is a transient condition at this site and is only present during heavy precipitation events. Additionally, since the ditch drains a larger area than SWMU 69, surface water in the ditch resulting from a precipitation event is likely comingled from numerous sources. Consequently, as per the approved Final Corrective Measures Study Work Plan for SWMU 69 (Baker, 2007) and the Final Sampling Strategy for Disturbed Soil Sampling, SWMU 69 – Aircraft Parking Area (Baker, 2010), the ditch was to be characterized by collection of soil/sediment samples. Sediment samples were collected (in the southern and eastern drainage ditches) as part of the 2010 Disturbed Soil Sampling Investigation to evaluate the potential for surface soil migration into the SWMU 69 drainage ditches resulting from soil disturbance by contractors in 2008 (which occurred after the 2008 CMS field investigation) and surface runoff from the adjacent expanded apron during precipitation events. Subsequently, sediment exposure was evaluated for the trespasser, on-site worker, and residential receptor scenarios as part of the 2010 Disturbed Soil Sampling Investigation HHRA. It is not expected that this approach will underestimate risks.

8.4.6.3 Comparison to Background Levels

As previously discussed, inorganics were not eliminated as COPCs based on comparison to background concentrations. Therefore, it is possible that risks presented from metals could represent background conditions rather than site-related.

Although concentrations of arsenic, cobalt, and vanadium exceeded corresponding background screening values in surface soil and total soil, site risks from these metals did not exceed USEPA's target risk criteria for the receptors evaluated in the HHRA.

Groundwater HIs were below the USEPA target risk criteria except for the Future Adult and Future Child Resident, which was primarily due to cobalt. Total arsenic, barium, and cobalt were detected at concentrations less than background. Therefore, site risks would be below background risks.

Arsenic, cadmium, lead, and vanadium were detected at concentrations that exceeded corresponding background screening values in sediment. However, site risks from these metals did not exceed USEPA's target risk criteria for the receptors evaluated in the HHRA.

8.4.7 Summary and Conclusions of the 2010 Disturbed Soil Sampling Investigation HHRA (2010 Data)

The risk assessment evaluated the exposure of potential receptor populations including adult and youth trespassers, adult on-site worker, adult and child residents, industrial/commercial workers, and construction workers to soil and sediment data obtained from the 2010 disturbed soil

sampling investigation. As previously discussed, 2008 groundwater data and 2008 subsurface soil data from below 24 inches bgs are included in the 2010 Disturbed Soil Sampling Investigation HHRA to present a total site risk.

The total site carcinogenic risks calculated for all media for the future residential receptors were within or below USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. Noncarcinogenic risks were greater than the USEPA's target hazard level for the future resident adult and child, primarily due to cobalt in groundwater. However, the maximum concentration of cobalt detected in groundwater did not exceed the corresponding background screening value. Therefore, risk from cobalt in SWMU 69 groundwater would be below the risk from background. It should be noted that potable use SWMU 69 groundwater is a very conservative risk estimation measure. Groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007) and this is not expected to change in the future. Therefore, consumption of this groundwater is not expected to occur. It should also be noted that for the future child resident the HI for soil also exceeded the USEPA's target hazard level of 1.0. However, individual HIs for the metals identified as COPCs (arsenic, cobalt, thallium, and vanadium) were all below 1.0.

The estimated carcinogenic risks from all media were within or below USEPA's target risk range for the remaining receptors (i.e., current/future trespassers, current/future on-site workers, future construction workers, and future industrial/commercial workers). Therefore, no human health COCs are identified for soil, groundwater, or sediment, and no further actions are recommended based on risk to trespassers, on-site workers, construction workers, and industrial/commercial workers.

8.5 Combined Conclusions for 2008 and 2010 Investigations

This section summarizes the combined conclusions and recommendations of the HHRAs conducted as part of the 2008 CMS Investigation (Section 8.3) and 2010 Disturbed Soil Sampling Investigation (Section 8.4). Both HHRAs evaluated the exposure of potential receptor populations including adult and youth trespassers, adult on-site worker, adult and child residents, industrial/commercial workers, and construction workers. Future residential land use was used to evaluate unrestricted land use at SWMU 69 and provide the most conservatively protective risk estimation, although it is highly unlikely that housing would be built on this site. The airfield parcel was transferred to the Puerto Rico Ports Authority on February 7, 2008. The Ports Authority plans to continue use of the property as an airfield. Consequently, future property use of these sites is expected to remain industrial. As a result, potential human exposure is limited to industrial or commercial property use, now and in the future. It is further noted that potable use of SWMU 69 groundwater is a very conservative risk estimation measure. Groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007), and this is not expected to change in the future. Therefore, consumption of this groundwater is not expected to occur. For these reasons, no further actions are recommended for site media based on risk to future residential receptors.

One of the objectives of the Revised Original HHRA was to support the decision to limit the analysis of 2010 data to inorganics. Based on the conclusions and recommendations of the Revised Original HHRA (refer to Section 8.3.7), no human health COCs were identified, and no further actions were recommended for site media based on risk to future residential receptors. More specifically, there were no carcinogenic or noncarcinogenic risks exceeding USEPA's target risk levels for the organic COPCs. Therefore, the results of the Revised Original HHRA support the decision to limit the analysis of 2010 data to inorganics only.

Additionally, since there were no COCs identified in either the original HHRA (Baker, 2008) or the Revised Original HHRA (which incorporated updates to screening and toxicity values, exposure assessment methodologies, and exposure parameters), the final recommendations are based on the results of the 2010 Disturbed Soil Sampling Investigation HHRA (refer to Section 8.4.7). In addition to evaluating the soil and sediment data collected during the 2010 disturbed soil sampling investigation, 2008 groundwater data and 2008 subsurface soil data from below 24 inches bgs were included to present a total site risk. In summary, the total site carcinogenic risks calculated for all media for all receptors were within or below USEPA's target risk range of 1×10^{-06} to 1×10^{-04}. Noncarcinogenic risks were greater than the USEPA's target hazard level for the future resident adult and child, primarily due to cobalt in groundwater. However, the maximum concentration of cobalt detected in groundwater did not exceed the corresponding background screening value. Therefore, risk from cobalt in SWMU 69 groundwater would be below the risk from background. Noncarcinogenic risks for all other receptors evaluated were less than target limits for all media. Therefore, no human health COCs are identified for soil, groundwater, or sediment, and no further actions are recommended based on risk to trespassers, on-site workers, construction workers, and industrial/commercial workers.

8.6 Development of CAOs

The CMS process from a human health risk assessment perspective continues when potential exposure to a site is considered to pose unacceptable levels of risk and hazard and medium- and chemical-specific CAOs are calculated for comparison to the site data to determine if and where potential cleanup may occur.

CAOs are medium- and chemical-specific goals for protecting human health and the environment. The CAOs are used to focus the development of corrective measure alternatives on technologies that may achieve appropriate target levels, thereby limiting the number of alternatives analyzed.

CAOs can be general and descriptive (i.e., qualitative) or specific and numerical (i.e., quantitative). They are achieved by reducing exposure (e.g., installing a soil cover or limiting access) or by reducing contaminant levels (e.g., active remediation; USEPA, 1988). CAOs are used to evaluate which samples/areas within a site may require corrective measures, and which corrective measures alternative best protects human health and the environment.

8.6.1 Qualitative CAOs

Unrestricted land use cannot be recommended because risk estimates exceeded target limits for future residential receptors. Therefore, the recommended qualitative CAO is restricting potable use of groundwater and future residential use of the site.

8.6.2 Quantitative CAOs

It is acknowledged that risk estimates exceeded target limits for future residential receptors evaluated for exposure to environmental media at SWMU 69. However, quantitative CAOs were not developed based on a residential scenario for these reasons. Future land use of SWMU 69 is expected to remain industrial (USEPA, 2007). The future residential receptor scenario was used to evaluate unrestricted land use at SWMU 69 and provide the most conservatively protective risk estimation. Noncarcinogenic risks were greater than the USEPA's target hazard level for the future residential adult and child primarily due to cobalt in groundwater. Although SWMU 69 total site HIs were greater than USEPA's target level of 1.0, after refinement of total site risks

addressing the contribution of background cobalt levels, site-specific risks from cobalt in groundwater can be attributed to background. It should be noted that the HI for soil was also greater than 1.0 for the child receptor, but the HIs for each COPC identified were less than 1.0. It is further noted that potable use of SWMU 69 groundwater is a very conservative risk estimation measure. Groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007), and this is not expected to change in the future. Therefore, consumption of this groundwater is not expected to occur. Therefore, quantitative CAOs for soil and groundwater for the protection of human health assuming residential land use were not developed for SWMU 69.

The estimated carcinogenic risks from all media were within or below USEPA's target risk range for the remaining receptors (i.e., current/future trespassers, current/future on-site workers, future construction workers, and future industrial/commercial workers). In addition, noncarcinogenic risks were also less than the target hazard level for these receptors . Therefore, no human health COCs are identified for soil, groundwater, or sediment, and no further actions are recommended for these media based on risk to trespassers, on-site workers, construction workers, and industrial/commercial workers.

8.7 References

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9.0 SUMMARY OF COCs AND CAOs

The risk assessment processes discussed in Sections 7.0 and 8.0 were followed to develop media specific corrective action objectives protective of ecological and human health. The COCs and CAOs for each media for SWMU 69 are summarized in the following sections. The extent of contamination in each media requiring cleanup, based on the CAOs is also established.

The HHRA did not identify any COCs or unacceptable risks to human receptors (based on on-site adult worker, industrial/commercial adult worker, and construction worker exposure scenarios) from potential exposure to constituents detected in soil, groundwater, or sediment. Therefore, human health quantitative CAOs were not developed. Although the Puerto Rico Ports Authority has developed the area into a regional airport, the human health risk assessment did conservatively consider a future residential exposure scenario in which potential risks were identified primarily due to exposure to site groundwater. Consequently, since residential risk estimates exceeded target limits, unrestricted land use cannot be recommended for SWMU 69. Therefore, a qualitative CAO (institutional control restricting potable use of groundwater and future residential use) will be developed as a human health qualitative CAO for the SWMU 69 property.

9.1 Surface Soil

The risk-based and background CAOs for surface soil (representing a depth range of 0.0 to 1.0 feet below ground surface) are presented in Section 7.12 and summarized on Table 7-49. Vanadium was the only ecological COC identified for surface soil, based on potential risk to terrestrial invertebrates and plants, and avian omnivores, amphibians, and reptiles. As discussed in Section 7.12.2, the background-based CAO for vanadium (367 mg/kg) was selected as the final CAO for vanadium in SWMU 69 surface soil because the risk-based CAOs (20 mg/kg for plants and invertebrates and 21.4 mg/kg for avian omnivores) were below the background-based CAO.

As shown on Table 9-1, three surface soil sample locations were identified as having concentrations of vanadium above the final CAO: 69SB128, 69SB132, and 69SB133. The concentrations of vanadium in the surface soil and the estimated extent of surface soil contamination in excess of the CAO of 367 mg/kg is shown on Figure 9-1. The overall extent of surface soil contamination in excess of the CAO for vanadium is limited to two areas adjacent to the southeastern portion of the drainage ditch system at SWMU 69. The vertical extent of contamination at sample locations 69SB128, 69SB132, and 69SB133 is not limited to the top one foot of soil due to subsurface soil contamination in excess of the CAO for vanadium at each location.

9.2 Subsurface Soil

The risk-based and background CAOs for subsurface soil (representing a depth range of 1.0 to 3.0 feet below ground surface) are presented in Section 7.12 and summarized on Table 7-50. Vanadium was the only ecological COC identified for subsurface soil, based on potential risk to terrestrial invertebrates and plants, and avian omnivores, amphibians, and reptiles. As discussed in Section 7.12.2, the background-based CAO for vanadium (367 mg/kg) was selected as the final CAO for vanadium in SWMU 69 subsurface soil because the risk-based CAOs (20 mg/kg for plants and invertebrates and 21.4 mg/kg for avian omnivores) were below the background-based CAO.

As shown on Table 9-1, seven subsurface soil (1.0 to 2.0 ft bgs) sample locations were identified as having concentrations of vanadium above the final CAO: 69SB122, 69SB127, 69SB128, 69SB132, 69SB133, 69SB140, and 69SB144. The concentrations of vanadium in the 1.0 to 2.0 ft bgs subsurface soil interval and the estimated extent of contamination in excess of the CAO of 367 mg/kg is shown on Figure 9-2. The vertical extent of contamination at sample locations 69SB122 and 69SB140 extends below the 1.0 to 2.0 ft bgs subsurface soil interval due to vanadium concentrations in the subsequent 2.0 to 3.0 ft bgs interval exceeding the CAO. The vertical extent of contamination at the remaining sample locations (69SB127, 69SB128, 69SB132, 69SB133, and 69SB144) is 2.0 ft bgs due to vanadium concentrations below the final CAO at the subsequent 2.0 to 3.0 ft bgs interval for each location.

As shown on Table 9-1, four subsurface soil (2.0 to 3.0 ft bgs) sample locations were identified as having concentrations of vanadium above the final CAO: 69SB122, 69SB129, 69SB130, and 69SB140. The concentrations of vanadium in the 2.0 to 3.0 ft bgs subsurface soil interval and the estimated extent of contamination in excess of the CAO of 367 mg/kg is shown on Figure 9-3. The 1.0 to 3.0 ft bgs interval is considered a biologically active zone. Therefore, the vertical extent of contamination in the 2.0 to 3.0 ft bgs subsurface soil interval is limited to 3.0 ft bgs. The maximum depth of subsurface soil requiring cleanup at locations 69SB122, 69SB129, 69SB130, and 69SB140 is 3.0 ft bgs.

Figure 9-4 shows the overall estimated extent of soil contamination exceeding the CAO for vanadium.

9.3 Groundwater

Based on the refined risk evaluation, no ecological COCs were identified for groundwater; consequently ecological CAOs were not developed for the groundwater for SWMU 69.

Although SWMU 69 total site HIs were greater than USEPA's target level of 1.0, after refinement of total site risks addressing the contribution of background cobalt levels, site-specific risks from cobalt in groundwater can be attributed to background. It should be noted that potable use of SWMU 69 groundwater is a very conservative risk estimation measure. As per the Technical Memorandum, Groundwater Usability Assessment (NAVFAC, 2012), the low yield of groundwater beneath NAPR and its naturally occurring high levels of total dissolved solids and salinity prevent attainment of potable use standards in accordance with the PRWQS regulation (PREQB, 2010). In addition, groundwater is not currently used as a potable (or other) source, and it has been recognized that there is no intention to use it as such (Navy, 2011). Since the HHRA did not identify any unacceptable risks for the industrial worker or construction worker receptor scenarios, and potable use of groundwater is considered an incomplete exposure pathway, human health quantitative CAOs were not developed for groundwater. However, because risk estimates exceeded target limits for future residential receptors, and the land will not allow for unrestricted use, establishment of an institutional control restricting potable use of groundwater was developed as a qualitative human health CAO for the SWMU 69 property.

9.4 Sediment

The ecological risk-based and background CAOs for sediment are presented in Section 7.12 and summarized on Table 7-51. Cadmium, lead, vanadium, and zinc were identified as ecological COCs for plants, invertebrates, and amphibians within the drainage ditch system at SWMU 69. Cadmium, lead, and vanadium were identified as ecological COCs for avian, amphibian, and reptile dietary exposures to chemicals in SWMU 69 sediment. As discussed in Section 7.12.2,

the minimum risk-based CAOs for cadmium (1.0 mg/kg) and lead (35.8 mg/kg) were selected as the final CAOs because the risk-based CAOs exceeded the background-based CAOs for these two metals (0.22 mg/kg for cadmium and 19.38 mg/kg for lead). The background-based CAOs for vanadium (241 mg/kg) and zinc (148 mg/kg) were selected as the final CAOs because the risk-based CAOs for vanadium (57 mg/kg for plants and invertebrates and 21.4 mg/kg for avian omnivores) and zinc (121 mg/kg for plants and invertebrates) were below the background-based CAOs.

As shown on Table 9-1, nine sediment sample locations were identified as having concentrations of cadmium above the final CAO: 69SD01, 69SD03, 69SD06, 69SD07, 69SD08, 69SD09, 69SD10, 69SD11, and 69SD12. Five sediment sample locations were identified as having concentrations of lead above the final CAO: 69SD01, 69SD03, 69SD06, 69SD07, and 69SD08. Vanadium was detected above the final CAO at sediment sample locations 69SD05, 69SD09, and the furthest downgradient sample location (69SD14). Zinc was detected above the final CAO at sediment sample locations 69SD06, 69SD07, and 69SD08. Figure 9-5 shows the concentrations of cadmium, lead, vanadium, and zinc in sediment and the estimated extent of contamination in excess of the CAOs. The depth of sediment requiring cleanup of cadmium, lead, vanadium, and zinc is limited to the depth required for the protection of benthic and aquatic life. This depth is typically considered as the top six inches of sediment: however, a conservative depth of one foot was assumed for SWMU 69.

9.5 References

NAVFAC, 2012. Technical Memorandum. Groundwater Usability Assessment, Naval Activity Puerto Rico, Ceiba, Puerto Rico. Prepared for NAPR Project Team. April 13, 2012 .

U.S. Department of the Navy. 2011. Supplemental Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads). May 2011.

10.0 JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURE

Site contaminants for which CAOs have been established through the ecological risk evaluation include vanadium for surface and subsurface soil and cadmium, lead, vanadium and zinc for sediment. Site contamination in excess of the CAOs is limited to areas of surface soil (0.0 to 1.0 ft bgs) and subsurface soil (1.0 to 2.0 ft bgs and 2.0 to 3.0 ft bgs) south of the expanded concrete apron area identified on Figure 9-4. Sediment contamination is present in the drainage ditch from its beginning at location 69SD01, location 69SD03, location 69SD05 downstream to 69SD11, at location 69SD12 (up gradient of location 69SD13), and 69SD14 (refer to Figure 9-5). Because of the limited nature of the contamination at this SWMU (i.e., metals contamination limited to areas of surface soil, subsurface soil, and drainage ditch sediment) as well as the easy accessibility of the site by typical construction equipment, a presumptive remedy of excavation and off-site disposal was selected for evaluation as a corrective measure. Note that use of a presumptive remedy such as excavation and off-site disposal bypasses several steps of the CMS process including the screening of corrective measures technologies, identification and formulation of corrective measures alternatives and evaluation of the corrective measures alternatives. This results in a Streamlined CMS that focuses on the description and evaluation of the selected remedy. The selected remedy is described in more detail in this section and technical, human health and environmental considerations are discussed. The technical approach to implementing the corrective measure is discussed in more detail in Section 11.

10.1 Description of the Remedy

The selected remedy for the soil and sediment contamination at SWMU 69 is excavation and off-site disposal coupled with an institutional control to restrict future residential land and groundwater use. The volumes of soil and sediment requiring excavation and a brief discussion of the excavation and off-site disposal corrective measure for each media are given in the following sections.

A corrective action requiring institutional controls (deed restrictions) is the most direct method to restrict residential use. Institutional controls are legal and administrative mechanisms used to implement land use restrictions which limit the exposure of future landowner(s) or user(s) of the property to hazardous substances present on the property. Institutional controls are required on a property where the selected remedy results in contamination remaining at the property above levels that allow for unlimited use and unrestricted exposure. Institutional controls will remain in place until cleanup is performed on the property that will allow for unlimited use of the property and unrestricted exposure. Implementation of institutional controls includes the requirement for monitoring and inspections, and reporting to ensure compliance with land use and activity restrictions.

Ownership of the Air Field parcel (Ofstie Airfield) was transferred from the United States Navy to the Puerto Rico Ports Authority on February 7, 2008. However, in accordance with the Administrative Order, the Covenant Deferral Request and the Quitclaim Deed of transfer, the US Navy maintains responsibility for the investigation and cleanup of SWMU 69. The Ports Authority plans to develop the airfield into a regional airport. The quitclaim deed requires the Ports Authority to allow access to the Navy and its contractors for the remedial action or corrective action found to be necessary after the date of the conveyance of the property. This access is guaranteed through 42 U.S.C. §9620(h)(3)(A)(iii), which also prohibits the Ports Authority from taking action to interfere with future necessary remedial and investigative actions.

The deed also says that remedial and investigative actions shall take priority in all cases where a conflict may exist with Port's and any lessee's or sub lessee's activities.

10.1.1 Soil

Soil will be removed from areas where metals contaminant concentrations exceed the established CAO, as determined in Section 7.0 through 9.0 of this document. The proposed cleanup levels are the following:

- Vanadium 367 mg/kg

The estimated maximum limit of soil contamination in excess of the CAO requiring excavation is comprised of three areas from 0.0 to 2.0 ft bgs (Area 1, Area 3, and Area 5) and two areas from 0.0 to 3.0 ft bgs (Area 2 and Area 4) in the southern portion of the SWMU, as shown on Figure 10-1. The lateral extent of each of the areas will be verified by post-excavation confirmation sampling. For the purpose of the CMS, the extent of contamination for each area was assumed as follows:

- Vanadium was identified at location 69SB144 at concentrations in excess of the CAO in the 1.0 to 2.0 ft bgs subsurface interval. Location 69SB144 is north of the beginning of the drainage ditch in the southern portion of the SWMU. The estimated extent of contamination at this area is bounded within the contours for vanadium and the drainage ditch to the south, as shown on Figure 10-1. An area of approximately 1,864 square feet (identified as Area 1 on Figure 10-1) encompassing location 69SB144 initially will be excavated. Confirmation sampling of the excavation sidewall will be utilized to verify extent of contamination has been delineated. Initial excavation depth will be 2.0 ft bgs, resulting in approximately 3,728 cubic feet of soil. Excavation depth is limited to a maximum of 3.0 ft bgs as determined by ecological risk assessment. Therefore, confirmation samples are required from the bottom of the excavation at Area 1.

- Vanadium was identified at location 69SB140 at concentrations in excess of the CAO in the 1.0 to 2.0 ft bgs and 2.0 to 3.0 ft bgs subsurface intervals. Location 69SB140 is south of former UST 794 and UST monitoring wells and adjacent to the drainage ditch in the southern portion of the SWMU. The estimated extent of contamination at this area is bounded within the contours for vanadium and the drainage ditch to the south, as shown on Figure 10-1. An area of approximately 2,983 square feet (identified as Area 2 on Figure 10-1) encompassing location 69SB140 initially will be excavated. Confirmation sampling of the excavation sidewall will be utilized to verify extent of contamination has been delineated. Excavation depth will be 3.0 ft bgs, resulting in approximately 8,949 cubic feet of soil. Excavation depth is limited to a maximum of 3.0 ft bgs as determined by ecological risk assessment. No ecological risks exist below 3.0 ft bgs; therefore no confirmation samples are required from the bottom of the excavation at Area 2.

- Vanadium was identified at locations 69SB132 and 69SB133 at concentrations in excess of the CAO in surface soil and the 1.0 to 2.0 ft bgs subsurface interval. Locations 69SB132 and 69SB133 are north of the drainage ditch in the southern portion of the SWMU. The estimated extent of contamination at this area is bounded within the contours for vanadium and the drainage ditch to the south, as shown on Figure 10-1. An area of approximately 5,176 square feet (identified as Area 3 on

Figure 10-1) encompassing locations 69SB132 and 69SB133 initially will be excavated. Confirmation sampling of the excavation sidewall will be utilized to verify extent of contamination has been delineated. Initial excavation depth will be 2.0 ft bgs, resulting in approximately 10,352 cubic feet of soil. Excavation depth is limited to a maximum of 3.0 ft bgs as determined by ecological risk assessment. Therefore, confirmation samples are required from the bottom of the excavation at Area 3.

- Vanadium was identified at location 69SB122 at concentrations in excess of the CAO in the 1.0 to 2.0 ft bgs and 2.0 to 3.0 ft bgs subsurface intervals. Location 69SB122 is approximately 45 feet south of the concrete apron. Vanadium was also identified at adjacent locations 69SB129 and 69SB130 at concentrations in excess of the CAO in the 2.0 to 3.0 ft bgs subsurface interval. Locations 69SB129 and 69SB130 are north of the drainage ditch in the southern portion of the SWMU. The estimated extent of contamination at this area is bounded within the contours for vanadium and the drainage ditch to the south, as shown on Figure 10-1. An area of approximately 8,441 square feet (identified as Area 4 on Figure 10-1) encompassing locations 69SB122, 69SB129, and 69SB130 initially will be excavated. Confirmation sampling of the excavation sidewall will be utilized to verify extent of contamination has been delineated. Excavation depth will be 3.0 ft bgs, resulting in approximately 25,323 cubic feet of soil. Excavation depth is limited to a maximum of 3.0 ft bgs as determined by ecological risk assessment. No ecological risks exist below 3.0 ft bgs; therefore no confirmation samples are required from the bottom of the excavation at Area 4.

- Vanadium was identified at location 69SB127 at concentrations in excess of the CAO in the 1.0 to 2.0 ft bgs subsurface interval. Vanadium was also identified at location 69SB128 at concentrations in excess of the CAO in surface soil and the 1.0 to 2.0 ft bgs subsurface interval. Locations 69SB127 and 69SB128 are adjacent to the drainage ditches in the southeastern portion of the SWMU. The estimated extent of contamination at this area is bounded within the contours for vanadium, the drainage ditch to the east, and the drainage ditch to the south, as shown on Figure 10-1. An area of approximately 5,808 square feet (identified as Area 5 on Figure 10-1) encompassing locations 69SB127 and 69SB128 initially will be excavated. Confirmation sampling of the excavation sidewall will be utilized to verify extent of contamination has been delineated. Initial excavation depth will be 2.0 ft bgs, resulting in approximately 11,616 cubic feet of soil. Excavation depth is limited to a maximum of 3.0 ft bgs as determined by ecological risk assessment. Therefore, confirmation samples are required from the bottom of the excavation at Area 5.

The remedy for SWMU 69 consists of excavation and off-site disposal of the contaminated soil. Based on the above, the volume of soil requiring excavation at SWMU 69 is approximately 59,968 cubic feet (2,221 cubic yards). After completion of the excavation, confirmatory samples will be collected to document removal of the contaminated soil. The contaminated soil will be transported to an on-island, permitted, disposal facility, unless confirmatory testing indicates levels exceeding landfill acceptance criteria. The on-island disposal facilities are located in Ponce and Penuelas. Licensed waste haulers are available and will be used to transport the soil to the disposal facility. Finally, the excavation area will be backfilled with clean soil, graded and revegetated.

10.1.2 Sediment

Sediment will be removed from areas where metals contaminant concentrations exceed the established CAOs, as determined in Section 7.0 through 9.0 of this document. The proposed cleanup levels are the following:

- Cadmium 1.0 mg/kg
- Lead 35.8 mg/kg
- Vanadium 241 mg/kg
- Zinc 148 mg/kg

The extent of sediment contamination in excess of the CAOs is shown on Figure 10-2. The area for sediment excavation includes four segments of the drainage ditch. A description of each segment and the associated volume of sediment are as follows:

Segment 1 is approximately five feet wide, covers an approximate area of 241 SF, and is lined with vegetation. Sample 69SD01 (located at the beginning of the drainage ditch at the site) indicated sediment with cadmium and lead in excess of the CAOs. Sample 69SD02 (located approximately 85 feet downgradient of 69SD01) did not indicate COCs in excess of the CAOs. Segment 1 represents the estimated extent of sediment contamination from 69SD01 to approximately half the distance to location 69SD02.

Segment 2 is approximately five feet wide, covers an approximate area of 499 SF, and is lined with vegetation. Segment 2 encompasses sample location 69SD03 where cadmium and lead exceeded their respective CAOs. Sample 69SD02 (located approximately 95 feet up gradient of 69SD03) did not indicate COCs in excess of the CAOs. In addition, sample 69SD04 (located approximately 85 feet downgradient of 69SD03) did not indicate COCs in excess of the CAOs. Segment 2 represents the estimated extent of sediment contamination at 69SD03 and extends approximately half the distance upgradient to 69SD02 and downgradient to 69SD04.

Segment 3 covers an approximate area of 4213 SF and varies in width. Segment 3 encompasses sample locations 69SD05 through 69SD11. Also included in this segment is upgradient sample location 69SD12, as shown on Figure 10-2. All samples located within Segment 3 indicated COCs in excess of the CAOs at SWMU 69. Segment 3 extends upgradient of location 69SD05 to approximately half the distance to 69SD04 where COCs in excess of the CAOs were not present. Segment 3 also extends upgradient of location 69SD12 due to cadmium detected in excess of the CAO. Segment 3 extends from 69SD11 downgradient half the distance to 69SD13, where no COCs were present in excess of the CAOs. Segment 3 represents the estimated extent of sediment contamination at locations 69SD05 through 69SD11 and 69SD12.

Segment 4 is approximately three feet wide and covers an approximate are of 230 SF. Sample 69SD14 indicated sediment with vanadium in excess of the CAO. No samples were obtained further downgradient from 69SD14; therefore, the extent of contamination beyond this location has not been delineated. Segment 4 encompasses sample location 69SD14 and extends upgradient to approximately 15 feet from location 69SD13 where COCs in excess of the CAOs were not present. Segment 4 represents the estimated extent of sediment contamination at 69SD14.

Based on the above, the total volume of sediment requiring excavation at SWMU 69 is approximately 192 cubic yards.

For the sediment excavation it is assumed within the channel that only sediment will be excavated and the excavation depth will not exceed one foot, which is of sufficient depth for protection of ecological and human receptors. Confirmation samples will be collected along the edge of excavation that extends perpendicular to the channel to verify the extent of contamination has been removed. Confirmation sampling will not be required along the sidewall of the channel bank since the entire width of the channel will be excavated to a conservative depth of one foot. The excavated sediment will be dewatered by placing it on polyethylene sheeting and allowing the excess water to drain or evaporate. The drained water will be containerized and samples will be collected for hazardous waste characterization. Similarly, the sediment will be sampled for hazardous waste characteristics. If the waste streams are determined to be hazardous, then they must be disposed of off-island to a facility in the continental United States, thereby substantially increasing project costs. Otherwise, the contaminated sediment then will be transported to an on-island, permitted, disposal facility. The on-island disposal facilities are located in Ponce and Penuelas. Licensed waste haulers are available and will be used to transport the sediment to the disposal facility. Finally, the excavation area will be backfilled with compacted low permeability soil, graded to promote positive drainage, and revegetated, as needed. The ditch invert will be armored with riprap to prevent future erosion.

The remedy for SWMU 69 consists of excavation and off-site disposal of the contaminated sediment. The outermost extent of contamination of the combined COCs above the proposed remediation levels will govern the extent of sediment excavation. Consequently, prior to excavation, additional sediment samples will be collected in an effort to further delineate and minimize the uncertainty associated with the lateral extent of contamination beyond the furthest downgradient location (69SD14).

10.2 Justification of the Corrective Measure

Justification for the selection of excavation and disposal as the corrective measure for SWMU 69 is provided in this section. The corrective measure is evaluated based upon technical, human health and environmental considerations.

10.2.1 Technical Considerations

Excavation and off-site disposal is proven and is commonly used at general construction and remediation sites. Because the contamination will be removed from SWMU 69, it is a permanent corrective measure. In terms of reliability, the contaminated media will be disposed in a permitted landfill, which is considered a commonly accepted treatment alternative. With respect to implementability, this corrective measure requires commonly used earth moving equipment and disposal facilities. If confirmation testing conducted during the excavation yields contaminant concentrations exceeding local landfill acceptance criteria, the media will require off-island transportation (i.e., barged to the United States) and disposal. In general, SWMU 69 is easily accessible and has limited site features that would interfere with the excavation. Safety concerns while implementing the corrective measure are anticipated to be minimal due to limited areas of excavation, the shallow depths of excavation, and the low population density adjacent to the sites. In general, this technology will be effective, reliable, and easily implementable.

In terms of reliability, the institutional controls will be documented in the form of a covenant and restriction, citing that no permanent residences shall be constructed or developed on SWMU 69 and restricting potable use of groundwater. The site conditions will be monitored annually to ensure that the property remains non-residential and no evidence of soil or groundwater being used on the property. With respect to implementability, this corrective measure requires a

covenant and restriction be placed on the property transfer documents. While operated as an airfield the location of SWMU 69 does not easily lend itself to residential development, covenant and restrictions placed on the property documents prohibiting the construction of residential units will ensure that the property will not be developed and used for residential purposes in the future. Safety concerns while implementing the corrective measure are anticipated to be minimal because this corrective action is being performed through administrative methods. In general, this technology will be effective, reliable, and easily implementable.

10.2.2 Human Health Considerations

No unacceptable human health risks from potential exposure to constituents detected in site soil, groundwater, or sediment were identified based on an industrial/commercial exposure scenario. Although risk estimates exceeded target limits for future residential receptors, institutional controls will be used to restrict residential land and groundwater use as previously described. Workers will be exposed to typical construction site risks; these will be addressed through preparation and implementation of a site-specific health and safety plan, as discussed in Section 11.1.1.

10.2.3 Environmental Considerations

Removing the contaminated media from SWMU 69 will provide an immediate benefit to the environment. Potential terrestrial receptors will no longer be in contact with the environmental media containing levels of hazardous constituents that exceed the cleanup goals.

11.0 TECHNICAL APROACH TO THE CORRECTIVE MEASURE IMPLEMENTATION

This section details the recommended selected remedy for mitigation of impacted soil and sediment at SWMU 69. The layout of the conceptual design, planning documents and design considerations are presented in Section 11.1. The reporting requirements are presented in Section 11.2. The estimated cost and schedule for implementation of the corrective measure are given in Sections 11.3 and 11.4.

11.1 Conceptual Design

The ecological risk evaluation identified vanadium as the COC in surface and subsurface soil at SWMU 69 requiring cleanup and established the cleanup objective of 367 mg/kg for vanadium. The ecological risk evaluation identified cadmium, lead, vanadium, and zinc as the COCs in sediment at SWMU 69 requiring cleanup; cleanup objectives for these five metals were at 1.0 mg/kg for cadmium, 35.8 mg/kg for lead, 241 mg/kg for vanadium, and 148 mg/kg for zinc. As discussed in the previous section, excavation and off-site disposal of approximately 2,221 CY of contaminated soil and 192 CY of sediment was selected as the cleanup alternative or corrective measure. In addition to excavation and off-site disposal, the corrective measure also includes an institutional control restricting future residential land and groundwater use.

The pre-determined limits of soil excavation (Figure 11-1) will be excavated to a depth of 2.0 ft bgs at Area 1, Area 3, and Area 5, and maximum depth of 3.0 ft bgs at Area 2 and Area 4 unless excavation refusal due to obstructions is encountered, at which time samples will be taken at the lowest achievable depth. Confirmation samples will be collected from each sidewall of the excavation area at a frequency of one sample every 25 linear feet along the wall or a minimum of one sample per sidewall. Bottom samples will be collected every 625 SF from Area 1, Area 3, and Area 5. No bottom samples will be collected from Area 2 and Area 4 as the maximum excavation depth of 3.0 ft bgs was established by ecological risk assessment. The sample identification, depth, number of samples, and QC samples within each area will be identified in the Corrective Action Project Plan. Confirmation samples will be collected and analyzed for vanadium.

The pre-determined limits of sediment excavation (Figure 11-2) will be excavated to a maximum depth of 1 foot at Segment 1, Segment 2, Segment 3, and Segment 4. The removal of the upper one foot of drainage ditch sediment removes the potential pathways to potential ecological/human receptors. Any contamination in excess of the CAOs that remain below the one foot excavation will not pose a risk to receptors because the excavation will be backfilled with one foot of clean soil. A confirmation sample will be collected from the excavation edge perpendicular to the channel to verify the extent of contamination has been removed. Confirmation samples will be analyzed for the same COCs exceeding the respective CAOs for each sediment sample adjacent to the excavation edge. Confirmation sampling will not be required along the sidewall of the channel bank since the entire width of the channel will be excavated to a conservative depth of one foot. The sample identification, depth, number of samples, and QC samples within each area will be identified in the Corrective Action Project Plan.

The corrective measure includes the collection of pre-excavation delineation sediment samples downgradient of location 69SD14. It is anticipated that this sampling will delineate contamination present at 69SD14 and investigate any impacts further downgradient in the ditch. In the event a delineation sample indicates contamination above the CAOs, excavation will be extended to that location. Sampling and excavation will not proceed beyond the confluence of

the ditches east of the site. In general, the delineation samples will be collected from the top six inches of sediment and will be analyzed for the four COCs identified for sediment. It is anticipated that four delineation samples will be collected downgradient of 69SD14. The actual samples locations will be defined in the Corrective Action Project Plan, as described in Section 11.1.1.

Figures 11-1 and 11-2 show the conceptual design plan for the areas at this site where the excavation will be implemented. All remedial waste generated as part of the cleanup of SWMU 69 will be managed in accordance with applicable federal, commonwealth and local guidelines.

The contractor will mobilize to the site to initiate the corrective measure. Figure 11-1 shows the conceptual design plan for the areas at this site where soil excavation will be implemented. All remedial waste generated as part of the cleanup of SWMU 69 will be managed in accordance with applicable federal, commonwealth and local guidelines.

The processes to be followed for implementation of the soil excavation and disposal portion of this corrective measure include:

- Mobilization of a small backhoe or gradeall, small front end loader, and roll-off boxes
- Construction of a decontamination pad and equipment laydown areas
- Installation of erosion controls
- Location by survey of excavation limits
- Excavation of two feet of soil from Area 1, Area 3, and Area 5
- Confirmation sampling of outer edge of excavation every 25 feet and of the bottom of excavation every 625 SF.
- Excavation of three feet of soil from Area 2 and Area 4
- Confirmation sampling of outer edge of excavation every 25 feet.
- Transportation of the excavated soil to lined roll-off boxes. The roll-off boxes will be placed so that they slope to drain to one corner of the box.
- Collection and analysis of representative soil samples for toxicity characteristics in accordance with 40 CFR Part 261.24
- Collection, analysis and disposal of water from the roll-off boxes
- Receipt of confirmation sample results indicating the contaminated soil has been removed. If the sidewall confirmation sample results indicate that contamination remains, the excavation will be extended horizontally a distance of 12.5 feet in the cardinal direction perpendicular to the sidewall and resampled for confirmation. If the bottom confirmation sample (Areas 1, 3, and 5 only) results indicate that contamination remains, the excavation will be extended vertically to 3.0 ft bgs. No further confirmation samples will be collected from the bottom of the excavation.
- Transportation and disposal of soil to an approved on-island disposal facility
- Survey of the achieved lateral and vertical limits of excavation prior to initiation of backfilling
- Backfill existing excavated areas with clean fill to match existing grade
- Revegetation of any disturbed areas
- Demobilization of all equipment, etc.
- Removal of erosion and sediment control structures

Confirmatory sampling will be conducted at SWMU 69 to verify that all COCs with concentrations higher than their respective clean up levels have been removed from the site. Confirmatory sampling will occur approximately every 25 linear feet outside the edge of the

excavation sidewalls in the upper one foot of the undisturbed soil and the subsurface interval where contamination was previously detected. The sampling methods will be identical to those used in previous investigations. Soil samples will be submitted to the laboratory for quick turnaround analysis of the COCs mentioned in this report. Should additional contamination be detected above the cleanup goals, the excavation will be extended horizontally a distance of 12.5 feet in the cardinal direction perpendicular to the sidewall and resampled for confirmation.

Figure 11-2 shows the conceptual design plan for the segments of the drainage ditch where sediment excavation will be implemented. All remedial waste generated as part of the cleanup of SWMU 69 will be managed in accordance with applicable federal, commonwealth and local guidelines.

The processes to be followed for implementation of the sediment excavation and disposal portion of this corrective measure include:

- Collection of pre-excavation sediment delineation samples downgradient of location 69SD14.
- Mobilization of a small backhoe or grade all, small front end loader, and roll-off boxes
- Construction of a decontamination pad and equipment lay down areas (use same area for soil and sediment excavation)
- Survey locate the excavation limits
- Installation of erosion controls within each reach of the drainage ditch
- Construction of sediment drying areas with erosion and sedimentation controls along the edge of the drainage ditch
- Excavation of sediment from each reach of the drainage ditch to maximum one foot depth
- Collect confirmation sample from edge of excavation perpendicular to the channel
- Placement of excavated sediment onto polyethylene sheeting for dewatering and drying
- Transportation of the excavated/dewatered sediment to lined roll-off boxes. The roll-off boxes will be placed so that they slope to drain to one corner of the box.
- Collection and analysis of representative soil samples for toxicity characteristics in accordance with 40 CFR Part 261.24
- Collection, analysis and disposal of water from the roll-off boxes
- Receipt of confirmation sample results indicating the contaminated sediment has been removed. If the results indicate that contamination remains, excavation will extend halfway to the closest sediment sample location below the CAOs and resampled.
- Transportation and disposal of sediment to an approved on-island disposal facility
- Survey of the achieved lateral and vertical limits of excavation prior to initiation of backfilling
- Backfill excavated areas with clean, low-permeability soil graded to promote positive drainage; place aggregate rip rap along disturbed portions of the ditch banks to provide future erosion resistance
- Revegetation of any disturbed areas
- Demobilization of all equipment, etc.
- Removal of erosion and sediment control structures

A confirmation sample will be collected from the excavation edge perpendicular to the channel to verify the extent of contamination has been removed. Confirmation sampling will not be required along the sidewall of the channel bank since the entire width of the channel will be excavated to a conservative depth of one foot.

11.1.1 Required Planning Documents

An initial step in the corrective action process will be preparation of a Corrective Action Project Plan by the remedial contractor. This is a planning document that will outline the approach and requirements for completing the corrective action and the actions the contractor will take to meet the project objectives. The Corrective Action Project Plan will consist of a Work Plan, Health and Safety Plan, Field Sampling and Analysis Plan and an Erosion and Sediment Control Plan. A brief description of each of these elements is provided below.

- Corrective Action Work Plan – The Corrective Action Work Plan for the removal action will discuss the overall objective of the work, the basis for evaluating the work, site background and physical setting, remediation operations and activities, organization and schedule. Also included in the Work Plan will be a listing of the hazardous materials that may be brought onto the site. The material Safety Data Sheets (MSDS) for each material will be included. The contractor will also include employee training documentation, a hazardous waste storage plan, and a listing of hazardous waste to be generated on site. The Work Plan will detail all permits that will be required for implementing the remedial action, including excavation, transportation of hazardous materials, disposal of hazardous materials and an air permit for fugitive dust emissions, if required.

- Site-Specific Health and Safety Plan (HASP) - The remedial contractor will prepare a HASP presenting the mechanism and procedures to establish safe working conditions at SWMU 69. The HASP will include specific hazard control methods to minimize the potential for accident or injury. The HASP also will include the names of the health and safety officer and alternates and will meet the requirements of 29 CFR 1910 and 1926; and the National Fire Protection Act (NFPA) 241.

- Site-Specific Field Sampling and Analysis Plan (FSAP) – The remedial contractor will prepare a FSAP outlining the procedures for pre-excavation contaminant delineation, contaminant removal verification and disposal characterization sampling. The FSAP will identify sampling location, rationale, and logistics (including laboratory information, sample handling and analysis requirements and QA/QC requirements).

- Erosion and Sediment Control Plan (ESCP) – The remedial contractor will prepare an ESCP presenting, as a minimum, the information required for the erosion and sediment controls as required by the PREQB.

11.1.2 Design Considerations for Corrective Measures Implementation

Many factors affect the ease with which a corrective measure can be performed at a site. Some of these items include site access, existing structures, disruption of adjacent facilities, available utilities, utility clearance, determination of extent of contamination, adequate space for staging areas, and availability of off-site waste disposal. Each of these design considerations with respect to SWMU 69 are presented on Table 11-1.

11.2 Reporting

To implement the corrective measure for SWMU 69, documents are required to report the progression of the sites from investigation to remediation. These documents include the CMS, the Corrective Measures Implementation (CMI) Design and the CMI Final Report. This document is the CMS. The CMI Design and CMI Final Report are discussed in the following sections.

11.2.1 Presumptive Remedy CMI Design

Designs must be prepared for SWMU 69 to detail the proposed corrective measure. Because the corrective measure is an accepted construction practice (dig and haul), it is anticipated that the design will not be complicated. The CMI Design will consist of a Basis of Design, and Plans and Specifications.

The contractor will prepare a Draft and Final Basis of Design report for implementation of the corrective measure at SWMU 69. The Basis of Design will follow the US Navy's most recent Remedial Action Construction Guidance. The Basis of Design will provide site background data for the removal action, describe the primary elements of the remedial design, and recommend criteria and present assumptions and any special requirements that may affect the design. The Basis of Design will also present the pertinent corrective measures implementation work breakdown structure and a construction schedule.

The contractor will prepare a 100% and Final Design Package (Plans and Specifications) for the removal action at SWMU 69. The following items are typically submitted with the 100% design package:

- Applicable SPECSINTACT specification sections
- Submittal Status Log
- 100% Drawings
- Cover Sheet and General Notes
- Existing Conditions Plans
- Removal Action Plans
- Grading and Revegetation Plans
- Civil Details

Final Design submittals typically consist of:

- Marked-up SPECSINTACT sections
- Final Submittal Approval and Distribution Chart for Specifications
- Final Drawings
- Final Cost Estimate
- Final Construction Schedule
- Written Responses to comments on the 100% design

11.2.2 CMI Final Report

The CMI Final report will be provided at the completion of the corrective measure. The report will include an introduction, summary of action, final health and safety report, summary of record documents, summary of field changes and contract modifications, final documents, a complete set

of analytical laboratory results, a complete set of validation reports, documentation of offsite transportation and disposal of soil and sediment, a quality control summary report and final cost data. The CMI Final Report will also include an evaluation of the corrective measure including the quantities of impacted media removed, problems encountered and solutions implemented. As-built drawings will be included as an appendix to the CMI Final Report.

11.3 Cost

An order of magnitude cost estimate for implementation of the excavation and off-site disposal corrective measure is provided in Table 11-2. The cost estimate considers capital costs for some of the principle components of the alternative. Note that since contamination will be removed from the site, long-term or operation and maintenance costs are not required. Also, since this corrective measure is a presumptive remedy, costs for other potential cleanup alternatives were not developed. The overall estimated capital cost for implementation of the excavation and off-site disposal corrective measure is $1,704,897.

11.4 Schedule

A schedule for implementation of this corrective measure is provided in Figure 11-3.

TABLES

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs (1)	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
	2008 CMS Investigation								
	69SB01	69SB01-00	0.0 - 1.0	04/29/08	X	X	X		
		69SB01-00D	0.0 - 1.0	04/29/08	X	X	X		Duplicate
		69SB01-00MS/MSD	0.0 - 1.0	04/29/08	X	X	X		Matrix Spike/Matrix Spike Duplicate
	69SB02	69SB02-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB03	69SB03-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB04	69SB04-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB05	69SB05-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB06	69SB06-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB07	69SB07-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB08	69SB08-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB09	69SB09-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB10	69SB10-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB11	69SB11-00	0.0 - 1.0	04/29/08	X	X	X		
		69SB11-00D	0.0 - 1.0	04/29/08	X	X	X		Duplicate
Surface Soil	69SB12	69SB12-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB13	69SB13-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB14	69SB14-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB15	69SB15-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB16	69SB16-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB17	69SB17-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB18	69SB18-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB19	69SB19-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB20	69SB20-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB21	69SB21-00	0.0 - 1.0	04/29/08	X	X	X		
		69SB21-00D	0.0 - 1.0	04/29/08	X	X	X		Duplicate
		69SB21-00MS/MSD	0.0 - 1.0	04/29/08	X	X	X		Matrix Spike/Matrix Spike Duplicate
	69SB22	69SB22-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB23	69SB23-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB24	69SB24-00	0.0 - 1.0	04/29/08	X	X	X		
	69SB27	69SB27-00	0.0 - 1.0	05/01/08	X	X	X		

TABLE 4-1

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs [1]	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Surface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SB101	69SB101-00	0.0 - 1.0	08/03/10			X		
		69SB101-00D	0.0 - 1.0	08/03/10			X		Duplicate
		69SB101-00MS/MSD	0.0 - 1.0	08/03/10			X		Matrix Spike/Matrix Spike Duplicate
	69SB102	69SB102-00	0.0 - 1.0	08/03/10			X		
	69SB103	69SB103-00	0.0 - 1.0	08/03/10			X		
	69SB104	69SB104-00	0.0 - 1.0	08/03/10			X		
	69SB105	69SB105-00	0.0 - 1.0	08/03/10			X		
	69SB106	69SB106-00	0.0 - 1.0	08/03/10			X		
	69SB107	69SB107-00	0.0 - 1.0	08/03/10			X		
	69SB108	69SB108-00	0.0 - 1.0	08/03/10			X		
	69SB109	69SB109-00	0.0 - 1.0	08/03/10			X		
	69SB110	69SB110-00	0.0 - 1.0	08/03/10			X		
	69SB111	69SB111-00	0.0 - 1.0	08/04/10			X		
		69SB111-00D	0.0 - 1.0	08/04/10			X		Duplicate
	69SB112	69SB112-00	0.0 - 1.0	08/04/10			X		
	69SB113	69SB113-00	0.0 - 1.0	08/04/10			X		
	69SB114	69SB114-00	0.0 - 1.0	08/04/10			X		
	69SB115	69SB115-00	0.0 - 1.0	08/04/10			X		
	69SB116	69SB116-00	0.0 - 1.0	08/04/10			X		
	69SB117	69SB117-00	0.0 - 1.0	08/04/10			X		
	69SB118	69SB118-00	0.0 - 1.0	08/04/10			X		
	69SB119	69SB119-00	0.0 - 1.0	08/04/10			X		
	69SB120	69SB120-00	0.0 - 1.0	08/04/10			X		
	69SB121	69SB121-00	0.0 - 1.0	08/04/10			X		
		69SB121-00D	0.0 - 1.0	08/04/10			X		Duplicate
		69SB121-00MS/MSD	0.0 - 1.0	08/04/10			X		Matrix Spike/Matrix Spike Duplicate
	69SB122	69SB122-00	0.0 - 1.0	08/05/10			X		
	69SB123	69SB123-00	0.0 - 1.0	08/05/10			X		
	69SB124	69SB24-00	0.0 - 1.0	08/05/10			X		

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs (1)	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Surface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SB125	69SB125-00	0.0 - 1.0	08/05/10			X		
	69SB126	69SB126-00	0.0 - 1.0	08/05/10			X		
	69SB127	69SB127-00	0.0 - 1.0	08/05/10			X		
	69SB128	69SB128-00	0.0-1.0	08/05/10			X		
	69SB129	69SB129-00	0.0-1.0	08/05/10			X		
	69SB130	69SB130-00	0.0-1.0	08/05/10			X		
	69SB131	69SB131-00	0.0-1.0	08/05/10			X		
	69SB131	69SB131-00D	0.0-1.0	08/05/10			X		Duplicate
	69SB132	69SB132-00	0.0-1.0	08/04/10			X		
	69SB133	69SB133-00	0.0-1.0	08/04/10			X		
	69SB134	69SB134-00	0.0-1.0	08/04/10			X		
	69SB135	69SB135-00	0.0-1.0	08/04/10			X		
	69SB136	69SB136-00	0.0-1.0	08/04/10			X		
	69SB137	69SB137-00	0.0-1.0	08/04/10			X		
	69SB138	69SB138-00	0.0-1.0	08/04/10			X		
	69SB139	69SB139-00	0.0-1.0	08/04/10			X		
	69SB140	69SB140-00	0.0-1.0	08/04/10			X		
	69SB141	69SB141-00	0.0-1.0	08/04/10			X		
	69SB141	69SB141-00D	0.0-1.0	08/04/10			X		Duplicate
	69SB141	69SB141-00MS/MSD	0.0-1.0	08/04/10			X		Matrix Spike/Matrix Spike Duplicate
	69SB142	69SB142-00	0.0-1.0	08/04/10			X		
	69SB143	69SB143-00	0.0-1.0	08/03/10			X		
	69SB144	69SB144-00	0.0-1.0	08/03/10			X		
	69SB145	69SB145-00	0.0-1.0	08/03/10			X		
	69SB146	69SB146-00	0.0-1.0	08/03/10			X		
	69SB147	69SB147-00	0.0-1.0	08/03/10			X		
	69SB148	69SB148-00	0.0-1.0	08/03/10			X		
	69SB149	69SB149-00	0.0-1.0	08/03/10			X		
	69SB150	69SB150-00	0.0-1.0	08/03/10			X		

TABLE 4-1

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs [1]	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Surface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SB151	69SB151-00	0.0-1.0	08/03/10			X		
	69SB151	69SB151-00D	0.0-1.0	08/03/10			X		Duplicate
	69SB151	69SB151-01	0.0-1.0	08/03/10			X		
	69SB152	69SB152-00	0.0-1.0	08/03/10			X		
Subsurface Soil	**2008 CMS Investigation**								
	69SB07	69SB07-01	1.0-3.0	04/29/08	X	X	X		
		69SB07-05	9.0-11.0	04/29/08	X	X	X		
	69SB08	69SB08-01	1.0-3.0	04/29/08	X	X	X		
		69SB08-05	9.0-11.0	04/29/08	X	X	X		
		69SB08-05D	9.0-11.0	04/29/08	X	X	X		Duplicate
		69SB08-05MS/MSD	9.0-11.0	04/29/08	X	X	X		Matrix Spike/Matrix Spike Duplicate
	69SB11	69SB11-01	1.0-3.0	04/29/08	X	X	X		
		69SB11-05	9.0-11.0	04/29/08	X	X	X		
	69SB12	69SB12-01	1.0-3.0	04/29/08	X	X	X		
		69SB12-05	9.0-11.0	04/29/08	X	X	X		
	69SB27	69SB27-01	1.0-3.0	05/01/08	X	X	X		
		69SB27-05	9.0-11.0	05/01/08	X	X	X		
	2010 CMS Disturbed Soil Sampling Investigation								
	69SB101	69SB101-01	1.0-2.0	08/03/10			X		
		69SB101-02	2.0-3.0	08/03/10			X		
	69SB102	69SB102-01	1.0-2.0	08/03/10			X		
		69SB102-02	2.0-3.0	08/03/10			X		
	69SB103	69SB103-01	1.0-2.0	08/03/10			X		
		69SB103-02	2.0-3.0	08/03/10			X		
	69SB104	69SB104-01	1.0-2.0	08/03/10			X		
		69SB104-01D	1.0-2.0	08/03/10			X		Duplicate
		69SB104-02	2.0-3.0	08/03/10			X		
	69SB105	69SB105-01	1.0-2.0	08/03/10			X		
		69SB105-02	2.0-3.0	08/03/10			X		

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs [1]	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Subsurface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SB106	69SB106-01	1.0-2.0	08/03/10			X		
		69SB106-02	2.0-3.0	08/03/10			X		
	69SB107	69SB107-01	1.0-2.0	08/03/10			X		
		69SB107-02	2.0-3.0	08/03/10			X		
		69SB107-02D	2.0-3.0	08/03/10			X		Duplicate
		69SB107-02MS/MSD	2.0-3.0	08/03/10			X		Matrix Spike/Matrix Spike Duplicate
	69SB108	69SB108-01	1.0-2.0	08/03/10			X		
		69SB108-02	2.0-3.0	08/03/10			X		
	69SB109	69SB109-01	1.0-2.0	08/03/10			X		
		69SB109-02	2.0-3.0	08/03/10			X		
	69SB110	69SB110-01	1.0-2.0	08/03/10			X		
		69SB110-02	2.0-3.0	08/03/10			X		
	69SB111	69SB111-01	1.0-2.0	08/04/10			X		
		69SB111-02	2.0-3.0	08/04/10			X		
	69SB112	69SB112-01	1.0-2.0	08/04/10			X		
		69SB112-02	2.0-3.0	08/04/10			X		
	69SB113	69SB113-01	1.0-2.0	08/04/10			X		
		69SB113-02	2.0-3.0	08/04/10			X		
	69SB114	69SB114-01	1.0-2.0	08/04/10			X		
		69SB114-01D	1.0-2.0	08/04/10			X		Duplicate
		69SB114-01MS/MSD	1.0-2.0	08/04/10			X		Matrix Spike/Matrix Spike Duplicate
		69SB114-02	2.0-3.0	08/04/10			X		
	69SB115	69SB115-01	1.0-2.0	08/04/10			X		
		69SB115-02	2.0-3.0	08/04/10			X		
	69SB116	69SB116-01	1.0-2.0	08/04/10			X		
		69SB116-02	2.0-3.0	08/04/10			X		
	69SB117	69SB117-01	1.0-2.0	08/04/10			X		
		69SB117-02	2.0-3.0	08/04/10			X		
		69SB117-02D	2.0-3.0	08/04/10			X		Duplicate

TABLE 4-1

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs [1]	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Subsurface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SB118	69SB118-01	1.0-2.0	08/04/10			X		
		69SB118-02	2.0-3.0	08/04/10			X		
	69SB119	69SB119-01	1.0-2.0	08/04/10			X		
		69SB119-02	2.0-3.0	08/04/10			X		
	69SB120	69SB120-01	1.0-2.0	08/04/10			X		
		69SB120-02	2.0-3.0	08/04/10			X		
	69SB121	69SB121-01	1.0-2.0	08/04/10			X		
		69SB121-02	2.0-3.0	08/04/10			X		
	69SB122	69SB122-01	1.0-2.0	08/05/10			X		
		69SB122-02	2.0-3.0	08/05/10			X		
	69SB123	69SB123-01	1.0-2.0	08/05/10			X		
		69SB123-02	2.0-3.0	08/05/10			X		
	69SB124	69SB124-01	1.0-2.0	08/05/10			X		
		69SB124-01D	1.0-2.0	08/05/10			X		Duplicate
		69SB124-02	2.0-3.0	08/05/10			X		
	69SB125	69SB125-01	1.0-2.0	08/05/10			X		
		69SB125-02	2.0-3.0	08/05/10			X		
	69SB126	69SB126-01	1.0-2.0	08/05/10			X		
		69SB126-02	2.0-3.0	08/05/10			X		
	69SB127	69SB127-01	1.0-2.0	08/05/10			X		
		69SB127-02	2.0-3.0	08/05/10			X		
		69SB127-02D	2.0-3.0	08/05/10			X		Duplicate
		69SB127-02MS/MSD	2.0-3.0	08/05/10			X		Matrix Spike/Matrix Spike Duplicate
	69SB128	69SB128-01	1.0-2.0	08/05/10			X		
		69SB128-02	2.0-3.0	08/05/10			X		
	69SB129	69SB129-01	1.0-2.0	08/05/10			X		
		69SB129-02	2.0-3.0	08/05/10			X		
	69SB130	69SB130-01	1.0-2.0	08/05/10			X		
		69SB130-02	2.0-3.0	08/05/10			X		

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs [1]	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Subsurface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SB131	69SB131-01	1.0-2.0	08/05/10			X		
		69SB131-02	2.0-3.0	08/05/10			X		
	69SB132	69SB132-01	1.0-2.0	08/04/10			X		
		69SB132-02	2.0-3.0	08/04/10			X		
	69SB133	69SB133-01	1.0-2.0	08/04/10			X		
		69SB133-02	2.0-3.0	08/04/10			X		
	69SB134	69SB134-01	1.0-2.0	08/04/10			X		
		69SB134-01D	1.0-2.0	08/04/10			X		Duplicate
		69SB134-01MS/MSD	1.0-2.0	08/04/10			X		Matrix Spike/Matrix Spike Duplicate
		69SB134-02	2.0-3.0	08/04/10			X		
	69SB135	69SB135-01	1.0-2.0	08/04/10			X		
		69SB135-02	2.0-3.0	08/04/10			X		
	69SB136	69SB136-01	1.0-2.0	08/04/10			X		
		69SB136-02	2.0-3.0	08/04/10			X		
	69SB137	69SB137-01	1.0-2.0	08/04/10			X		
		69SB137-02	2.0-3.1	08/03/10			X		
		69SB137-02D	2.0-3.0	08/04/10			X		Duplicate
	69SB138	69SB138-01	2.0-3.0	08/04/10			X		
		69SB138-02	2.0-3.0	08/04/10			X		
	69SB139	69SB139-01	1.0-2.0	08/04/10			X		
		69SB139-02	2.0-3.0	08/04/10			X		
	69SB140	69SB140-01	1.0-2.0	08/04/10			X		
		69SB140-02	2.0-3.0	08/04/10			X		
	69SB141	69SB141-01	1.0-2.0	08/04/10			X		
		69SB141-02	2.0-3.0	08/04/10			X		
	69SB142	69SB142-01	1.0-2.0	08/04/10			X		
		69SB142-02	2.0-3.0	08/04/10			X		
	69SB143	69SB143-01	1.0-2.0	08/03/10			X		
		69SB143-02	2.0-3.0	08/03/10			X		
	69SB144	69SB144-01	1.0-2.0	08/03/10			X		
		69SB144-01D	1.0-2.0	08/03/10			X		Duplicate

TABLE 4-1

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs [1]	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Subsurface Soil	**2010 CMS Disturbed Soil Sampling Investigation**								
		69SB144-02	2.0-3.0	08/03/10			X		
	69SB145	69SB145-01	1.0-2.0	08/03/10			X		
		69SB145-02	2.0-3.0	08/03/10			X		
	69SB146	69SB146-01	1.0-2.0	08/03/10			X		
		69SB146-02	2.0-3.0	08/03/10			X		
	69SB147	69SB147-01	1.0-2.0	08/03/10			X		
		69SB147-02	2.0-3.0	08/03/10			X		
		69SB147-02D	2.0-3.0	08/03/10			X		Duplicate
		69SB147-02MS/MSD	2.0-3.0	08/03/10			X		Matrix Spike/Matrix Spike Duplicate
	69SB148	69SB148-01	1.0-2.0	08/03/10			X		
		69SB148-02	2.0-3.0	08/03/10			X		
	69SB149	69SB149-01	1.0-2.0	08/03/10			X		
		69SB149-02	2.0-3.0	08/03/10			X		
	69SB150	69SB150-01	1.0-2.0	08/03/10			X		
		69SB150-02	2.0-3.0	08/03/10			X		
	69SB151	69SB151-01	1.0-2.0	08/03/10			X		
		69SB151-02	2.0-3.0	08/03/10			X		
	69SB152	69SB152-01	1.0-2.0	08/03/10			X		
		69SB152-02	2.0-3.0	08/03/10			X		
Groundwater	**2008 CMS Investigation**								
	69SB07	69GW07	NA	05/01/08	X	X	X	X	
	69SB08	69GW08	NA	05/01/08	X	X	X	X	
	69SB11	69GW11	NA	05/01/08	X	X	X	X	
		69GW11D	NA	05/01/08	X	X	X	X	Duplicate
		69GW11MS/MSD	NA	05/01/08	X	X	X	X	Matrix Spike/Matrix Spike Duplicate
	69SB12	69GW12	NA	05/01/08	X	X	X	X	
	69SB25	69GW25	NA	05/01/08	X	X	X	X	
	69SB26	69GW26	NA	05/03/08	X	X	X	X	
	69SB27	69GW27	NA	05/03/08	X	X	X	X	

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

					Analysis Requested				
Media	**Site ID**	**Sample ID**	**Sample Depth (ft bgs)**	**Sample Date**	App IX VOCs	App IX SVOCs (1)	App IX Metals (Total)	App IX Metals (Dissolved)	**Comment**
Sediment	**2010 CMS Disturbed Soil Sampling Investigation**								
	69SD01	69SD01	0.0-0.5	11/05/10			X		
		69SD01D	0.0-0.5	11/05/10			X		Duplicate
	69SD02	69SD02	0.0-0.5	11/05/10			X		
		69SD02D	0.0-0.5	11/05/10			X		Duplicate
		69SD02MS/MSD	0.0-0.5	11/05/10			X		Matrix Spike/Matrix Spike Duplicate
	69SD03	69SD03	0.0-0.5	11/05/10			X		
	69SD04	69SD04	0.0-0.5	11/05/10			X		
	69SD05	69SD05	0.0-0.5	11/05/10			X		
	69SD06	69SD06	0.0-0.5	11/05/10			X		
	69SD07	69SD07	0.0-0.5	11/05/10			X		
	69SD08	69SD08	0.0-0.5	11/05/10			X		
	69SD09	69SD09	0.0-0.5	11/05/10			X		
	69SD10	69SD10	0.0-0.5	11/05/10			X		
	69SD11	69SD11	0.0-0.5	11/05/10			X		
	69SD12	69SD12	0.0-0.5	11/05/10			X		
	69SD13	69SD13	0.0-0.5	11/05/10			X		
	69SD14	69SD14	0.0-0.5	11/05/10			X		

Notes:
Due to soil disturbance in 2008; shaded samples are no longer representative of site conditions
ft bgs - feet below ground surface.
NA - Not Applicable.
(1) Low Level PAHs included in SVOCs analysis

TABLE 4-2

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

			Analysis Requested			
Media	**Sample ID**	**Sample Date**	App IX VOCs	App IX SVOCs	App IX Metals (Total)	**Comment**
Trip Blanks	69TB-01	04/29/08	X			
	69TB-02	04/30/08	X			
	56TB-03	05/01/08	X			
	56TB-04	05/04/08	X			
	QATB01	05/04/08	X			
	74TB12	05/04/08	X			
Equipment Rinsates	ER03	04/30/08	X	X	X	Macro Core Liner
	ER04	05/01/08	X	X	X	Groundwater Sampling Tubing
	ER05	05/02/08	X	X	X	Groundwater Sampling Tubing
	69ER01	08/03/10			X	Macro Core Liner
	69ER02	08/04/10			X	Stainless Steel Spoon
	69ER03	08/05/10			X	Aluminum Pie Pan
	69ER-SD	11/05/10			X	Stainless Steel Spoon
Field Blanks	FB01	05/02/08	X	X	X	Lab Grade Deionized Water
	69FB01	08/05/10			X	Lab Grade Deionized Water
	69FB-SD	11/05/10			X	Lab Grade Deionized Water

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
Appendix IX - VOCs			
Acetone	25	50	8260B (5030)(low level)
Acetonitrile	40	200	8260B (5030)(low level)
Acrolein	20	100	8260B (5030)(low level)
Acrylonitrile	20	100	8260B (5030)(low level)
Benzene	1.0	5.0	8260B (5030)(low level)
Bromodichloromethane	1.0	5.0	8260B (5030)(low level)
Bromoform	1.0	5.0	8260B (5030)(low level)
Bromomethane	1.0	10	8260B (5030)(low level)
Carbon Disulfide	1.0	5.0	8260B (5030)(low level)
Carbon Tetrachloride	1.0	5.0	8260B (5030)(low level)
Chlorobenzene	1.0	5.0	8260B (5030)(low level)
Chloroethane	1.0	10	8260B (5030)(low level)
Chloroform	1.0	5.0	8260B (5030)(low level)
Chloromethane	1.0	10	8260B (5030)(low level)
Chloroprene	1.0	5.0	8260B (5030)(low level)
3-Chloro-1-propene	1.0	5.0	8260B (5030)(low level)
1,2-Dibromo-3-chloropropane	1.0	10	8260B (5030)(low level)
Dibromochloromethane	1.0	5.0	8260B (5030)(low level)
1,2-Dibromoethane	1.0	5.0	8260B (5030)(low level)
Dibromomethane	1.0	5.0	8260B (5030)(low level)
trans-1,4-Dichloro-2-butene	2.0	10	8260B (5030)(low level)
Dichlorodifluoromethane	1.0	5.0	8260B (5030)(low level)
1,1-Dichloroethane	1.0	5.0	8260B (5030)(low level)
1,2-Dichloroethane	1.0	5.0	8260B (5030)(low level)
trans-1,2-dichloroethene	1.0	5.0	8260B (5030)(low level)
1,1-Dichloroethene	1.0	5.0	8260B (5030)(low level)
Methylene Chloride	5.0	5.0	8260B (5030)(low level)
1,2-Dichloropropane	1.0	5.0	8260B (5030)(low level)
cis-1,3-Dichloropropene	1.0	5.0	8260B (5030)(low level)
trans-1,3-Dichloropropene	1.0	5.0	8260B (5030)(low level)
Ethyl benzene	1.0	5.0	8260B (5030)(low level)
Ethyl methacrylate	1.0	5.0	8260B (5030)(low level)
2-Hexanone	10	25	8260B (5030)(low level)
Iodomethane	5.0	5.0	8260B (5030)(low level)
Isobutanol	40	200	8260B (5030)(low level)
Methacrylonitrile	20	100	8260B (5030)(low level)
2-Butanone	10	25	8260B (5030)(low level)
Methyl methacrylate	1.0	5.0	8260B (5030)(low level)
4-Methyl-2-pentanone	10	25	8260B (5030)(low level)
Pentachloroethane	5.0	25	8260B (5030)(low level)
Propionitrile	20	100	8260B (5030)(low level)
Stryene	1.0	5.0	8260B (5030)(low level)
1,1,1,2-Tetrachloroethane	1.0	5.0	8260B (5030)(low level)
1,1,2,2-Tetrachloroethane	1.0	5.0	8260B (5030)(low level)
Tetrachloroethene	1.0	5.0	8260B (5030)(low level)
Toluene	1.0	5.0	8260B (5030)(low level)

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		
	Water (µg/L)	Low Soil (µg/kg)	Method Number (Description)
Appendix IX - VOCs (continued)			
1,1,1-Trichloroethane	1.0	5.0	8260B (5030)(low level)
1,1,2-Trichloroethane	1.0	5.0	8260B (5030)(low level)
Trichloroethene	1.0	5.0	8260B (5030)(low level)
Trichlorofluoromethane	1.0	5.0	8260B (5030)(low level)
1,2,3-Trichloropropane	1.0	5.0	8260B (5030)(low level)
Vinyl Acetate	2.0	10	8260B (5030)(low level)
Vinyl Chloride	1.0	10	8260B (5030)(low level)
Xylene	2.0	10	8260B (5030)(low level)
Appendix IX - SVOCs			
Acenaphthene	0.2	6.7	8270C
Acenaphthylene	0.2	6.7	8270C
Acetophenone	10	330	8270C
2-Acetylaminofluorene	10	330	8270C
4-Aminobiphenyl	20	330	8270C
Aniline	20	660	8270C
Anthracene	0.2	6.7	8270C
Aramite	10	330	8270C
Benzo(a)anthracene	0.2	6.7	8270C
Benzo(b)fluoranthene	0.2	6.7	8270C
Benzo(k)fluoranthene	0.2	6.7	8270C
Benzo(g,h,i)perylene	0.2	6.7	8270C
Benzo(a)pyrene	0.2	6.7	8270C
Benzyl alcohol	10	330	8270C
Bis(2-chloroethoxyl)methane	10	330	8270C
Bis(2-chloroethyl)ether	10	330	8270C
Bis(2-ethylhexyl)phthalate	10	330	8270C
4-Bromophenyl phenyl ether	10	330	8270C
Butylbenzylphthalate	10	330	8270C
4-Chloroaniline	20	660	8270C
4-Chloro-3-methylphenol	10	330	8270C
2-Chloronaphthalene	10	330	8270C
2-Chlorophenol	10	330	8270C
4-Chlorophenyl phenyl ether	10	330	8270C
Chrysene	0.2	6.7	8270C
3&4 Methylphenol	10	330	8270C
2-Methylphenol	10	330	8270C
Diallate	10	330	8270C
Dibenzofuran	10	330	8270C
Di-n-butyl phthalate	10	330	8270C
Dibenzo(a,h)anthracene	0.2	6.7	8270C
o-Dichlorobenzene	10	330	8270C
m-Dichlorobenzene	10	330	8270C
p-Dichlorobenzene	10	330	8270C

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
Appendix IX - SVOCs (continued)			
3,3'-Dichlorobenzidine	20	660	8270C
2,4-Dichlorophenol	10	330	8270C
2,6-Dichlorophenol	10	330	8270C
Diethylphthalate	10	330	8270C
p-(Dimethylamino)azobenzene	10	330	8270C
7,12-Dimethyl benz(a)anthracene	10	330	8270C
3,3-Dimethyl benzidine	20	1,700	8270C
2,4-Dimethylphenol	10	330	8270C
alpha, alpha-Dimethylphenethylamine	2,000	67,000	8270C
Dimethyl phthalate	10	330	8270C
m-Dinitrobenzene	10	330	8270C
4,6-Dinitro-2-methylphenol	50	1,700	8270C
2,4-Dinitrophenol	50	1,700	8270C
2,4-Dinitrotoluene	10	330	8270C
2,6-Dinitrotoluene	10	330	8270C
Di-n-octylphthalate	10	330	8270C
1,4-Dioxane	10	330	8270C
Dinoseb	10	330	8270C
Ethylmethanesulfonate	10	330	8270C
Fluoranthene	0.2	6.7	8270C
Fluorene	0.2	6.7	8270C
Hexachlorobenzene	10	330	8270C
Hexachlorobutadiene	10	330	8270C
Hexachlorocyclopentadiene	10	330	8270C
Hexachloroethane	10	330	8270C
Hexachlorophene	5,000	170,000	8270C
Hexachloropropene	10	330	8270C
Indeno(1,2,3-cd)pyrene	0.2	6.7	8270C
Isophorone	10	330	8270C
Isosafrole	10	330	8270C
Methapyrilene	2,000	67,000	8270C
3-Methylcholanthrene	10	330	8270C
Methyl methanesulfonate	10	330	8270C
1-Methylnaphthalene	0.2	6.7	8270C
2-Methylnaphthalene	0.2	6.7	8270C
Naphthalene	10	330	8270C
1,4-Naphthoquinone	10	330	8270C
1-Naphthylamine	10	330	8270C
2-Naphthylamine	10	330	8270C
2-Nitroaniline	50	1,700	8270C
3-Nitroaniline	50	1,700	8270C
4-Nitroaniline	50	1,700	8270C
Nitrobenzene	10	330	8270C
2-Nitrophenol	10	330	8270C
4-Nitrophenol	50	1,700	8270C
4-Nitroquinoline-1-oxide	20	3,300	8270C
n-Nitrosodi-n-butylamine	10	330	8270C
n-Nitrosodiethylamine	10	330	8270C

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
Appendix IX - SVOCs (continued)			
n-Nitrosodiphenylamine	10	330	8270C
n-Nitrosodi-n-propylamine	10	330	8270C
n-Nitrosomethylethylamine	10	330	8270C
n-Nitrosomorpholine	10	330	8270C
n-Nitrosopiperidine	10	330	8270C
n-Nitrosopyrrolidine	10	330	8270C
5-Nitro-o-toluidine	10	330	8270C
bis-(2-chloroisopropyl)ether	10	330	8270C
Pentachlorobenzene	10	330	8270C
Pentachloronitrobenzene	10	330	8270C
Pentachlorophenol	50	1,700	8270C
Phenacetin	10	330	8270C
Phenanthrene	0.2	6.7	8270C
Phenol	10	330	8270C
1,4-Phenylenediamine	2,000	1,700	8270C
2-Picolin	10	330	8270C
Pronamide	10	330	8270C
Pyrene	0.2	6.7	8270C
Pyridine	50	330	8270C
Safrole	10	330	8270C
1,2,4,5-Tetrachlorobenzene	10	330	8270C
2,3,4,6-Tetrachlorophenol	10	330	8270C
o-Toluidine	20	330	8270C
1,2,4-Trichlorobenzene	10	330	8270C
2,4,5-Trichlorophenol	10	330	8270C
2,4,6-Trichlorophenol	10	330	8270C
1,3,5-Trinitrobenzene	10	330	8270C
Appendix IX - Metals (Total) - 2008 CMS Investigation			
Antimony	20	2.0	6010B (Inductively Coupled Plasma)
Arsenic	10	1.0	6010B (Inductively Coupled Plasma)
Barium	10	1.0	6010B (Inductively Coupled Plasma)
Beryllium	4.0	0.4	6010B (Inductively Coupled Plasma)
Cadmium	5.0	0.5	6010B (Inductively Coupled Plasma)
Chromium	10	1.0	6010B (Inductively Coupled Plasma)
Cobalt	10	1.0	6010B (Inductively Coupled Plasma)
Copper	20	2.0	6010B (Inductively Coupled Plasma)
Lead	5.0	0.5	6010B (Inductively Coupled Plasma)
Mercury	0.2	0.02	7470A/7471A (Cold Vapor AA)
Nickel	40	4.0	6010B (Inductively Coupled Plasma)
Selenium	10	1.0	6010B (Inductively Coupled Plasma)
Silver	10	1.0	6010B (Inductively Coupled Plasma)
Thallium	10	1.0	6010B (Inductively Coupled Plasma)
Tin	10	5.0	6010B (Inductively Coupled Plasma)
Vanadium	10	1.0	6010B (Inductively Coupled Plasma)
Zinc	20	2.0	6010B (Inductively Coupled Plasma)

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
Appendix IX - Metals (Total) - 2010 Disturbed Soil Sampling Investigation			
Antimony	5.0	2.0	6020A
Arsenic	2.5	0.5	6020A
Barium	5.0	1.0	6020A
Beryllium	0.5	0.1	6020A
Cadmium	0.5	0.1	6020A
Chromium	5.0	1.0	6020A
Cobalt	0.5	0.1	6020A
Copper	5.0	1.0	6020A
Lead	1.5	0.4	6020A
Mercury	0.2	0.02	7470A/7471A
Nickel	5.0	1.0	6020A
Selenium	2.5	1.0	6020A
Silver	1.0	0.2	6020A
Thallium	1.0	0.2	6020A
Tin	5.0	20	6010C
Vanadium	10	1.0	6020A
Zinc	20	4.0	6020A

TABLE 5-1

SUMMARY OF SLUG TEST RESULTS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Location	Date	Rising Head Test (feet/day)	Falling Head Test (feet/day)	Average Hydraulic Conductivity (feet/day)	Comment
69SB07f	5/4/2008		8.58		Water within screened interval
69SB07r	5/4/2008	0.93			
69SB08f	5/4/2008		3.30		Water within screened interval
69SB08r	5/4/2008	3.54			
69SB11f	5/2/2008		21.86		Water within screened interval
69SB11r	5/2/2008	11.33			
69SB12f	5/4/2008		36.91		Water within screened interval
69SB12r	5/4/2008	145.58			
69SB25f	5/4/2008		2.20		
Average Hydraulic Conductivity (feet/day) at 69SB07, 69SB08, and 69SB25				**2.22**	**Using Rising Head Values for 69SB07 and 69SB08, and Falling Head Values for 69SB25**
Average Hydraulic Conductivity (feet/day) at 69SB11 and 69SB12				**78.46**	**Using Rising Head Values for 69SB11 and 69SB12**

TABLE 5-2

GROUNDWATER ELEVATION SUMMARY
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Well Identification	Northing	Easting	Total Well Depth (ft bgs)	Ground Surface Elevation (ft)[1]	Screen Interval (ft bgs)	Elevation Top of PVC (ft)[1]	Depth to Groundwater on 05/07/08 (ft)[2]	Groundwater Elevation (ft)[1, 3]	Depth to Groundwater on 07/22/08 (ft)[2]	Groundwater Elevation (ft)[1, 3]
69SB07	808325.9	930178.4	16.5	138.3	6.5 to 16.5	140.77	9.98	130.79	11.55	129.22
69SB08	808287.4	930157.4	16.0	136.8	6.0 to 16.0	139.82	8.87	130.95	10.68	129.14
69SB11	808370.0	930016.7	16.0	141.3	6.0 to 16.0	144.44	12.78	131.66	14.28	130.16
69SB12	808311.0	930040.1	15.0	138.9	5.0 to 15.0	142.09	10.40	131.69	11.88	130.21
69SB25	808406.0	930442.2	18.0	135.7	8.0 to 18.0	138.62	9.19	129.43	10.65	127.97
69SB26	808231.5	929763.8	18.0	143.5	8.0 to 18.0	146.30	11.00	135.30	13.17	133.13
69SB27	808169.0	930053.6	18.0	140.6	8.0 to 18.0	143.44	12.61	130.83	14.38	129.06

Notes:

ft = feet

bgs = below ground surface

(1) Datum is mean sea level plus 100 feet

(2) Measured from top of PVC

(3) Groundwater Elevation = Elevation of top of PVC - Depth to Groundwater

TABLE 6-1

SUMMARY OF DETECTED LABORATORY RESULTS - 2008 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	69SB07	69SB08	69SB08	69SB11	69SB12	69SB27
Sample ID	Airfield	69SB07-05	69SB08-05	69SB08-05D	69SB11-05	69SB12-05	69SB27-05
Date	Background	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range		9.0-11.0	9.0-11.0	9.0-11.0	9.0-11.0	9.0-11.0	9.0-11.0
Inorganics (mg/kg)							
Arsenic	2.34	0.83	0.54 J	0.93	1.5	1.1	2.2
Barium	231	10	7.1	10	64	78	11
Beryllium	0.65	0.18	0.18	0.26	0.26	0.28	0.35
Cadmium	0.65	0.041 UJ	0.041 UJ	0.041 UJ	0.034 UJ	0.046 J	0.036 UJ
Chromium	68.81	9	8 J	12 J	21	18	20
Cobalt	46.43	2.4	2.6 J	5 J	13	16	3.3
Copper	223	120	120 J	240 J	76	79	270
Lead	16.86	2.7	1.3	2.9	2.9	2.8	4.3
Mercury	0.10	0.0057 U	0.0062 J	0.0086 J	0.059	0.03	0.0081 J
Nickel	22.97	3.1	2.9	4	8	9	2.7
Selenium	1.85	0.97	0.64 J	1.1	0.25 J	0.23 J	1.2
Silver	NE	0.047 J	0.071 J	0.13 U	0.042 U	0.04 U	0.088 J
Thallium	0.77	0.16 U	0.16 U	0.16 U	0.13 U	0.13 U	0.14 U
Vanadium	367	390	210 J	460 J	230	230	430
Zinc	112	11	10	16	43	45	14

TABLE 6-1

SUMMARY OF DETECTED RESULTS - 2008 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	69SB07	69SB08	69SB08	69SB11	69SB12	69SB27
Sample ID	Basewide	69SB07-05	69SB08-05	69SB08-05D	69SB11-05	69SB12-05	69SB27-05
Date	Background	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range		9.0-11.0	9.0-11.0	9.0-11.0	9.0-11.0	9.0-11.0	9.0-11.0
Volatile Organic Compounds (ug/kg)							
2-Chloro-1,3-butadiene	NE	7.6 J	0.68 UJ	0.67 UJ	0.54 UJ	0.54 UJ	22 UJ
2-Hexanone	NE	2.7 U	2.5 U	6.3 J	2 UJ	2 UJ	80 U
4-Methyl-2-pentanone (MIBK)	NE	3.7 U	3.5 U	3.7 J	2.7 U	2.7 U	110 U
Acetone	NE	7 J	15 J	16 J	4.1 UJ	4.1 UJ	520 R
Carbon disulfide	NE	0.64 U	0.61 U	0.6 U	0.48 U	0.48 U	19 U
Semivolatile Organic Compounds (ug/kg)							
Bis(2-ethylhexyl) phthalate	NE	14 J	31 U	23 U	24 U	29 U	30 UJ

Notes/Qualifiers:

J - Estimated value
U - Not detected above the reported sample quantitation limit
R - Result is rejected; the presence or absense of the analyte cannot be verified
UJ - Reported quantitation limit is qualified as estimated
ft bgs - feet below ground surface
ug/kg - micrograms per kilogram
mg/kg - miligrams per kilogram
NE - Not Established
NAPR - Naval Activity Puerto Rico
(1) NAPR basewide background surface soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2008)

TABLE 6-2

SUMMARY OF DETECTED RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	PRWQS	69SB07	69SB08	69SB11	69SB11D	69SB12	69SB25	69SB26	69SB27
Sample ID	Basewide	Class SG	69GW07	69GW08	69GW11	69GW11D	69GW12	69GW25	69GW26	69GW27
Date	Background (1)	(2)	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L)										
2-Hexanone	NE	NE	0.68 U	0.68 U	0.68 U	0.68 U	0.68 UJ	0.68 UJ	1.1 J	0.68 U
Acetone	NE	NE	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	15 J
Chloromethane	NE	NE	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	1.5 J	0.28 U	0.28 U
Semivolatile Organic Compounds (ug/L)										
3 & 4 Methylphenol	NE	NE	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	2.1
Acenaphthene	NE	670	0.019 U	0.019 U	0.019 U	0.019 U	0.019 UJ	0.019 UJ	0.019 U	0.11 J
Bis(2-ethylhexyl) phthalate	NE	12	0.34 U	0.34 U	0.34 U	0.34 U	0.34 UJ	0.6 J	0.61 U	0.78 U
Dibenzofuran	NE	NE	0.097 U	0.097 U	0.097 U	0.097 U	0.097 UJ	0.097 UJ	0.097 U	0.36 J
Fluorene	NE	1,100	0.018 U	0.018 U	0.018 U	0.018 U	0.018 UJ	0.018 UJ	0.083 J	0.018 U
Phenanthrene	NE	NE	0.017 U	0.017 U	0.017 U	0.017 U	0.017 UJ	0.017 UJ	0.28	0.017 U
Total Metals (ug/L)										
Arsenic	18.89	10	1.7 U	1.5 U	1.4 U	1.7 U	0.43 J	0.34 J	0.46 J	0.56 J
Barium	686	NE	23	23	570	560	580 J	12 J	28	42
Cadmium	16.62	5.0	0.12 J	0.12 UJ	0.12 UJ	0.12 UJ	0.16 J	0.12 UJ	0.12 UJ	0.12 UJ
Cobalt	633.21	NE	0.24 U	0.32 U	11	11	9.9 J	1.7 J	0.81 J	0.27 U
Nickel	95.7	610	0.47 J	0.44 J	0.55 J	0.51 J	0.52 J	0.9 J	0.74 J	0.57 J
Vanadium	484.66	NE	6.9	5.7	6.4	6.6	4.8 J	5.1 J	2.7 J	3.3 J
Zinc	547.53	NE	7.7 J	6.5 U	6.5 U	6.5 U	7.2 J	6.5 UJ	10 J	8.9 J
Dissolved Metals (ug/L)										
Arsenic	14.03	10	1.5 U	1.3 U	1.4 U	1.3 U	0.32 J	0.28 U	0.37 J	0.38 J
Barium	260	NE	23	23	540	530	570 J	12 J	27	40
Cadmium	36.42	5.0	0.14 J	0.12 UJ	0.12 UJ	0.12 UJ	0.16 J	0.12 UJ	0.12 U	0.12 U
Cobalt	580.50	NE	0.41 U	0.43 U	11	10	12 J	2.4 J	1.2 J	0.71 J
Nickel	84.1	610	0.42 J	0.42 J	0.67 J	0.45 J	0.78 J	0.89 J	0.85 J	0.59 J
Vanadium	20.96	NE	6.1	5.4	6.6	5.9	4.2 J	4.8 J	2.5 J	2.4 J
Zinc	360.64	NE	6.5 U	6.5 U	6.5 U	6.5 U	7.2 J	13 J	16 J	7.5 J

TABLE 6-2

SUMMARY OF DETECTED RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes/Qualifiers:

J - Estimated value
R - Result is rejected; the presence or absense of the analyte cannot be verified
U - Not detected above the reported sample quantitation limit
UJ - Reported quantitation limit is qualified as estimated
ft bgs - feet below ground surface
ug/L - micrograms per liter
NE - Not Established
NAPR - Naval Activity Puerto Rico
PRWQS - Puerto Rico Water Quality Standard (PREQB, 2010)
SG - Groundwater

(1) NAPR basewide background surface soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2008)

(2) PRWQS are provided for informational purposes and are not considered project action limits. Values are for total recoverable fractions, and are shown for comparison to both total and dissolved concentrations.

TABLE 6-3

SUMMARY OF DETECTED RESULTS - 2008 QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Equipment Rinsates			Field Blank	Trip Blanks					
Sample ID	ER03	ER04	ER05	FB01	69TB01	69TB02	56TB03	56TB04	QATB01	74TB12
Date	4/30/2008	5/1/2008	5/2/2008	5/2/2008	4/29/2008	4/30/2008	5/2/2008	5/4/2008	5/2/2008	5/7/2008
Volatile Organic Compounds (ug/L)										
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.69 J	0.6 U	5 R	0.6 UJ	0.6 U	0.6 U	0.6 U
Chloromethane	0.28 U	0.28 U	0.28 U	0.28 UJ	0.28 U	1.4 J	0.38 J	0.28 U	0.28 U	0.28 U
Toluene	0.31 U	0.79 J	0.9 J	0.31 U	0.31 U	0.31 R	0.31 UJ	0.31 U	0.31 U	0.31 U
1,4-Dichlorobenzene	0.17 J	0.12 UJ	0.15 UJ	0.16 J	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/L)										
Acetophenone	0.39 J	0.35 J	0.35 J	0.38 J	NA	NA	NA	NA	NA	NA
Diethyl phthalate	0.27 J	0.18 UJ	0.24 UJ	0.33 J	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	1.2 J	0.32 J	0.42 J	1.2 J	NA	NA	NA	NA	NA	NA
Metals (ug/L)										
Copper	2.1 J	1.2 UJ	1.2 UJ	2.1 J	NA	NA	NA	NA	NA	NA
Lead	0.15 UJ	0.15 UJ	0.15 UJ	0.38 J	NA	NA	NA	NA	NA	NA

Notes/Qualifiers:

J - Estimated value
U - Not detected above the reported sample quantitation limit
R - Result is rejected; the presence or absense of the analyte cannot be verified
UJ - Reported quantitation limit is qualified as estimated
ug/L- micrograms per liter
NA - Not Analyzed

TABLE 6-4

SUMMARY OF DETECTIONS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	EPA Region III	**EPA Region III**	15E-01	15E-02	15E-03	15E-04	15E-05	15E-05
Sample ID	Industrial	**Residential**	15E-SS01	15E-SS02	15E-SS03	15E-SS04	15E-SS05	15E-SS05D
Sample Date	RBCs	**RBCs**	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	(ug/kg)	(ug/kg)	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
Volatile Organic Compounds (ug/kg)								
Tetrachloroethene	5,300	1,200	5.6 U	5.6 U	5.2 J	6.6 J	1.9 J	5.6 U
Chlorobenzene	2,000,000	160,000	5.6 U	5.6 U	2.5 J	2.6 J	5 U	5.6 U
Semivolatile Organic Compounds (ug/kg)								
bis(2-Ethylhexyl)phthalate	200,000	46,000	390 U	380 U	1,000	210 J	380 U	380 U
Butylbenzylphthalate	20,000,000	1,600,000	390 U	380 U	200 J	58 J	380 U	380 U
Chrysene	390,000	87,000	390 U	380 U	680	100 J	120 J	45 J
Dibenzo(a,h)anthracene	390	87	390 U	380 U	**140** J	54 J	380 U	380 U
Fluoranthene	4,100,000	310,000	390 U	380 U	680	87 J	140 J	46 J
Indeno(1,2,3-cd)pyrene	3,900	870	390 U	380 U	590 J	120 J	67 J	44 J
Isophorone	3,000,000	670,000	390 U	380 U	620 U	550 U	410	380 U
Anthracene	31,000,000	2,300,000	390 U	380 U	620 U	550 U	38 J	380 U
Phenanthrene	NE	NE	390 U	380 U	210 J	550 U	380 U	380 U
Pyrene	3,100,000	230,000	390 U	20 J	700	97 J	150 J	54 J
Benzo(a)anthracene	3,900	870	390 U	380 U	350 J	100 J	62 J	380 U
Benzo(a)pyrene	390	87	390 U	380 U	**380** J	75 J	58 J	41 J
Benzo(b)fluoranthene	3,900	870	390 U	380 U	560 J	94 J	94 J	48 J
Benzo(g,h,i)perylene	NE	NE	390 U	48 J	640	140 J	76 J	60 J
Benzo(k)fluoranthene	39,000	8,700	390 U	380 U	260 J	44 J	81 J	39 J
Total Petroleum Hydrocarbons (mg/kg)								
Diesel Range Organics	NE	NE	2.8 J	8.8	300	170	6	8.4

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was analyzed for, but was not detected at or above the MDL/PQL.
NE - Not Established.
ft bgs - feet below ground surface.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Data Not Validated

TABLE 6-4

SUMMARY OF DETECTIONS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (ug/kg)	**EPA Region III Residential RBCs (ug/kg)**	Number Exceeding EPA Region III Industrial RBCs	Range Exceeding EPA Region III Industrial RBCs	**Number Exceeding EPA Region III Residential RBCs**	**Range Exceeding EPA Region III Residential RBCs**	Location of Maximum Detection
Volatile Organic Compounds (ug/kg)							
Tetrachloroethene	5,300	1,200	0/6	---	0/6	---	15E-SS04
Chlorobenzene	2,000,000	160,000	0/6	---	0/6	---	15E-SS04
Semivolatile Organic Compounds (ug/kg)							
bis(2-Ethylhexyl)phthalate	200,000	46,000	0/6	---	0/6	---	15E-SS03
Butylbenzylphthalate	20,000,000	1,600,000	0/6	---	0/6	---	15E-SS03
Chrysene	390,000	87,000	0/6	---	0/6	---	15E-SS03
Dibenzo(a,h)anthracene	390	87	0/6	---	1/6	140J	15E-SS03
Fluoranthene	4,100,000	310,000	0/6	---	0/6	---	15E-SS03
Indeno(1,2,3-cd)pyrene	3,900	870	0/6	---	0/6	---	15E-SS03
Isophorone	3,000,000	670,000	0/6	---	0/6	---	15E-SS05
Anthracene	31,000,000	2,300,000	0/6	---	0/6	---	15E-SS05
Phenanthrene	NE	NE	NE	---	NE	---	15E-SS03
Pyrene	3,100,000	230,000	0/6	---	0/6	---	15E-SS03
Benzo(a)anthracene	3,900	870	0/6	---	0/6	---	15E-SS03
Benzo(a)pyrene	390	87	0/6	---	1/6	380J	15E-SS03
Benzo(b)fluoranthene	3,900	870	0/6	---	0/6	---	15E-SS03
Benzo(g,h,i)perylene	NE	NE	NE	---	NE	---	15E-SS03
Benzo(k)fluoranthene	39,000	8,700	0/6	---	0/6	---	15E-SS03
Total Petroleum Hydrocarbons (mg/kg)							
Diesel Range Organics	NE	NE	NE	---	NE	---	15E-SS03

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was analyzed for, but was not detected at or above the MDL/PQL.
NE - Not Established.
ft bgs - feet below ground surface.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Data Not Validated

TABLE 6-4

SUMMARY OF DETECTIONS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (mg/kg)	**EPA Region III Residential RBCs** (mg/kg)	2x Average Detected Background (mg/kg)	15E-01 15E-SS01 05/09/04 0.00 - 1.00	15E-02 15E-SS02 05/09/04 0.00 - 1.00	15E-03 15E-SS03 05/09/04 0.00 - 1.00	15E-04 15E-SS04 05/09/04 0.00 - 1.00	15E-05 15E-SS05 05/09/04 0.00 - 1.00	15E-05 15E-SS05D 05/09/04 0.00 - 1.00
Appendix IX Inorganic Compounds (mg/kg)									
Silver	510	39	0.37	1.1 U	1.1 U	0.25 B	0.3 B	0.98 U	1.1 U
Arsenic	1.9	0.43	2.4	**3.5**	**3.6**	**2.9**	**3.6**	**1**	**1.9**
Barium	7,200	550	181	14	30	43	**1,400**	25	19
Beryllium	200	16	0.45	0.06 B	0.092 B	0.2 B	0.23 B	0.095 B	0.097 B
Cadmium	100	7.8	0.27	0.57 U	0.86	**16**	**24**	0.32 B	0.37 B
Cobalt	2,000	160	44.0	2.4	6	11	10	16	13
Chromium	310	23	59.3	11	17	**50**	**58**	**45**	**41**
Copper	4,100	310	234	9.5	19	110	100	55	46
Nickel	2,000	160	16.6	3.4 B	6.5	16	20	18	16
Lead	800[(1)]	400[(1)]	125	4.6	19	390	**450**	16	23
Tin	61,000	4,700	2.43	2.4 B	3 B	6.6 B	5.6 B	2.6 B	3 B
Vanadium	100	7.8	355	**22**	**46**	**94**	**70**	**79**	**87**
Zinc	31,000	2,300	125	8.6 E	26 E	250 E	380 E	40 E	39 E
Mercury	31[(2)]	2.3[(2)]	0.11	0.022 U	0.005 B	0.054	0.061	0.015 B	0.015 B

Notes:

B - The reported result is an estimated concentration that is less than the PQL, greater than or equal to the MDL.

U - The compound was analyzed for, but was not detected at or above the MDL/PQL.

E- The reported value is an estimated because of the presence of matrix interference.

(1) - USEPA Region 9 soil screening levels obtained from: http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf

(2) - Value based on the RBC for Mercuric Chloride.

NE - Not Established.

ft bgs - feet below ground surface.

mg/kg - milligrams per kilogram.

Data Not Validated

TABLE 6-4

SUMMARY OF DETECTIONS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (mg/kg)	**EPA Region III Residential RBCs** (mg/kg)	2x Average Detected Background (mg/kg)	Number Exceeding EPA Region III Industrial RBCs	Range Exceeding EPA Region III Industrial RBCs	**Number Exceeding EPA Region III Residential RBCs**	**Range Exceeding EPA Region III Residential RBCs**	Number Exceeding 2x Average Detected Background	Range Exceeding 2x Average Detected Background	Location of Maximum Detection
Appendix IX Inorganic Compounds (mg/kg)										
Silver	510	39	0.37	0/6	---	0/6	---	0/6	---	15E-SS04
Arsenic	1.9	0.43	2.4	4/6	2.9 - 3.6	6/6	1 - 3.6	4/6	2.9 - 3.6	15E-SS02, 15E-SS04
Barium	7,200	550	181	0/6	---	1/6	1,400	1/6	1,400	15E-SS04
Beryllium	200	16	0.45	0/6	---	0/6	---	0/6	---	15E-SS04
Cadmium	100	7.8	0.27	0/6	---	2/6	16 - 24	5/6	0.32B - 24	15E-SS04
Cobalt	2,000	160	44.0	0/6	---	0/6	---	0/6	---	15E-SS05
Chromium	310	23	59.3	0/6	---	4/6	41 - 58	0/6	---	15E-SS04
Copper	4,100	310	234	0/6	---	0/6	---	0/6	---	15E-SS03
Nickel	2,000	160	16.6	0/6	---	0/6	---	2/6	18 - 20	15E-SS04
Lead	800[(1)]	400[(1)]	125	0/6	---	1/6	450	2/6	390 - 450	15E-SS04
Tin	61,000	4,700	2.43	0/6	---	0/6	---	5/6	2.6B - 6.6B	15E-SS03
Vanadium	100	7.8	355	0/6	---	6/6	22 - 94	0/6	---	15E-SS03
Zinc	31,000	2,300	125	0/6	---	0/6	---	2/6	250E - 380E	15E-SS04
Mercury	31[(2)]	2.3[(2)]	0.11	0/6	---	0/6	---	0/6	---	15E-SS04

Notes:

B - The reported result is an estimated concentration that is less than the PQL, greater than or equal to the MDL.

U - The compound was analyzed for, but was not detected at or above the MDL/PQL.

E- The reported value is an estimated because of the presence of matrix interference.

(1) - USEPA Region 9 soil screening levels obtained from: http://www.epa.gov/region09/v

(2) - Value based on the RBC for Mercuric Chloride.

NE - Not Established.

ft bgs - feet below ground surface.

mg/kg - milligrams per kilogram.

Data Not Validated

TABLE 6-5

SUMMARY OF DETECTIONS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	EPA Region III	**EPA Region III**	15E-01	15E-02	15E-03	15E-04	15E-05
Sample ID	Industrial	**Residential**	15E-SB01-01	15E-SB02-01	15E-SB03-01	15E-SB04-01	15E-SB05-02
Sample Date	RBCs	**RBCs**	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	(ug/kg)	(ug/kg)	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	3.00 - 5.00
Volatile Organic Compounds (ug/kg)							
Acetone	92,000,000	7,000,000	62 U	61 U	63 U	67 U	28 J
Semivolatile Organic Compounds (ug/kg)							
bis(2-Ethylhexyl)phthalate	200,000	46,000	430 U	190 J	420 U	450 U	430 U
Benzo(g,h,i)perylene	NE	NE	58 J	430 U	420 U	450 U	430 U
Total Petroleum Hydrocarbons (mg/kg)							
Diesel Range Organics	NE	NE	3.6 J	2.9 J	3.2 J	4 J	2.7 J

Notes:
J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was analyzed for, but was not detected at or above the MDL/PQL.
NE - Not Established.
ft bgs - feet below ground surface.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Data Not Validated

TABLE 6-5

SUMMARY OF DETECTIONS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (ug/kg)	**EPA Region III Residential RBCs** (ug/kg)	Number Exceeding EPA Region III Industrial RBCs	Range Exceeding EPA Region III Industrial RBCs	**Number Exceeding EPA Region III Residential RBCs**	**Range Exceeding EPA Region III Residential RBCs**	Location of Maximum Detection
Volatile Organic Compounds (ug/kg)							
Acetone	92,000,000	7,000,000	0/5	---	0/5	---	15E-SB05-02
Semivolatile Organic Compounds (ug/kg)							
bis(2-Ethylhexyl)phthalate	200,000	46,000	0/5	---	0/5	---	15E-SB02-01
Benzo(g,h,i)perylene	NE	NE	NE	---	NE	---	15E-SB01-01
Total Petroleum Hydrocarbons (mg/kg)							
Diesel Range Organics	NE	NE	NE	---	NE	---	15E-SB04-01

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was analyzed for, but was not detected at or above the MDL/PQL.
NE - Not Established.
ft bgs - feet below ground surface.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Data Not Validated

TABLE 6-5

SUMMARY OF DETECTIONS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (mg/kg)	**EPA Region III Residential RBCs** (mg/kg)	2x Average Detected Background (mg/kg)	15E-01 15E-SB01-01 05/09/04 1.00 - 3.00	15E-02 15E-SB02-01 05/09/04 1.00 - 3.00	15E-03 15E-SB03-01 05/09/04 1.00 - 3.00	15E-04 15E-SB04-01 05/09/04 1.00 - 3.00	15E-05 15E-SB05-02 05/09/04 3.00 - 5.00
Appendix IX Inorganic Compounds (mg/kg)								
Barium	7,200	550	222	17	35	85	77	100
Beryllium	200	16	0.74	0.15 B	0.18 B	0.26 B	0.34 B	0.32 B
Cobalt	2,000	160	30.0	9.4	4.9	12	19	19
Chromium	310	23	133	10	9.8	15	15	16
Copper	4,100	310	193	220	120	88	100	68
Nickel	2,000	160	31.9	2.2 B	3.3 B	7.9	8.2	7.4
Lead	800[(1)]	400[(1)]	8.68	0.53 B	1.8	2.7	2.6	2.2
Tin	61,000	4,700	2.96	3.1 B	3.1 B	2.4 B	3.2 B	3.7 B
Vanadium	100	7.8	462	**270**	**170**	**130**	**210**	**160**
Zinc	31,000	2,300	88.6	16 E	22 E	65 E	71 E	70 E
Mercury	31[(2)]	2.3[(2)]	0.093	0.018 B	0.063	0.03	0.023 B	0.039

Notes:

B - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.

E- The reported value is an estimated because of the presence of matrix interference.

(1) - USEPA Region 9 soil screening levels obtained from: http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf

(2) - Value based on the RBC for Mercuric Chloride.

NE - Not Established.

ft bgs - feet below ground surface.

mg/kg - milligrams per kilogram.

Data Not Validated

TABLE 6-5

SUMMARY OF DETECTIONS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (mg/kg)	**EPA Region III Residential RBCs** (mg/kg)	2x Average Detected Background (mg/kg)	Number Exceeding EPA Region III Industrial RBCs	Range Exceeding EPA Region III Industrial RBCs	**Number Exceeding EPA Region III Residential RBCs**	**Range Exceeding EPA Region III Residential RBCs**	Number Exceeding 2x Average Detected Background	Range Exceeding 2x Average Detected Background	Location of Maximum Detection
Appendix IX Inorganic Compounds (mg/kg)										
Barium	7,200	550	222	0/5	---	0/5	---	0/5	---	15E-SB05-02
Beryllium	200	16	0.74	0/5	---	0/5	---	0/5	---	15E-SB04-01
Cobalt	2,000	160	30.0	0/5	---	0/5	---	0/5	---	15E-SB04-01, 15E-SB05-02
Chromium	310	23	133	0/5	---	0/5	---	0/5	---	15E-SB05-02
Copper	4,100	310	193	0/5	---	0/5	---	1/5	220	15E-SB01-01
Nickel	2,000	160	31.9	0/5	---	0/5	---	0/5	---	15E-SB04-01
Lead	800[1]	400[1]	8.68	0/5	---	0/5	---	0/5	---	15E-SB03-01
Tin	61,000	4,700	2.96	0/5	---	0/5	---	4/5	3.1B - 3.7B	15E-SB05-02
Vanadium	100	7.8	462	5/5	130 - 270	5/5	130 - 270	0/5	---	15E-SB01-01
Zinc	31,000	2,300	88.6	0/5	---	0/5	---	0/5	---	15E-SB04-01
Mercury	31[2]	2.3[2]	0.093	0/5	---	0/5	---	0/5	---	15E-SB02-01

Notes:

B - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.

E- The reported value is an estimated because of the presence of matrix interference.

[1] - USEPA Region 9 soil screening levels obtained from: http://www.epa.gov/region09/

[2] - Value based on the RBC for Mercuric Chloride.

NE - Not Established.

ft bgs - feet below ground surface.

mg/kg - milligrams per kilogram.

Data Not Validated

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	**Soil to Groundwater SSLs** [(1)]	69SB101	69SB101	69SB102	69SB103	69SB104	69SB105	69SB106	69SB107	69SB108
Sample ID			69SB101-00	69SB101-00D	69SB102-00	69SB103-00	69SB104-00	69SB105-00	69SB106-00	69SB107-00	69SB108-00
Date			8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)											
Arsenic	2.34	0.29	5.1	6.2	3.7	2.6	4	**2.1**	2.9	3.9	4.1
Barium	231	82	17 J	10 J	9.7 J	16 J	9 J	35 J	14 J	17	21
Beryllium	0.713	3.2	0.11 U	0.1 U	0.12 U	0.063 J	0.11 U	0.057 J	0.1 U	0.11 U	0.12 U
Cadmium	0.650	0.38	0.047 J	0.035 J	0.12 U	0.1 U	0.11 U	0.29	0.1 U	0.066 J	1.4
Chromium	86.7	180,000	12 J	18 J	20 J	21 J	5.9 J	14 J	13 J	26	23
Cobalt	53.6	0.21	**3.8**	**5.3**	**5**	**4.1**	**1.3**	**7.9**	**4.2**	**7**	**6.6**
Copper	223	46	15	15	17	44	3	33	14	15	19
Lead	27.9	14	0.52	0.59	0.67	2.6	0.25 J	9.7	1.7	2.5	12
Mercury	0.111	0.10	0.029	0.011 J	0.013 J	0.021	0.021 U	0.01 J	0.02 U	0.022 U	0.024 U
Nickel	26.8	20	4.6	6.4	7.3	5	2	6.2	4.9	8.6	7.6
Selenium	1.85	0.26	1.1 U	1 U	1.2 U	1 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U
Silver	NE	0.6	0.22 U	0.2 U	0.23 U	0.2 U	0.22 U	0.21 U	0.21 U	0.23 U	0.24 U
Thallium	0.766	0.14	0.43 U	0.054 J	0.46 U	0.41 U	0.43 U	0.43 U	0.42 U	0.45 U	0.47 U
Vanadium	367	78	45 J	70 J	**110**	75	9	76	44	65 J	62 J
Zinc	112	290	6	7.5	10	8.6	4.3 U	21	7.2	11	16

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	Soil to Groundwater SSLs [1]	69SB109	69SB110	69SB111	69SB111	69SB112	69SB113	69SB114	69SB115	69SB116
Sample ID			69SB109-00	69SB110-00	69SB111-00	69SB111-00D	69SB112-00	69SB113-00	69SB114-00	69SB115-00	69SB116-00
Date			8/3/2010	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**2.3**	3.4	2.8 J	4.1 J	3.9	3.9	3.7	3.5	4
Barium	231	82	34	24	19	18	11	19	41	**130**	29
Beryllium	0.713	3.2	0.11 U	0.06 J	0.13 U	0.11 U	0.11 U	0.058 J	0.24	0.21	0.067 J
Cadmium	0.650	0.38	**0.62**	0.082 J	0.35	**0.45**	0.086 J	0.16	0.72	5.3	0.35
Chromium	86.7	180,000	15	23	16	18	38	26	20	35	14
Cobalt	53.6	0.21	**4.9**	**7.6**	**5.3**	**5.8**	**9.8**	**5.9**	**12**	**11**	**5.5**
Copper	223	46	24	28	14	16	32	17 J	32 J	**57 J**	20 J
Lead	27.9	14	6	7	3.7 R	6.4 R	1.1	3.6 J	**17 J**	53 **J**	6.8 J
Mercury	0.111	0.10	0.013 J	0.022 U	0.028 U	0.022 U	0.021 U	0.009 J	0.036	0.1	0.012 J
Nickel	26.8	20	5.2	7.4	6	6.3	12	7.9	6.7	13	5.3
Selenium	1.85	0.26	1.1 U	1.2 U	1.3 U	1.1 U	1.1 U	1.1 U	1.2 U	1.2 U	1.3 U
Silver	NE	0.6	0.22 U	0.23 U	0.26 U	0.22 U	0.22 U	0.21 U	0.25 U	0.15 J	0.25 U
Thallium	0.766	0.14	0.44 U	0.47 U	0.52 U	0.45 U	0.43 U	0.071 J	0.5 U	0.061 J	0.5 U
Vanadium	367	78	66 J	76 J	50 J	52 J	**100 J**	71 J	**100 J**	**93 J**	52 J
Zinc	112	290	19	18	11	14	10	8.7	88	200	27

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	**Soil to Groundwater SSLs [1]**	69SB117	69SB118	69SB119	69SB120	69SB121	69SB121	69SB122	69SB123
Sample ID			69SB117-00	69SB118-00	69SB119-00	69SB120-00	69SB121-00	69SB121-00D	69SB122-00	69SB123-00
Date			8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/5/2010	8/5/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)										
Arsenic	2.34	0.29	4.3	5.8	3	4	4.3	4.1	3.6	**2.3**
Barium	231	82	20	18	13	41	22	27	32	28
Beryllium	0.713	3.2	0.11 U	0.056 J	0.14 U	0.13	0.072 J	0.072 J	0.09 J	0.067 J
Cadmium	0.650	0.38	0.063 J	0.15	0.32	**0.55**	0.67	0.72	4.4	0.79
Chromium	86.7	180,000	26	26	36	22	27	26	33	68
Cobalt	53.6	0.21	**6.5**	**6.1**	**6.7**	**12**	**7.9**	**7.3**	**8.3**	**16**
Copper	223	46	16 J	18 J	20	**82**	24	21	43	37
Lead	27.9	14	2.5 J	9.1 J	5.4 J	11 J	9.1 J	12 J	71 **J**	7.3 J
Mercury	0.111	0.10	0.021 U	0.009 J	0.03 J	0.025 J	0.029 J	0.028 J	0.034 J	0.032 J
Nickel	26.8	20	7.7	7.4	7.8	9.1	8.8	8.9	10	19
Selenium	1.85	0.26	1.1 U	1 U	1.4 U	1.2 U	1.1 U	1.2 U	1.3 U	1.1 U
Silver	NE	0.6	0.21 U	0.21 U	0.28 U	0.24 U	0.22 U	0.24 U	0.25 U	0.23 U
Thallium	0.766	0.14	0.43 U	0.42 U	0.57 U	0.077 J	0.44 U	0.12 J	0.51 U	0.46 U
Vanadium	367	78	74 J	71 J	77	**100**	73	70	**100**	**110**
Zinc	112	290	9.9	9.2	13 J	29 J	25 J	21 J	77 J	26 J

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	Soil to Groundwater SSLs [1]	69SB124	69SB125	69SB126	69SB127	69SB128	69SB129	69SB130	69SB131
Sample ID			69SB124-00	69SB125-00	69SB126-00	69SB127-00	69SB128-00	69SB129-00	69SB130-00	69SB131-00
Date			8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)										
Arsenic	2.34	0.29	2.7	2.8	3	**2.2**	**1.4**	**1.6**	**1.7**	**1.8**
Barium	231	82	80	59 J	470 **J**	50 J	16 J	26 J	20 J	50 J
Beryllium	0.713	3.2	0.25	0.23	0.25	0.2	0.15	0.12 J	0.13	0.19
Cadmium	0.650	0.38	1.7	0.28	**0.47**	1.3	0.059 J	0.26	0.22	0.67 J
Chromium	86.7	180,000	27	18 J	27 J	22 J	27 J	19 J	36 J	22 J
Cobalt	53.6	0.21	**13**	64	**45**	**10**	**4.5**	**3.8**	**2.3**	**11**
Copper	223	46	**87**	**67**	**89**	**70**	**120**	**84**	**55**	**68 J**
Lead	27.9	14	**16 J**	7.1	8.2	**19**	3.8	3.6	4.6	13 J
Mercury	0.111	0.10	0.053 J	0.18	0.17	0.15	0.12	0.093	0.18	0.047
Nickel	26.8	20	13	7.3	5.7	7.6	3.3	3.7	3.6	5.6
Selenium	1.85	0.26	1.6 U	2	2.1	**0.83 J**	**1 J**	**0.91 J**	**0.71 J**	1.3 U
Silver	NE	0.6	0.18 J	0.27	0.2 J	0.28 U	0.29 U	0.3 U	0.25 U	0.26 U
Thallium	0.766	0.14	0.14 J	**0.26 J**	**0.32 J**	0.57 U	0.58 U	0.6 U	0.49 U	0.11 J
Vanadium	367	78	**100**	**270**	**310**	**240**	410	**330**	**240**	**160 J**
Zinc	112	290	110 J	60	52	44	12	24	12	47

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	**Soil to Groundwater SSLs [1]**	69SB131	69SB132	69SB133	69SB134	69SB135	69SB136	69SB137	69SB138
Sample ID			69SB131-00D	69SB132-00	69SB133-00	69SB134-00	69SB135-00	69SB136-00	69SB137-00	69SB138-00
Date			8/5/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)										
Arsenic	2.34	0.29	**0.97**	**2**	2.6	2.4	**2**	**1**	**0.93**	**1.3**
Barium	231	82	36 J	10 J	29 J	54 J	63 J	68 J	40 J	**86**
Beryllium	0.713	3.2	0.11 J	0.11 J	0.13	0.13	0.16	0.29	0.23	0.25
Cadmium	0.650	0.38	1.5 J	0.044 J	0.34	0.75	1.5	0.092 J	0.097 J	**0.49**
Chromium	86.7	180,000	11 J	17	19	18	16	12	12	20 J
Cobalt	53.6	0.21	**7.8 J**	**2 J**	**6.4 J**	**11 J**	**13 J**	**17 J**	**11 J**	**19**
Copper	223	46	45 J	**95**	**86**	**48**	**64**	**73**	**74**	**88 J**
Lead	27.9	14	32 **J**	2.2	8.6	13	35	3.4	4.1	**15 J**
Mercury	0.111	0.10	0.039	**0.11**	0.066	0.028	0.04	0.073	0.14	0.042 J
Nickel	26.8	20	4.9	2.6	4.5	6.9	7.4	7.3	6.4	6.6
Selenium	1.85	0.26	1.5 U	**0.67 J**	**1 J**	1.3 U	1.3 U	1.2 U	1.2 U	1.2 U
Silver	NE	0.6	0.3 U	0.26 U	0.26 U	0.25 U	0.25 U	0.25 U	0.25 U	0.24 U
Thallium	0.766	0.14	0.6 U	0.51 U	0.53 U	0.073 J	0.07 J	0.099 J	0.067 J	**0.15 J**
Vanadium	367	78	**95 J**	550	370	**100**	**120**	**160**	**190**	**210 J**
Zinc	112	290	51	11	21	43	70	71	49	110

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	**Soil to Groundwater SSLs [1]**	69SB139	69SB140	69SB141	69SB141	69SB142	69SB143	69SB144	69SB145
Sample ID			69SB139-00	69SB140-00	69SB141-00	69SB141-00D	69SB142-00	69SB143-00	69SB144-00	69SB145-00
Date			8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)										
Arsenic	2.34	0.29	5.1	**1.2**	4.7	3.8	2.6	**1.8**	**2.1**	**1.8**
Barium	231	82	15	29	14	15	22	12	62	12
Beryllium	0.713	3.2	0.13 U	0.17	0.11 U	0.13 U	0.15 J	0.079 J	0.2	0.11 U
Cadmium	0.650	0.38	0.095 J	0.36	0.15	**0.43**	0.14 J	0.16	0.18	0.14
Chromium	86.7	180,000	7.8 J	17 J	25 J	35 J	60 J	19 J	14	68
Cobalt	53.6	0.21	**2.1**	**8**	**7.8 J**	**13 J**	**12**	**4.5**	**14**	**14**
Copper	223	46	7.4 J	**90 J**	19 J	44 J	**79 J**	**55 J**	**57 J**	33 J
Lead	27.9	14	2.6 J	8.5 J	1.5 J	5.6 J	4.8 J	2 J	7.4	1.4
Mercury	0.111	0.10	0.024 UJ	0.08 J	0.022 J	0.026 UJ	0.034 UJ	0.08 J	0.099 R	0.025 R
Nickel	26.8	20	2.5	5.1	9.7 J	14 J	10	4.7	6	19
Selenium	1.85	0.26	1.3 U	1.4 U	1.1 U	1.3 U	1.6 U	1.1 U	**0.58 J**	1.1 U
Silver	NE	0.6	0.26 U	0.27 U	0.23 U	0.26 U	0.32 U	0.23 U	0.22 U	0.23 U
Thallium	0.766	0.14	0.51 U	0.54 U	0.45 U	0.53 U	0.083 J	0.063 J	0.13 J	0.46 U
Vanadium	367	78	18 J	**210 J**	59 J	**94 J**	**210 J**	**180 J**	**150**	**120**
Zinc	112	290	13	35	10 J	21 J	24	12	42	18

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	Soil to Groundwater SSLs [1]	69SB146	69SB147	69SB148	69SB149	69SB150	69SB151	69SB151	69SB152
Sample ID			69SB146-00	69SB147-00	69SB148-00	69SB149-00	69SB150-00	69SB151-00	69SB151-00D	69SB152-00
Date			8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (mg/kg)										
Arsenic	2.34	0.29	**0.89**	**0.96**	**1.3**	**0.65**	**0.86**	**1.5**	**1.2**	**1.4**
Barium	231	82	21	16	22	22	47	50	49	82
Beryllium	0.713	3.2	0.073 J	0.13 U	0.12	0.12 U	0.19	0.19	0.17	0.24
Cadmium	0.650	0.38	0.055 J	0.13 U	0.089 J	0.12 U	0.079 J	0.29	0.31	0.19
Chromium	86.7	180,000	7.6	9.7	14	4.2	16	12	13	13
Cobalt	53.6	0.21	**3.2**	**0.61**	**3.7**	**1**	**15**	**13**	**13**	**17**
Copper	223	46	**65 J**	37 J	**88 J**	**55 J**	**96**	**52**	**68**	**59**
Lead	27.9	14	2.6	1.8	2.8	1.3	3.6	7	5.8	5.3
Mercury	0.111	0.10	0.023 R	0.025 R	0.079 R	0.071 R	0.077	0.04	0.053	0.024
Nickel	26.8	20	1.9	1.2 J	4.2	1.3	7.2	11	8.5	7.3
Selenium	1.85	0.26	**0.65 J**	**0.98 J**	**0.78 J**	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U
Silver	NE	0.6	0.23 U	0.25 U	0.24 U	0.24 U	0.24 U	0.23 U	0.24 U	0.22 U
Thallium	0.766	0.14	0.057 J	0.5 U	0.079 J	0.48 U	0.083 J	0.46 U	0.062 J	0.11 J
Vanadium	367	78	**150**	**310**	**160**	70	**160 J**	**110 J**	**120 J**	**140 J**
Zinc	112	290	10	5.1	13	4.9	49	51	44	58

Notes:

mg/kg - milligrams per kilogram
NAPR - Naval Activity Puerto Rico
NE - Not Established
U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
R - Result is rejected and unusable

[1] Soil to groundwater SSLs are provided for informational purposes and are not considered project action limits. USEPA Regional Screning Levels Table (November 2011).

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR Airfield Background	**Soil to Groundwater SSLs [1]**	69SB101	69SB101	69SB102	69SB102	69SB103	69SB103	69SB104	69SB104	69SB104
Sample ID			69SB101-01	69SB101-02	69SB102-01	69SB102-02	69SB103-01	69SB103-02	69SB104-01	69SB104-01D	69SB104-02
Date			8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**1.6**	**0.73**	**1.5**	**0.84**	**1.2**	**0.76**	**0.7**	**0.69 J**	0.27 J
Barium	231	82	17 J	15 J	13 J	12 J	27 J	24 J	80 J	46 J	76 J
Beryllium	0.65	3.2	0.12	0.11 U	0.12 J	0.057 J	0.09 J	0.17	0.12	0.22	0.074 J
Cadmium	0.65	0.38	0.12 U	0.11 U	0.13 U	0.11 U	0.12 U	0.13 U	0.11 U	0.14 U	0.12 U
Chromium	68.81	180,000	17 J	5.3 J	12 J	7.6 J	11 J	5.1 J	8.1 J	5.9 J	4 J
Cobalt	46.43	0.21	**4.1**	**1.5**	**3.7**	**4.2**	**3.6**	**3.5**	**2 J**	**4.5 J**	**0.6**
Copper	223	46	**130**	**57**	**120**	**54**	**140**	**180**	**100 J**	**200 J**	26
Lead	16.86	14	3.6	0.92	2.2	0.99	1.3	1.4	4.2 R	0.98 R	0.48 J
Mercury	0.10	0.10	0.074	0.099	0.017 J	0.021 J	0.026	0.026 U	0.0098 J	0.011 J	0.016 J
Nickel	22.97	20	3.9	1.8	4.4	2.7	2.4	2.1	2.3	3.2	2.2
Selenium	1.85	0.26	**1.9**	**0.73 J**	**1.8**	**0.88 J**	**0.85 J**	1.3 U	1.1 U	1.4 U	1.2 U
Silver	NE	0.6	0.24 U	0.23 U	0.26 U	0.23 U	0.25 U	0.26 U	0.22 U	0.28 U	0.25 U
Thallium	0.77	0.14	0.11 J	0.46 U	0.13 J	0.097 J	0.071 J	0.52 U	0.068 J	0.56 U	0.078 J
Vanadium	367	78	**270**	**170**	**220**	**120**	**130**	**330**	**210**	**290**	**140**
Zinc	112	290	14	7.2	13	5.4	9.8	11	10 J	18 J	4.9 U

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB105	69SB105	69SB106	69SB106	69SB107	69SB107	69SB107	69SB108	69SB108
Sample ID	Airfield	**Groundwater**	69SB105-01	69SB105-02	69SB106-01	69SB106-02	69SB107-01	69SB107-02	69SB107-02D	69SB108-01	69SB108-02
Date	Background	**SSLs** [(1)]	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**1**	**0.72**	**0.45 J**	**0.41 J**	**4.1**	**4.3 J**	**1.2 J**	**4**	**3.4**
Barium	231	82	15 J	9.8 J	12 J	11 J	20	16	22	17	17
Beryllium	0.65	3.2	0.058 J	0.12 U	0.14 U	0.13 U	0.055 J	0.13 U	0.16 U	0.13 U	0.071 J
Cadmium	0.65	0.38	0.11 U	0.12 U	0.14 U	0.13 U	0.058 J	0.052 J	0.16 U	0.06 J	0.073 J
Chromium	68.81	180,000	8.8 J	6.1 J	4.1 J	3 J	27	17	15	18	28
Cobalt	46.43	0.21	**1.9**	**0.97**	**0.39**	**0.38**	**7.3**	**4.1**	**3.3**	**5.4**	**5.2**
Copper	223	46	**91**	**90**	43	39	16	30 J	**48 J**	12	23
Lead	16.86	14	1.1	0.83	1	0.87	1.4	0.68	0.86	1.5	2.6
Mercury	0.10	0.10	0.012 J	0.01 J	**0.11**	0.021 J	0.023 U	0.024 U	0.03 U	0.024 U	0.02 U
Nickel	22.97	20	1.1	1.2	1 J	0.76 J	9.3	6.3	6.7	6.5	5.8
Selenium	1.85	0.26	**1.3**	**0.88 J**	1.4 U	1.3 U	1.1 U	1.3 U	1.6 U	1.3 U	1.1 U
Silver	NE	0.6	0.23 U	0.24 U	0.28 U	0.25 U	0.22 U	0.26 U	0.32 U	0.25 U	0.21 U
Thallium	0.77	0.14	0.46 U	0.48 U	0.56 U	0.51 U	0.44 U	0.51 U	0.64 U	0.5 U	0.43 U
Vanadium	367	78	**300**	**130**	**240**	48	65 J	**110 J**	**150 J**	51 J	**110 J**
Zinc	112	290	5.6	6.5	5.6 U	5.1 U	10	7.5	7.7	8.1	9.5

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB109	69SB109	69SB110	69SB110	69SB111	69SB111	69SB112	69SB112	69SB113
Sample ID	Airfield	**Groundwater**	69SB109-01	69SB109-02	69SB110-01	69SB110-02	69SB111-01	69SB111-02	69SB112-01	69SB112-02	69SB113-01
Date	Background	**SSLs** [(1)]	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**0.99**	**0.95**	**1.5**	**0.45 J**	**0.77**	**1.1**	**1.2**	**1.2**	**3.9**
Barium	231	82	26	32	9.1	7.1	**220**	**100**	**90**	46	17
Beryllium	0.65	3.2	0.16	0.18	0.089 J	0.12 U	0.25	0.22	0.25	0.21	0.11 U
Cadmium	0.65	0.38	0.13 U	0.13 U	0.12 U	0.12 U	0.18	0.093 J	0.08 J	0.082 J	0.044 J
Chromium	68.81	180,000	8.6	9.5	9.2	3.2	15	15	15	14	28
Cobalt	46.43	0.21	**6.6**	**6.1**	**3.3**	**0.76**	**29**	**22**	**18**	**16**	**6.5**
Copper	223	46	**110**	**130**	**97**	42	**76**	**94**	**87**	**89**	13 J
Lead	16.86	14	1.4	1.4	1.9	0.5	2.2	2.2	2.3	2.4	0.75 J
Mercury	0.10	0.10	0.1	0.084	**0.18**	0.1	0.034	0.067	0.036	0.062	0.021 U
Nickel	22.97	20	3.8	4.5	3	1.2	9.3	6.2	7.6	6	9.1
Selenium	1.85	0.26	1.3 U	1.3 U	1.2 U	1.2 U	1.5 U	1.2 U	1.3 U	1.3 U	1.1 U
Silver	NE	0.6	0.26 U	0.26 U	0.24 U	0.24 U	0.29 U	0.23 U	0.25 U	0.26 U	0.22 U
Thallium	0.77	0.14	0.52 U	0.51 U	0.07 J	0.48 U	0.094 J	0.099 J	0.09 J	0.087 J	0.44 U
Vanadium	367	78	**200 J**	**220 J**	**320 J**	**110 J**	**180 J**	**220 J**	**210 J**	**270 J**	**83 J**
Zinc	112	290	23	26	10	5.4	59	48	60	45	9.4

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB113	69SB114	69SB114	69SB114	69SB115	69SB115	69SB116	69SB116	69SB117
Sample ID	Airfield	**Groundwater**	69SB113-02	69SB114-01	69SB114-01D	69SB114-02	69SB115-01	69SB115-02	69SB116-01	69SB116-02	69SB117-01
Date	Background	**SSLs** [(1)]	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**1.6**	**4.4**	**5.4**	**1.1**	**4.7**	**1.4**	**1.2**	**0.89**	**1.1**
Barium	231	82	**190**	33 J	23 J	**150**	14	**110**	66	76	**100**
Beryllium	0.65	3.2	0.31	0.1 J	0.06 J	0.27	0.11 U	0.33	0.35	0.29	0.32
Cadmium	0.65	0.38	0.049 J	0.15	0.11	0.12 J	0.044 J	0.084 J	0.076 J	0.069 J	0.072 J
Chromium	68.81	180,000	18	29	25	18	22	18	19	15	17
Cobalt	46.43	0.21	**21**	**7.2 J**	**4.6 J**	**20**	**3.6**	**27**	**16**	**15**	**16**
Copper	223	46	**77 J**	26 J	11 J	**110 J**	8.1 J	**120 J**	**120 J**	**100 J**	**94 J**
Lead	16.86	14	3.3 J	3.6 J	2.4 J	3 J	0.67 J	2.8 J	3 J	2.4 J	2.7 J
Mercury	0.10	0.10	0.025	0.032	0.012 J	0.072	0.02 U	0.045	0.037	0.035	0.032
Nickel	22.97	20	9.1	8.2 J	5.4 J	9.2	4.9	10	10	9.7	9.7
Selenium	1.85	0.26	1.2 U	1.3 U	1.1 U	1.3 U	1.1 U	1.3 U	1.3 U	1.2 U	1.3 U
Silver	NE	0.6	0.24 U	0.26 U	0.23 U	0.25 U	0.21 U	0.25 U	0.25 U	0.24 U	0.26 U
Thallium	0.77	0.14	0.11 J	0.53 U	0.46 U	**0.16 J**	0.42 U	0.11 J	0.12 J	0.083 J	0.14 J
Vanadium	367	78	**210 J**	**88 J**	49 J	**210 J**	49 J	**230 J**	**220 J**	**170 J**	**180 J**
Zinc	112	290	58	28 J	10 J	76	6.4	72	50	72	79

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB117	69SB117	69SB118	69SB118	69SB119	69SB119	69SB120	69SB120	69SB121
Sample ID	Airfield	**Groundwater**	69SB117-02	69SB117-02D	69SB118-01	69SB118-02	69SB119-01	69SB119-02	69SB120-01	69SB120-02	69SB121-01
Date	Background	**SSLs** [(1)]	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**0.66**	**0.88**	**0.88**	**1.2**	**4.4**	**1.2**	**3.4**	**0.99**	**1.4**
Barium	231	82	69	62	**110**	**110**	17	**97**	39	**84**	59
Beryllium	0.65	3.2	0.29	0.31	0.32	0.31	0.066 J	0.27	0.091 J	0.3	0.42
Cadmium	0.65	0.38	0.076 J	0.082 J	0.064 J	0.095 J	0.064 J	0.12	0.084 J	0.069 J	0.063 J
Chromium	68.81	180,000	16	16	18	14	31	19	24	16	21
Cobalt	46.43	0.21	**13**	**14**	**16**	**16**	**7.5**	**15**	**9.3**	**13**	**23**
Copper	223	46	**100 J**	**97 J**	**96 J**	**97 J**	15	**67**	28	**82**	**93**
Lead	16.86	14	3 J	2.8 J	2.6 J	2.6 J	2.1 J	5.6 J	3.4 J	2.1 J	2.8 J
Mercury	0.10	0.10	0.037	0.032	0.034	0.023 J	0.021 UJ	0.035 J	0.022 UJ	0.098 J	**0.11 J**
Nickel	22.97	20	9.3	9.3	11	9.3	8.5	8.6	7.7	8.5	10
Selenium	1.85	0.26	1.3 U	1.3 U	1.3 U	1.3 U	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U
Silver	NE	0.6	0.26 U	0.27 U	0.76	0.96	0.22 U	0.21 J	0.23 U	0.25 U	0.24 U
Thallium	0.77	0.14	0.13 J	0.14 J	0.087 J	0.091 J	0.44 U	0.11 J	0.47 U	0.15 J	0.17 J
Vanadium	367	78	**170 J**	**190 J**	**170 J**	**180 J**	78	**170**	**90**	**190**	**230**
Zinc	112	290	85	81	86	83	15 J	56 J	20 J	67 J	80 J

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB121	69SB122	69SB122	69SB123	69SB123	69SB124	69SB124	69SB124	69SB125
Sample ID	Airfield	**Groundwater**	69SB121-02	69SB122-01	69SB122-02	69SB123-01	69SB123-02	69SB124-01	69SB124-01D	69SB124-02	69SB125-01
Date	Background	**SSLs** [(1)]	8/4/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range			2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**1.4**	**2.6**	**2.3**	**2.5**	**0.87**	**0.38 J**	**0.37 J**	**0.42 J**	**4**
Barium	231	82	30	40	53	40	63	**240**	**250**	**92**	18 J
Beryllium	0.65	3.2	0.33	0.18	0.16	0.11 J	0.34	0.39	0.36	0.3	0.11 U
Cadmium	0.65	0.38	0.067 J	0.26	0.13 U	0.069 J	0.047 J	0.12 J	0.13	0.043 J	0.072 J
Chromium	68.81	180,000	18	46	36	27	14	18	19	16	29 J
Cobalt	46.43	0.21	**10**	**3**	**3.2**	**9.2**	**15**	**21**	**22**	**10**	**7.7**
Copper	223	46	**80**	**120**	**130**	40	**100**	**120**	**120**	**120**	19
Lead	16.86	14	2.4 J	9.7 J	5.4 J	0.76 J	2.6 J	3.4 J	3.5 J	3.4 J	1.3
Mercury	0.10	0.10	**0.11 J**	0.09 J	0.073 J	0.022 UJ	0.03 J	0.033 J	0.064 J	**0.12 J**	0.021
Nickel	22.97	20	8.8	4.9	4.5	9.9	9.8	11	11	8.9	8
Selenium	1.85	0.26	1.2 U	**1.3 J**	**1.1 J**	1.2 U	1.3 U	1.3 U	1.3 U	1.3 U	1.1 U
Silver	NE	0.6	0.24 U	0.28 U	0.26 U	0.23 U	0.24 J	0.25 U	0.27 U	0.26 U	0.23 U
Thallium	0.77	0.14	0.13 J	0.55 U	0.53 U	0.06 J	0.093 J	**0.23 J**	**0.22 J**	**0.16 J**	0.46 U
Vanadium	367	78	**200**	**480**	**430**	**85**	**180**	**120**	**120**	**120**	77
Zinc	112	290	71 J	17 J	15 J	28 J	80 J	100 J	100 J	76 J	10

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB125	69SB126	69SB126	69SB127	69SB127	69SB127	69SB128	69SB128	69SB129
Sample ID	Airfield	**Groundwater**	69SB125-02	69SB126-01	69SB126-02	69SB127-01	69SB127-02	69SB127-02D	69SB128-01	69SB128-02	69SB129-01
Date	Background	**SSLs** [(1)]	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range			2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**2.4**	**3.5**	**1.2**	**1.7**	**0.84**	0.73 U	**1.5**	**0.33 J**	**0.79**
Barium	231	82	54 J	**130 J**	77 J	25 J	21 J	27 J	21 J	28 J	18 J
Beryllium	0.65	3.2	0.21	0.074 J	0.3	0.13	0.11 J	0.15 U	0.14	0.068 J	0.075 J
Cadmium	0.65	0.38	0.25	0.18	0.11 J	0.065 J	0.031 J	0.15 U	0.057 J	0.034 J	0.14 U
Chromium	68.81	180,000	15 J	26 J	17 J	19 J	10 R	3.8 R	18 J	5.7 J	15 J
Cobalt	46.43	0.21	**34**	**17**	**24**	**2.5**	**1.5 J**	**0.68 J**	**4.1**	**1.5**	**1.2**
Copper	223	46	**67**	36	**92**	**85**	**85 J**	22 J	**110**	40	**55**
Lead	16.86	14	6	2.7	3	4.4	2.8 J	0.52 J	2.9	0.88	1.7
Mercury	0.10	0.10	**0.15**	0.03	0.048	0.026	0.087	0.032	0.066	0.081	0.042
Nickel	22.97	20	8	8.7	9.7	2.7	1.5	0.93 J	2.8	1.4	2.8
Selenium	1.85	0.26	**1.7**	1 U	1.2 U	**1.6**	**0.91 J**	1.5 U	**1.1 J**	1.2 U	1.4 U
Silver	NE	0.6	0.17 J	0.21 U	0.24 U	0.25 U	0.24 U	0.29 U	0.28 U	0.25 U	0.27 U
Thallium	0.77	0.14	0.11 J	0.08 J	0.13 J	0.5 U	0.48 U	0.58 U	0.55 U	0.49 U	0.54 U
Vanadium	367	78	**240**	**100**	**210**	**580**	400 R	64 R	**390**	**150**	**250**
Zinc	112	290	58	19	74	11	6.7	5.8 U	9.9	5.8	7.3

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB129	69SB130	69SB130	69SB131	69SB131	69SB132	69SB132	69SB133	69SB133
Sample ID	Airfield	**Groundwater**	69SB129-02	69SB130-01	69SB130-02	69SB131-01	69SB131-02	69SB132-01	69SB132-02	69SB133-01	69SB133-02
Date	Background	**SSLs** [(1)]	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**2.4**	**1.4**	**2.8**	**0.68**	**0.99**	**1.1**	**0.77**	**1**	**1.2**
Barium	231	82	17 J	22 J	19 J	49 J	31 J	12 J	8.2 J	14 J	14 J
Beryllium	0.65	3.2	0.12	0.11 J	0.2	0.15	0.17	0.098 J	0.11 J	0.095 J	0.098 J
Cadmium	0.65	0.38	0.12 U	0.035 J	0.045 J	0.11 U	0.12 U	0.12 U	0.13 U	0.045 J	0.13 U
Chromium	68.81	180,000	19 J	29 J	53 J	11	14	11	9.4	12	9.1
Cobalt	46.43	0.21	**1.4**	**2**	**2.7**	**9.6 J**	**11 J**	**1.2 J**	**1 J**	**3.4 J**	**1.2 J**
Copper	223	46	**100**	**75**	**140**	46	**66**	**67**	**74**	**85**	**65**
Lead	16.86	14	4.4	1.4	4.5	2	2.1	2.2	1.8	3.3	2.1
Mercury	0.10	0.10	0.083	0.071	**0.15**	0.046	0.069	0.044	0.034	0.07	0.058
Nickel	22.97	20	2.1	2.5	3.5	4.2	4.2	1.5	1.4	3.5	1.7
Selenium	1.85	0.26	**2.2**	**0.79 J**	**1.9**	1.1 U	1.2 U	1.2 U	1.3 U	**0.92 J**	**0.79 J**
Silver	NE	0.6	0.24 U	0.25 U	0.27 U	0.22 U	0.25 U	0.23 U	0.27 U	0.24 U	0.26 U
Thallium	0.77	0.14	0.47 U	0.08 J	0.54 U	0.085 J	0.11 J	0.47 U	0.54 U	0.49 U	0.51 U
Vanadium	367	78	**560**	**290**	**580**	**130**	**210**	**400**	**350**	**380**	**220**
Zinc	112	290	10	10	14	34	38	6.1	7.7	12	7.8

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB134	69SB134	69SB134	69SB135	69SB135	69SB136	69SB136	69SB137	69SB137
Sample ID	Airfield	**Groundwater**	69SB134-01	69SB134-01D	69SB134-02	69SB135-01	69SB135-02	69SB136-01	69SB136-02	69SB137-01	69SB137-02
Date	Background	**SSLs** [(1)]	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**1.1**	**1.3**	**1**	**1**	**0.59 J**	**1.3**	**1.2**	**1.4**	**0.55 J**
Barium	231	82	**130 J**	**270 J**	42 J	78 J	41 J	51 J	30 J	26	30
Beryllium	0.65	3.2	0.37	0.36	0.28	0.25	0.19	0.19	0.17	0.19	0.12 J
Cadmium	0.65	0.38	0.27	0.16	0.065 J	0.15	0.066 J	0.07 J	0.092 J	0.05 J	0.13 U
Chromium	68.81	180,000	13	13	11	12	11	11	11	15 J	12 J
Cobalt	46.43	0.21	**23 J**	**33 J**	**14 J**	**18 J**	**11 J**	**19 J**	**16 J**	**6.9**	**4.5**
Copper	223	46	**85**	**89**	**73**	**81**	**62**	**73**	**71**	**80 J**	**61 J**
Lead	16.86	14	3	3	2.6	5.3	3	3.5	3.4	2.6 J	1.8 J
Mercury	0.10	0.10	0.059	0.069	0.04	0.035	0.047	0.085	**0.11**	**0.13 J**	0.085 J
Nickel	22.97	20	7.9	7.9	7.6	7.6	6.1	5.7	4.6	5.8	4.3
Selenium	1.85	0.26	1.2 U	1.2 U	1.2 U	1.3 U	1.2 U	1.2 U	1.2 U	**0.74 J**	1.3 U
Silver	NE	0.6	0.23 U	0.24 U	0.24 U	0.26 U	0.24 U	0.25 U	0.24 U	0.25 U	0.25 U
Thallium	0.77	0.14	0.14 J	**0.18 J**	0.1 J	0.083 J	0.072 J	0.12 J	0.13 J	0.11 J	0.071 J
Vanadium	367	78	**200**	**210**	**180**	**200**	**130**	**170**	**160**	**240 J**	**140 J**
Zinc	112	290	71	72	65	68	55	57	42	33	28

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB137	69SB138	69SB138	69SB139	69SB139	69SB140	69SB140	69SB141	69SB141
Sample ID	Airfield	**Groundwater**	69SB137-02D	69SB138-01	69SB138-02	69SB139-01	69SB139-02	69SB140-01	69SB140-02	69SB141-01	69SB141-02
Date	Background	**SSLs** [(1)]	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range			2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Arsenic	2.34	0.29	**1.1**	**1.3**	**2.5**	**5.9**	**1.9**	**1.8**	**1.2**	**1.1**	**1**
Barium	231	82	26	55	22	48	24	27	16	54	46
Beryllium	0.65	3.2	0.15	0.24	0.17	0.12	0.13	0.17	0.19	0.18	0.13
Cadmium	0.65	0.38	0.045 J	0.089 J	0.049 J	0.031 J	0.12 U	0.066 J	0.061 J	0.064 J	0.052 J
Chromium	68.81	180,000	13 J	18 J	28 J	15 J	14 J	52 J	20 J	28 J	12 J
Cobalt	46.43	0.21	**6.9**	**19**	**9.4**	**8.3**	**3.9**	**6.9**	**7.8**	**11**	**15**
Copper	223	46	**70 J**	**78 J**	**130 J**	**57 J**	**87 J**	**67 J**	**90 J**	**91 J**	**81 J**
Lead	16.86	14	2 J	3.3 J	3.7 J	1.7 J	2.1 J	5.9 J	4 J	3.2 J	2.5 J
Mercury	0.10	0.10	0.056 J	0.051 J	0.028 J	0.036 J	**0.15 J**	0.068 J	0.071 J	**0.11 J**	0.053 J
Nickel	22.97	20	4.5	8	5.6	4	3.4	3.3	4	5.7	4.6
Selenium	1.85	0.26	**0.68 J**	1.3 U	**1.1 J**	1.1 U	**1 J**	**0.64 J**	1.3 U	1.1 U	1.3 U
Silver	NE	0.6	0.27 U	0.26 U	0.24 U	0.23 U	0.24 U	0.26 U	0.25 U	0.23 U	0.26 U
Thallium	0.77	0.14	0.077 J	0.094 J	0.099 J	0.099 J	0.065 J	0.51 U	0.51 U	0.099 J	0.088 J
Vanadium	367	78	**230 J**	**200 J**	**280 J**	**140 J**	**270 J**	**530 J**	**370 J**	**260 J**	**280 J**
Zinc	112	290	32	58	28	18	16	20	20	37	16

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB142	69SB142	69SB143	69SB143	69SB144	69SB144	69SB144	69SB145
Sample ID	Airfield	**Groundwater**	69SB142-01	69SB142-02	69SB143-01	69SB143-02	69SB144-01	69SB144-01D	69SB144-02	69SB145-01
Date	Background	**SSLs** [(1)]	8/4/2010	8/4/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (mg/kg)										
Arsenic	2.34	0.29	**2.2**	**2.5**	**1**	**0.75**	**0.58 J**	**0.92**	**0.51 J**	**1.3**
Barium	231	82	26	**110**	9.1	10	15	18	25	26
Beryllium	0.65	3.2	0.18	0.2	0.069 J	0.14 U	0.065 J	0.13	0.075 J	0.071 J
Cadmium	0.65	0.38	0.044 J	0.053 J	0.12 U	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U
Chromium	68.81	180,000	30 J	22 J	6.2	5	10	14	9.4	13
Cobalt	46.43	0.21	**18**	**14**	**1.8**	**1.8**	**2**	**1.7**	**2.7**	**1.8**
Copper	223	46	**120 J**	**130 J**	**76 J**	**54 J**	**67 J**	**100 J**	**77 J**	**77 J**
Lead	16.86	14	3.6 J	2.3 J	1.2	0.82	1	1.4	0.94	2
Mercury	0.10	0.10	0.066 J	0.073 J	0.068 R	0.048 R	0.024 R	0.024 R	0.019 R	0.064 R
Nickel	22.97	20	6.9	4.8	1.9	1.8	1.9	2	2.1	2
Selenium	1.85	0.26	**0.96 J**	**0.88 J**	**0.73 J**	1.4 U	1.3 U	**0.9 J**	1.4 U	**0.95 J**
Silver	NE	0.6	0.24 U	0.24 U	0.24 U	0.28 U	0.26 U	0.26 U	0.27 U	0.28 U
Thallium	0.77	0.14	**0.17 J**	**0.15 J**	0.078 J	0.07 J	0.11 J	0.53 U	0.14 J	0.55 U
Vanadium	367	78	**270 J**	**320 J**	**200**	**190**	**190 J**	**380 J**	**130**	**240**
Zinc	112	290	33	23	11	6.4	12	16	12	5.6

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB145	69SB146	69SB146	69SB147	69SB147	69SB147	69SB148	69SB148
Sample ID	Airfield	**Groundwater**	69SB145-02	69SB146-01	69SB146-02	69SB147-01	69SB147-02	69SB147-02D	69SB148-01	69SB148-02
Date	Background	**SSLs** [(1)]	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)										
Arsenic	2.34	0.29	**0.9**	**0.31 J**	**0.4 J**	**0.85**	0.62 U	**0.73**	**1.2**	**1**
Barium	231	82	22	18	8	15	12	14	18	16
Beryllium	0.65	3.2	0.12	0.13 U	0.092 J	0.13 U	0.12 U	0.072 J	0.26	0.17
Cadmium	0.65	0.38	0.12 U	0.13 U	0.14 U	0.13 U	0.12 U	0.12 U	0.13 U	0.12 U
Chromium	68.81	180,000	13	4.4	3.1	10	5.4 J	8.5 J	17	13
Cobalt	46.43	0.21	**2.3**	**0.53**	**1**	**0.88**	0.32 R	2 R	**2.9**	**2.7**
Copper	223	46	**170 J**	34 J	**67 J**	**63 J**	21 J	**74 J**	**170 J**	**160 J**
Lead	16.86	14	1.5	1.5	1.5	1.8	0.92 J	1.4 J	1.3	0.98
Mercury	0.10	0.10	0.077 R	0.027 R	0.028 R	0.026 R	0.077 R	0.13 R	0.025 R	0.025 R
Nickel	22.97	20	1.5	1.3 U	1.4 U	1.3	1.1 J	1.5	2.9	3.9
Selenium	1.85	0.26	**0.63 J**	1.3 U	1.4 U	**0.75 J**	1.2 U	1.2 U	**1.1 J**	**0.94 J**
Silver	NE	0.6	0.24 U	0.25 U	0.28 U	0.26 U	0.25 U	0.25 U	0.26 U	0.25 U
Thallium	0.77	0.14	0.49 U	0.5 U	0.56 U	0.51 U	0.49 U	0.084 J	0.52 U	0.49 U
Vanadium	367	78	**280**	**87**	**120**	**250**	46 R	260 R	**270**	**180**
Zinc	112	290	12	5 U	5.6 U	5.9	6.4	7.4	11	7.5

TABLE 6-7

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	**Soil to**	69SB149	69SB149	69SB150	69SB150	69SB151	69SB151	69SB152	69SB152
Sample ID	Airfield	**Groundwater**	69SB149-01	69SB149-02	69SB150-01	69SB150-02	69SB151-01	69SB151-02	69SB152-01	69SB152-02
Date	Background	**SSLs** [(1)]	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range			1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (mg/kg)										
Arsenic	2.34	0.29	**1.2**	**1**	**0.61**	**0.6 J**	**0.89**	**1.1**	**0.79**	**0.97**
Barium	231	82	20	31	60	44	15	7.2	13	27
Beryllium	0.65	3.2	0.15	0.11 J	0.21	0.45	0.19	0.15	0.14	0.3
Cadmium	0.65	0.38	0.12 U	0.12 U	0.12 U	0.12 U	0.054 J	0.12 U	0.12 U	0.034 J
Chromium	68.81	180,000	15	6	6.9	5.7	14	15	11	13
Cobalt	46.43	0.21	**22**	**2.3**	**7.4**	**12**	**8**	**5.5**	**5.5**	**6.2**
Copper	223	46	**110**	**110**	**150**	**280**	**120**	**150**	**120**	**200**
Lead	16.86	14	2.9	4.4	1.2	0.44 J	4.6	2.1	1.2	3.2
Mercury	0.10	0.10	0.022 J	0.052	0.017 J	0.013 J	0.066	**0.14**	0.068	0.065
Nickel	22.97	20	1.6	0.99 J	3.4	3.9	5.6	3.4	4.5	6.4
Selenium	1.85	0.26	**0.72 J**	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Silver	NE	0.6	0.23 U	0.24 U	0.24 U	0.25 U	0.24 U	0.24 U	0.23 U	0.24 U
Thallium	0.77	0.14	0.068 J	0.073 J	0.091 J	0.13 J	**0.15 J**	0.1 J	0.47 U	0.48 U
Vanadium	367	78	**170 J**	**130 J**	**210 J**	**260 J**	**170 J**	**220 J**	**200 J**	**310 J**
Zinc	112	290	7.7	4.9 U	17	21	20	15	8.9	12

Notes:

mg/kg - milligrams per kilogram
NAPR - Naval Activity Puerto Rico
NE - Not Established
SSLs - Soil Screening Levels

U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
R - Result is rejected and unusable

[(1)] Soil to groundwater SSLs are provided for informational purposes and are not considered project action limits. USEPA Regional Screning Levels Table (November 2011).

TABLE 6-8

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	69SD01	69SD01	69SD02	69SD02	69SD03	69SD04	69SD05	69SD06	69SD07
Sample ID	Basewide	69SD01	69SD01D	69SD02	69SD02D	69SD03	69SD04	69SD05	69SD06	69SD07
Sample Date	Background	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)										
Arsenic	2.83	1.2 J	1.6 J	1.8 J	1.8 J	2.8 J	1.9	3.4	3.8 J	4.6 J
Barium	208	31 J	38 J	38 J	33 J	48 J	24 J	26 J	110 J	130 J
Beryllium	0.358	0.11 J	0.13 J	0.15 J	0.13 J	0.14 J	0.16 J	0.2	0.29 J	0.33 J
Cadmium	0.217	0.89 J	1.1 J	0.77 J	0.52 J	4.6 J	0.38	0.44	16 J	24 J
Chromium	63.4	26 J	18 J	21 J	18 J	25 J	20	30	99 J	72 J
Cobalt	45.1	5.2 J	6.4 J	7.2 J	6.2 J	8.5 J	5.8 J	5.6 J	18 J	18 J
Copper	160	64 J	83 J	90 J	96 J	85 J	96 J	130 J	140 J	160 J
Lead	19.4	51 J	14 J	8.3 J	6.9 J	48 J	6.4	8.6	440 J	680 J
Mercury	0.168	0.081 J	0.067 J	0.068 J	0.077 J	0.073 J	0.067	0.062	0.085 J	0.076 J
Nickel	18.1	6.7 J	6.9 J	6.7 J	6.8 J	10 J	5.3	5.3	34 J	27 J
Selenium	3.69	1.9 UJ	1.1 J	1.2 J	1.1 J	2.1 UJ	0.85 J	1.3 J	2.1 UJ	2.7 UJ
Silver	NE	0.37 UJ	0.4 UJ	0.46 UJ	0.42 UJ	0.43 UJ	0.33 U	0.33 U	0.7 J	0.47 J
Thallium	1.30	0.37 UJ	0.4 UJ	0.46 UJ	0.11 J	0.43 UJ	0.33 U	0.33 U	0.41 UJ	0.53 UJ
Vanadium	241	140 J	180 J	190 J	220 J	170 J	190 J	350 J	110 J	140 J
Zinc	148	49 J	41 J	44 J	33 J	100 J	40	55	450 J	490 J

Notes:

mg/kg - milligrams per kilogram
NE - Not Established
NAPR - Naval Activity Puerto Rico

U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated

TABLE 6-8

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	69SD08	69SD09	69SD10	69SD11	69SD12	69SD13	69SD14
Sample ID	Basewide	69SD08	69SD09	69SD10	69SD11	69SD12	69SD13	69SD14
Sample Date	Background	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)								
Arsenic	2.83	3 J	4.8 J	2.4 J	2.1	1	2.1	4
Barium	208	140 J	77 J	100 J	52 J	33 J	65 J	99 J
Beryllium	0.358	0.2 J	0.25 J	0.22 J	0.18	0.098 J	0.21	0.28
Cadmium	0.217	12 J	2.9 J	4.1 J	1.5	1.4	1	0.92
Chromium	63.4	40 J	32 J	23 J	20	10	23	61
Cobalt	45.1	14 J	20 J	16 J	12 J	7.7 J	15 J	16 J
Copper	160	110 J	130 J	110 J	70 J	38 J	72 J	98 J
Lead	19.4	250 J	30 J	26 J	24	15	21	15
Mercury	0.168	0.067 J	0.07 J	0.14 J	0.063	0.048	0.045	0.05
Nickel	18.1	15 J	11 J	10 J	8.3	5.2	7.5	8.1
Selenium	3.69	2.3 UJ	1.3 J	3.1 UJ	1.8 U	1.8 U	1.9 U	1 J
Silver	NE	0.25 J	0.41 UJ	0.62 UJ	0.36 U	0.37 U	0.39 U	0.32 U
Thallium	1.30	0.46 UJ	0.41 UJ	0.62 UJ	0.36 U	0.37 U	0.39 U	0.32 U
Vanadium	241	150 J	370 J	230 J	150 J	67 J	170 J	350 J
Zinc	148	220 J	89 J	110 J	71	44	63	70

Notes:

mg/kg - milligrams per kilogram
NE - Not Established
NAPR - Naval Activity Puerto Rico

U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated

TABLE 6-9

SUMMARY OF DETECTED LABORATORY RESULTS - 2010 QUALITY ASSURANCE / QUALITY CONTROL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69ER-SD	69FB-SD	69ER01	69ER02	69ER03	69FB01
Sample ID	69ER-SD	69FB-SD	69ER01	69ER02	69ER03	69FB01
Sample Date	11/5/2010	11/5/2010	8/3/2010	8/4/2010	8/5/2010	8/5/2010
Inorganics (µg/L)						
Copper	2.4 J	5 U	1.1 J	5 U	1.7 J	1.1 J
Tin	5 U	5 U	8.3	5 U	5 U	5 U
Zinc	20 U	20 U	20 U	9 J	13 J	9.1 J

Notes:

U - Not detected
J - Analyte present - Reported value is estimated

TABLE 6-10

PERCENT COMPLETENESS BY METHOD AND MATRIX
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY INVESTIGATION
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

MATRIX	PARAMETER CLASS	TOTAL UNIQUE RESULTS	FULLY REJECTED RESULTS	DIFFERENCE	PERCENT COMPLETE
SS	Metals	986	8	978	99.19
SB	Metals	1938	24	1914	98.76
SD	Metals	272	2	270	99.26
		3196	**34**	3162	98.94

TABLE 7-1
LIST OF BIRDS REPORTED FROM OR HAVING THE POTENTIAL TO OCCUR AT
NAVAL ACTIVITY PUERTO RICO
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Common Name [(1)]		
Pied-billed grebe	Red-billed tropicbird	Brown pelican
Brown booby	Magnificent frigatebird	Great blue heron
Louisiana heron	Snowy egret	Great egret
Striated heron	Little blue heron	Cattle egret
Least bittern	Yellow-crowned night heron	Black-crowned night heron
White-cheeked pintail	Blue-winged teal	American widgeon
Red-tailed hawk	Osprey	Merlin
Clapper rail	American coot	Caribbean coot
Common gallinule	Piping plover [(3)(4)]	Semipalmated plover
Black-bellied plover	Wilson's plover	Killdeer
Ruddy turnstone	Black-necked stilt	Whimbrel
Spotted sandpiper	Semipalmated sandpiper	Short-billed dowitcher
Greater yellowlegs	Lesser yellowlegs	Willet
Stilt sandpiper	Pectoral sandpiper	Laughing gull
Royal tern	Sandwich tern	Bridled tern
Least tern	Brown noddy	White-winged dove
Zenaida dove	White-crowned pigeon	Mourning dove
Red-necked pigeon	Common ground dove	Bridled quail dove
Ruddy quail dove	Caribbean parakeet	Smooth-billed ani
Yellow-billed cuckoo	Mangrove cuckoo	Short-eared owl
Chuck-will's-widow	Common nighthawk	Antillean crested hummingbird
Green-throated carib	Antillean mango	Belted kingfisher

TABLE 7-1
LIST OF BIRDS REPORTED FROM OR HAVING THE POTENTIAL TO OCCUR AT NAVAL ACTIVITY PUERTO RICO
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE ME ASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Common Name [1]		
Gray kingbird	Loggerhead kingbird	Stolid flycatcher
Caribbean elaenia	Purple martin	Cave swallow
Barn swallow	Northern mockingbird	Pearly-eyed thrasher
Red-legged thrush	Black-whiskered vireo	American redstart
Parula warbler	Prairie warbler	Yellow warbler
Magnolia warbler	Cape May warbler	Black-throated blue warbler
Adelaide's warbler	Palm warbler	Black and white warbler
Ovenbird	Northern water thrush	Bananaquit
Striped-headed tanager	Shiny cowbird	Black-cowled oriole
Greater Antillean grackle	Yellow-shouldered blackbird [2]	Hooded manakin
Yellow-faced grassquit	Black-faced grassquit	Least sandpiper
Western sandpiper	Puerto Rican woodpecker	Rock dove
Puerto Rican emerald	Puerto Rican flycatcher	Pin-tailed whydah
Spice finch	Ruddy duck	Peregrine falcon
Marbled godwit	Puerto Rican lizard cuckoo	Prothonotary warbler
Green-winged teal	Orange-cheeked waxbill	Roseate tern [3][4]
Least grebe	West Indian whistling duck	Puerto Rican screech owl
Puerto Rican tody	Green heron	

Notes:

[1] List of birds taken from Geo-Marine, Inc. (1998).
[2] Federally-designated endangered species.
[3] Federally-designated threatened species.
[4] Species has the potential to occur at Naval Activity Puerto Rico.

TABLE 7-2
PRELIMINARY ASSESSMENT ENDPOINTS, RISK QUESTIONS, AND MEASUREMENT ENDPOINTS (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Assessment Endpoints	Risk Questions	Measurement Endpoints
Terrestrial Habitat: Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-related chemical concentrations in surface and subsurface soil sufficient to adversely affect terrestrial soil invertebrate communities?	Comparison of maximum chemical concentrations in surface and subsurface soil with soil screening values.
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related chemical concentrations in surface and subsurface soil sufficient to adversely affect terrestrial plant communities?	Comparison of maximum chemical concentrations in surface and subsurface soil with soil screening values.
Survival, growth, and reproduction of flying mammalian herbivores (i.e., bats).	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to flying mammal species (i.e., bats) that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.
Survival, growth, and reproduction of terrestrial avian herbivores.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.
Survival, growth, and reproduction of terrestrial avian omnivores.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume terrestrial plants and soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.
Survival, growth, and reproduction of terrestrial avian carnivores.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.

TABLE 7-2
PRELIMINARY ASSESSMENT ENDPOINTS, RISK QUESTIONS, AND MEASUREMENT ENDPOINTS (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Assessment Endpoints	Risk Questions	Measurement Endpoints
Terrestrial Habitat (continued): Survival, growth, and reproduction of terrestrial amphibian and reptile communities.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to terrestrial reptiles?	Qualitative examination of exposures and risks to ecological receptors occupying similar trophic levels.

TABLE 7-3
LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} (1) (L/Kg)	Bioaccumulative Chemical (2)
Volatile Organics:					
1,1,1,2-Tetrachloroethane	2.63 to 3.03	2.63	USEPA 1995	385	Yes
1,1,1-Trichloroethane	2.47 to 2.51	2.48	USEPA 1995	274	No
1,1,2,2-Tetrachloroethane	2.31 to 2.64	2.39	USEPA 1995	224	No
1,1,2-Trichloroethane	2.03 to 2.07	2.05	USEPA 1995	104	No
1,1-Dichloroethane	1.78 to 1.85	1.79	USEPA 1995	57.5	No
1,1-Dichloroethene	2.13 to 2.37	2.13	USEPA 1995	124	No
1,2,3-Trichloropropane	1.98 to 2.63	2.25	USEPA 1995	163	No
1,2-Dibromo-3-chloropropane	2.26 to 2.41	2.34	USEPA 1995	200	No
1,2-Dichloroethane	1.4 to 1.48	1.47	USEPA 1995	27.9	No
1,2-Dichloropropane	1.94 to 1.99	1.97	USEPA 1995	86.5	No
2-Butanone (MEK)	0.28 to 0.69	0.28	USEPA 1995	1.89	No
2-Chloro-1,3-butadiene	2.03 to 2.13	2.08	USEPA 1995	124.00	No
2-Hexanone	Not Reported	1.38	USEPA 1996a	22.7	No
3-Chloro-1-propene	Not Reported	1.93	SRC 1998	79.0	No
4-Methyl-2-pentanone (MIBK)	Not Reported	1.31	SRC 1998	19.4	No
Acetone	-0.21 to -0.24	-0.24	USEPA 1995	0.58	No
Acetonitrile	-0.34 to -0.39	-0.34	USEPA 1995	0.46	No
Acrolein	-0.01 to 0.90	-0.01	USEPA 1995	0.98	No
Acrylonitrile	-0.92 to 1.20	0.25	USEPA 1995	1.76	No
Benzene	1.83 to 2.50	2.13	USEPA 1995	124	No
Bromoform	2.30 to 2.38	2.35	USEPA 1995	204	No
Bromomethane	Not Reported	1.19	USEPA 1996a	14.8	No
Carbon disulfide	1.84 to 2.16	2.00	USEPA 1995	92.5	No
Carbon tetrachloride	2.03 to 3.10	2.73	USEPA 1995	483	Yes
Chlorobenzene	2.56 to 3.79	2.86	USEPA 1995	648	Yes
Clorodibromomethane	2.13 to 2.24	2.17	USEPA 1995	136	No
Chloroethane	Not Reported	1.43	USEPA 1996a	25.5	No
Chloroform	1.81 to 3.04	1.92	USEPA 1995	77.2	Yes
Chloromethane	Not Reported	0.91	USEPA 1996a	7.85	No
cis-1,3-Dichloropropene	Not Reported	2.06	SRC 1998	106	No
Dibromomethane	Not Reported	1.53	USEPA 1996a	31.9	No
Dichlorobromomethane	1.88 to 2.14	2.10	USEPA 1995	116	No
Dichlorodifluoromethane	2.0 to 2.37	2.16	USEPA 1995	133	No
Ethylbenzene	3.07 to 3.57	3.14	USEPA 1995	1,222	Yes
Ethylene dibromide	Not Reported	2.00	USEPA 1996a	92.5	No
Ethyl methacrylate	1.59 to 1.65	1.59	USEPA 1996a	36.6	No
Iodomethane	Not Reported	1.51	SRC 1998	30.5	No
Isobutyl alcohol	0.65 to 0.76	0.75	USEPA 1995	5.46	No
Methacrylonitrile	0.54 to 0.70	-0.54	USEPA 1996a	0.29	No
Methylene chloride	1.22 to 1.40	1.25	USEPA 1995	16.9	No
Methyl methacrylate	1.11 to 1.38	1.38	USEPA 1995	22.7	No
Pentachloroethane	Not Reported	3.06	USEPA 1996a	1,019	Yes
Propionitrile	Not Reported	0.16	SRC 1998	1.44	No
Styrene	2.76 to 3.16	2.94	USEPA 1995	777	Yes
Tetrachloroethene	2.53 to 2.98	2.67	USEPA 1995	422	No
Toluene	2.21 to 3.13	2.75	USEPA 1995	505	Yes
trans-1,2-Dichloroethene	1.77 to 2.10	2.07	USEPA 1995	108	No
trans-1,3-Dichloropropene	Not Reported	2.03	SRC 1998	99.0	No
trans-1,4-Dichloro-2-butene	Not Reported	2.60	SRC 1998	360	No
Trichloroethene	2.42 to 3.14	2.71	USEPA 1995	462	Yes
Trichlorofluoromethane	2.44 to 2.58	2.53	USEPA 1995	307	No

TABLE 7-3
LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} [1] (L/Kg)	Bioaccumulative Chemical [2]
Volatile Organics:					
Vinyl acetate	0.21 to 0.83	0.73	USEPA 1995	5.22	No
Vinyl chloride	1.23 to 1.52	1.50	USEPA 1995	29.8	No
Xylenes (total) [3]	2.77 to 3.54	3.13	USEPA 1995	1,194	Yes
Semi-Volatile Organics:					
1,2,4,5-Tetrachlorobenzene	4.51 to 4.83	4.64	USEPA 1995	36,425	Yes
1,2,4-Trichlorobenzene	3.89 to 4.23	4.01	USEPA 1995	8,752	Yes
1,3,5-Trinitrobenzene	1.18 to 1.37	1.18	USEPA 1995	14.5	No
1,1-Biphenyl	Not Reported	3.98	SRC 1998	8,177	Yes
1,2-Dichlorobenzene	3.20 to 3.61	3.43	USEPA 1995	2,355	Yes
1,3-Dichlorobenzene	Not Reported	3.60	USEPA 1996a	3,460	Yes
1,3-Dinitrobenzene	1.49 to 1.63	1.50	USEPA 1995	29.8	No
1,4,-Dichlorobenzene	3.26 to 3.78	3.42	USEPA 1995	2,302	Yes
1,4-Dioxane	Not Reported	-0.27	USEPA 1996a	0.54	No
1,4-Naphthoquinone	Not Reported	1.71	SRC 1998	48.0	No
2,3,4,6-Tetrachlorophenol	Not Reported	4.45	USEPA 1996a	23,694	Yes
2,4,5-Trichlorophenol	Not Reported	3.72	USEPA 1996a	4,540	Yes
2,4,6-Trichlorophenol	3.29 to 4.05	3.70	USEPA 1995	4,339	Yes
2,2'-Oxybis(1-chloropropane)	Not Reported	2.48	USEPA 1996a	274	No
2,4-Dichlorophenol	2.80 to 3.30	3.08	USEPA 1995	1,066	Yes
2,4-Dimethylphenol	1.99 to 2.49	2.36	USEPA 1995	209	No
2,4-Dinitrophenol	1.40 to 1.79	1.55	USEPA 1995	33.4	No
2,4-Dinitrotoluene	1.98 to 2.05	2.01	USEPA 1995	94.6	No
2,6-Dichlorophenol	Not Reported	2.75	SRC 1998	505	No
2,6-Dinitrotoluene	1.72 to 2.03	1.87	USEPA 1995	68.9	No
2-Acetylaminofluorene	Not Reported	3.12	SRC 1998	1,167	Yes
2-Chloronaphthalene	Not Reported	3.38	USEPA 1996a	2,103	Yes
2-Chlorophenol	0.83 to 2.32	2.15	USEPA 1995	130	No
2-Methylphenol	1.90 to 2.04	1.99	USEPA 1995	90.5	No
2-Naphthylamine	2.09 to 2.42	2.28	USEPA 1995	174	No
2-Nitroaniline	Not Reported	1.85	USEPA 1996a	65.9	No
2-Nitrophenol	Not Reported	1.79	USEPA 1996a	57.5	No
2-Picoline	Not Reported	1.11	SRC 1998	12.3	No
2-Toluidine	Not Reported	1.32	SRC 1998	19.9	No
3,4-Methylphenol [4]	1.92 to 2.05	1.97	USEPA 1995	86.5	No
3,3'-Dichlorobenzidine	3.51 to 3.95	3.51	USEPA 1995	2,822	Yes
3,3'-Dimethylbenzidine	2.34 to 3.01	2.68	USEPA 1995	431	Yes
3-Methylcholanthrene	6.42 to 6.76	6.42	USEPA 1995	2,047,104	Yes
3-Nitroaniline	Not Reported	1.37	USEPA 1996a	22.2	No
4,6-Dinitro-2-methylphenol	Not Reported	2.12	USEPA 1996a	121	No
4-Aminobiphenyl	Not Reported	2.86	SRC 1998	648	No
4-Bromophenyl phenyl ether	4.89 to 5.24	5.00	USEPA 1995	82,277	Yes
4-Chloro-3-methylphenol	Not Reported	3.10	SRC 1998	1,116	Yes
4-Chloroaniline	1.57 to 2.02	1.85	USEPA 1995	65.9	No
4-Chlorophenyl phenyl ether	4.08 to 5.09	4.95	USEPA 1995	73,473	Yes
4-Nitroaniline	Not Reported	1.39	USEPA 1996a	23.3	No
4-Nitrophenol	Not Reported	1.91	SRC 1998	75.5	No
4-Nitroquinoline-1-oxide	Not Reported	1.09	SRC 1998	11.8	No
7,12-Dimethylbenz(a)anthracene	5.98 to 6.66	6.62	USEPA 1995	3,219,141	Yes
Acetophenone	1.55 to 1.72	1.64	USEPA 1995	41.0	No
A, A-Dimethyl phenethylamine	Not Reported	1.90	USEPA 1996a	73.8	No

TABLE 7-3
LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} (1) (L/Kg)	Bioaccumulative Chemical (2)
Semi-Volatile Organics:					
Aniline	0.78 to 1.24	0.98	USEPA 1995	9.20	No
Aramite, total	Not Reported	4.82	SRC 1998	54,744	Yes
Benzyl alcohol	0.87 to 1.22	1.11	USEPA 1995	12.3	No
bis(2-Chloroethoxy)methane	Not Reported	0.75	USEPA 1996a	5.46	No
bis(2-Chloroethyl)ether	1.0 to 1.29	1.21	USEPA 1995	15.5	No
bis(2-Ethylhexyl)phthalate	4.20 to 8.61	7.30	USEPA 1995	15,003,065	Yes
Butyl benzyl phthalate	3.57 to 5.02	4.84	USEPA 1995	57,280	Yes
Diallate	3.79 to 5.23	4.49	USEPA 1995	25,939	Yes
Dibenzofuran	Not Reported	4.20	USEPA 1996a	13,455	Yes
Diethyl phthalate	1.40 to 3.00	2.50	USEPA 1995	287	Yes
Dimethyl phthalate	1.34 to 1.90	1.57	USEPA 1995	35.0	No
Di-n-butyl phthalate	3.74 to 4.79	4.61	USEPA 1995	34,034	Yes
Di-n-octyl phthalate	8.03 to 9.49	8.06	USEPA 1995	83,803,084	Yes
Dinoseb	Not Reported	3.69	USEPA 1996a	4,242	Yes
Ethyl methanesulfonate	0.01 to 0.05	0.05	USEPA 1995	1.12	No
Hexachlorobenzene	5.00 to 7.42	5.89	USEPA 1995	616,808	Yes
Hexachlorobutadiene	4.74 to 5.16	4.81	USEPA 1995	53,519	Yes
Hexachlorocyclopentadiene	5.04 to 5.51	5.39	USEPA 1995	198,907	Yes
Hexachloroethane	3.82 to 4.14	4.00	USEPA 1995	8,556	Yes
Hexachlorophene	7.08 to 7.60	7.54	USEPA 1995	25,828,548	Yes
Hexachloropropene	Not Reported	4.38	SRC 1998	20,222	Yes
Isophorone	1.67 to 1.90	1.70	USEPA 1995	46.9	No
Isosafrole	Not Reported	3.37	SRC 1998	2,056	Yes
Methapyrilene	Not Reported	2.87	SRC 1998	663	No
Methyl methanesulfonate	Not Reported	-0.66	SRC 1998	0.22	No
N-Nitro-o-toluidine	Not Reported	1.87	SRC 1998	68.90	No
n-Nitrosodiethylamine	0.29 to 0.56	0.48	USEPA 1995	2.97	No
n-Nitrosodimethylamine	-0.77 to -0.48	-0.57	USEPA 1995	0.28	No
n-Nitroso-di-n-butylamine	2.41 to 2.45	2.41	USEPA 1995	234	No
n-Nitroso-di-n-propylamine	1.31 to 1.45	1.40	USEPA 1995	23.8	No
n-Nitrosodiphenylamine	3.13 to 3.45	3.16	USEPA 1995	1,278	Yes
n-Nitrosomethylethylamine	-0.24 to 1.35	-0.12	USEPA 1995	0.76	No
n-Nitrosomorpholine	Not Reported	-0.44	SRC 1998	0.37	No
n-Nitrosopiperidine	0.25 to 0.63	0.63	USEPA 1995	4.16	No
n-Nitrosopyrrolidine	-0.29 to -0.19	-0.19	USEPA 1995	0.65	No
Nitrobenzene	Not Reported	1.84	USEPA 1996a	64.4	No
p-Dimethylamino azobenzene	Not Reported	4.58	SRC 1998	31,799	Yes
Pentachlorobenzene	4.88 to 6.12	5.26	USEPA 1995	148,204	Yes
Pentachloronitrobenzene	4.18 to 4.64	4.64	USEPA 1995	36,425	Yes
Pentachlorophenol	3.29 to 5.24	5.09	USEPA 1995	100,867	Yes
Phenacetin	Not Reported	1.58	SRC 1998	35.8	No
Phenol	0.79 to 1.55	1.48	USEPA 1995	28.5	No
p-Phenylene diamine	Not Reported	-0.30	SRC 1998	0.51	No
Pronamide	3.26 to 3.86	3.51	USEPA 1995	2,822	Yes
Pryridine	0.62 to 1.28	0.67	USEPA 1995	4.56	No
Safrole, total	2.66 to 2.88	2.66	USEPA 1995	412	No
PAHs:					
2-Methylnaphthalene	Not Reported	3.90	USEPA 1996a	6,823	Yes
Acenaphthene	3.77 to 4.49	3.92	USEPA 1995	7,139	Yes
Acenaphthylene	Not Reported	4.10	USEPA 1996a	10,730	Yes
Anthracene	3.45 to 4.80	4.55	USEPA 1995	29,712	Yes

TABLE 7-3
LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Log K_{ow} Range	Recommended Log K_{ow}	Reference	K_{oc} [1] (L/Kg)	Bioaccumulative Chemical [2]
PAHs:					
Benzo(a)anthracene	4.00 to 5.79	5.70	USEPA 1995	401,218	Yes
Benzo(a)pyrene	5.98 to 6.42	6.11	USEPA 1995	1,014,869	Yes
Benzo(b)fluoranthene	5.79 to 6.40	6.20	USEPA 1995	1,244,171	Yes
Benzo(g,h,i)perylene	6.63 to 7.05	6.70	USEPA 1995	3,858,158	Yes
Benzo(k)fluoranthene	6.12 to 6.27	6.20	USEPA 1995	1,244,171	Yes
Chrysene	5.41 to 5.79	5.70	USEPA 1995	401,218	Yes
Dibenzo(a,h)anthracene	6.50 to 6.88	6.69	USEPA 1995	3,771,812	Yes
Fluoranthene	4.31 to 5.39	5.12	USEPA 1995	107,954	Yes
Fluorene	4.04 to 4.40	4.21	USEPA 1995	13,763	Yes
Indeno(1,2,3-cd)pyrene	6.58 to 6.72	6.65	USEPA 1995	3,445,323	Yes
Naphthalene	3.01 to 4.70	3.36	USEPA 1995	2,010	Yes
Phenanthrene	4.28 to 4.57	4.55	USEPA 1995	29,712	Yes
Pyrene	4.76 to 5.52	5.11	USEPA 1995	105,538	Yes

Notes:

K_{ow} = Octanol-Water Partition Coefficient
K_{oc} = Organic Carbon Partition Coefficient
L/kg = liter per kilogram
PAH = Polynuclear Aromatic Hydrocarbon
SRC = Syracuse Research Corporation
USEPA = United States Environmental Protection Agency

(1) K_{oc} values were estimated from the following equation: Log K_{oc} = 0.00028 + (0.983)(Log K_{ow}) (USEPA 1993 and 1996b).

(2) An organic chemical is considered a bioaccumulative chemical if its Log K_{ow} value is greater than or equal to 3.0. When a range of Log K_{ow} values was reported, the upper value within the range was conservatively used to identify bioaccumulative chemicals.

(3) The K_{ow} values shown are for o-xylene

(4) The K_{ow} values shown are for 3-methylphenol.

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TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Volatile Organics (µg/kg):			
1,1,1,2-Tetrachloroethane	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,1,1-Trichloroethane	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,1,2,2-Tetrachloroethane	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,1,2-Trichloroethane	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,1-Dichloroethane	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,1-Dichloroethene	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,2,3-Trichloropropane	NA	---	---
1,2-Dibromo-3-chloropropane	NA	---	---
1,2-Dichloroethane	402 (1)	MHSPE 2000	---
1,2-Dichloropropane	700,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
2-Butanone (MEK)	NA	---	---
2-Chloro-1,3-butadiene	NA	---	---
2-Hexanone	NA	---	---
3-Chloro-1-propene	NA	---	---
4-Methyl-2-pentanone (MIBK)	NA	---	---
Acetone	NA	---	---
Acetonitrile	NA	---	---
Acrolein	NA	---	---
Acrylonitrile	1,000,000	Efroymson et al. 1997a	Toxicological threshold for soil microorganisms and microbial processes
Benzene	101 (1)	MHSPE 2000	---
Bromoform	NA	---	---
Bromomethane	NA	---	---
Carbon disulfide	NA	---	---
Carbon tetrachloride	1,000,000	Efroymson et al. 1997a	Toxicological threshold for soil microorganisms and microbial processes
Chlorobenzene	40,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Chlorodibromomethane	NA	---	---
Chloroethane	NA	---	---
Chloroform	1,002 (1)	MHSPE 2000	---
Chloromethane	NA	---	---
cis-1,3-Dichloropropene	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
Dibromomethane	NA	---	---
Dichlorobromomethane	NA	---	---
Dichlorodifluoromethane	NA	---	---
Ethylbenzene	5,003 (1)	MHSPE 2000	---
Ethylene dibromide	300	CCME 2007	Canadian soil quality guideline based on agricultural land uses

TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Volatile Organics (µg/kg):			
Ethyl methacrylate	NA	---	---
Iodomethane	NA	---	---
Isobutyl alcohol	NA	---	---
Methacrylonitrile	NA	---	---
Methylene chloride	1,040 (1)	MHSPE 2000	---
Methyl methacrylate	NA	---	---
Pentachloroethane	NA	---	---
Propionitrile	NA	---	---
Styrene	10,030 (1)	MHSPE 2000	---
Tetrachloroethene	400 (1)	MHSPE 2000	---
Toluene	13,001 (1)	MHSPE 2000	---
trans-1,2-Dichloroethene	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
trans-1,3-Dichloropropene	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
trans-1,4-Dichloro-2-butene	1,000,000	Efroymson et al. 1997a	Toxicological threshold for soil microorganisms and microbial processes
Trichloroethene	6,010 (1)	MHSPE 2000	---
Trichlorofluoromethane	NA	---	---
Vinyl acetate	NA	---	---
Vinyl chloride	11.0 (1)	MHSPE 2000	---
Xylenes, total	2,510 (1)	MHSPE 2000	---
Semi-Volatile Organics (µg/kg):			
1,2,4,5-Tetrachlorobenzene	50.0	CCME 2007	Canadian soil quality guideline based on agricultural land uses
1,2,4-Trichlorobenzene	20,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
1,3,5-Trinitrobenzene	40,000	---	Value for nitrobenzene used as a surrogate
1,1-Biphenyl	NA	---	---
1,2-Dichlorobenzene	3,003 (1)	MHSPE 2000	Value for total chlorobenzenes (2)
1,3-Dichlorobenzene	3,003 (1)	MHSPE 2000	Value for total chlorobenzenes (2)
1,3-Dinitrobenzene	40,000	---	Value for nitrobenzene used as a surrogate
1,4-Dichlorobenzene	20,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
1,4-Dioxane	NA	---	---
1,4-Naphthoquinone	NA	---	---
2,3,4,6-Tetrachlorophenol	1,001 (1)	MHSPE 2000	Value for total chlorophenols (3)
2,4,5-Trichlorophenol	4,000	Efroymson et al. 1997b	Toxicological threshold for plants
2,4,6-Trichlorophenol	10,000	Efroymson et al. 1997a	Toxicological threshold for earthworms

TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Semi-Volatile Organics (µg/kg):			
2,2'-Oxybis(1-chloropropane)	NA	---	---
2,4-Dichlorophenol	1,001 (1)	MHSPE 2000	Value for total chlorophenols (3)
2,4-Dimethylphenol	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
2,4-Dinitrophenol	20,000	Efroymson et al. 1997b	Toxicological threshold for plants
2,4-Dinitrotoluene	NA	---	---
2,6-Dichlorophenol	1,001 (1)	MHSPE 2000	Value for total chlorophenols (3)
2,6-Dinitrotoluene	NA	---	---
2-Acetylaminofluorene	NA	---	---
2-Chloronaphthalene	NA	---	---
2-Chlorophenol	1,001 (1)	MHSPE 2000	Value for total chlorophenols (3)
2-Methylphenol	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
2-Naphthylamine	NA	---	---
2-Nitroaniline	NA	---	---
2-Nitrophenol	7,000	---	Value for 4-nitrophenol used as a surrogate
2-Picoline	NA	---	---
2-Toluidine	NA	---	---
3,3'-Dichlorobenzidine	NA	---	---
3,3'-Dimethylbenzidine	NA	---	---
3,4-Methylphenol	100	CCME 2007	Canadian soil quality guideline based on agricultural land uses
3-Methylcholanthrene	NA	---	---
3-Nitroaniline	NA	---	---
4,6-Dinitro-2-methylphenol	NA	---	---
4-Aminobiphenyl	NA	---	---
4-Bromophenyl phenyl ether	NA	---	---
4-Chloro-3-methylphenol	NA	---	---
4-Chloroaniline	NA	---	---
4-Chlorophenyl phenyl ether	NA	---	---
4-Nitroaniline	NA	---	---
4-Nitrophenol	7,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
4-Nitroquinoline-1-oxide	NA	---	---
7,12-Dimethylbenz(a)anthracene	NA	---	---
Acetophenone	NA	---	---
A,A-Dimethylphenethylamine	NA	---	---
Aniline	NA	---	---
Aramite, total	NA	---	---

TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Semi-Volatile Organics (µg/kg):			
Benzyl alcohol	NA	---	---
bis(2-Chloroethoxy)methane	NA	---	---
bis(2-Chloroethyl)ether	NA	---	---
bis(2-Ethylhexyl)phthalate	6,010 (1)	MHSPE 2000	Value for total phthalates (4)
Butyl benzyl phthalate	6,010 (1)	MHSPE 2000	Value for total phthalates (4)
Diallate	NA	---	---
Dibenzofuran	NA	---	---
Diethyl phthalate	100,000	Efroymson et al. 1997b	Toxicological threshold for plants
Dimethyl phthalate	200,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Di-n-butyl phthalate	200,000	Efroymson et al. 1997b	Toxicological threshold for plants
Di-n-octyl phthalate	6,010 (1)	MHSPE 2000	Value for total phthalates (4)
Dinoseb	NA	---	---
Ethyl methanesulfonate	NA	---	---
Hexachlorobenzene	1,000,000	Efroymson et al. 1997a	Toxicological threshold for soil microorganisms and microbial processes
Hexachlorobutadiene	NA	---	---
Hexachlorocyclopentadiene	10,000	Efroymson et al. 1997b	Toxicological threshold for plants
Hexachloroethane	NA	---	---
Hexachlorophene	NA	---	---
Hexachloropropene	NA	---	---
Hexachlorophene	NA	---	---
Hexachloropropene	NA	---	---
Isophorone	NA	---	---
Isosafrole	NA	---	---
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
N-Nitro-o-toluidine	NA	---	---
N-Nitrosodiethylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitrosodimethylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitroso-di-n-butylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitroso-di-n-propylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitrosodiphenylamine	20,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
N-Nitrosomethylethylamine	20,000	---	Value for n-Nitrosdiphenylamine used as a surrogate
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---

TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Semi-Volatile Organics (µg/kg):			
Nitrobenzene	40,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
p-Dimethylamino azobenzene	NA	---	---
Pentachlorobenzene	1,150	USEPA 1999	Toxicological threshold for earthworms
Pentachloronitrobenzene	NA	---	---
Pentachlorophenol	5,000	USEPA 2007a	Ecological soil screening level for plants
Phenacetin	NA	---	---
Phenol	30,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
p-Phenyl diamine	NA	---	---
Pronamide	NA	---	---
Pyridine	NA	---	---
Safrole, total	NA	---	---
PAHs (µg/kg):			
Low molecular weight PAHs (5)	29,000	USEPA 2007b	Ecological soil screening level for soil invertebrates
High molecular weight PAHs (6)	18,000	USEPA 2007b	Ecological soil screening level for soil invertebrates
Metals (mg/kg):			
Antimony	78.0	USEPA 2005a	Ecological soil screening level for soil invertebrates
Arsenic	18.0	USEPA 2005b	Ecological soil screening level for plants
Barium	330	USEPA 2005c	Ecological soil screening level for soil invertebrates
Beryllium	40.0	USEPA 2005d	Ecological soil screening level for soil invertebrates
Cadmium	32.0	USEPA 2005e	Ecological soil screening level for plants
Chromium, total	57.0	USEPA 2008	Reproduction-based MATC for *Eisenia andrei* (earthworm)
Cobalt	13.0	USEPA 2005f	Ecological soil screening level for plants
Copper	70.0	USEPA 2007c	Ecological soil screening level for plants
Lead	120	USEPA 2005g	Ecological soil screening level for plants
Mercury	0.10	Efroymson et al. 1997a	Toxicological threshold for earthworms
Nickel	38.0	USEPA 2007d	Ecological soil screening level for plants
Selenium	0.52	USEPA 2007e	Ecological soil screening level for plants
Silver	560	USEPA 2006	Ecological soil screening level for plants
Thallium	1.00	Efroymson et al. 1997b	Toxicological threshold for plants
Tin	50.0	Efroymson et al. 1997b	Toxicological threshold for plants
Vanadium	20.0	USEPA 2005h	Growth-based LOAEC for *Brassica oleracea* (broccoli) with a safety factor of 5
Zinc	120	USEPA 2007f	Ecological soil screening level for soil invertebrates

TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes:

NA = Not Available
MHSPE = Ministry of Housing, Spatial Planning and Environment
CCME = Canadian Council of Ministers of the Environment
USEPA = United States Environmental Protection Agency
MATC = Maximum Acceptable Toxicant Concentration
LOAEC = Lowest Observed Adverse Effect Concentration
PAH = Polynuclear Aromatic Hydrocarbon
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram

(1) The screening value shown is an average of the target and intervention soil standards for soil remediation. The value is based on a default organic carbon content of 0.02 (2 percent), which represents a minimum value (adjustment range is 2 to 30 percent).

(2) The value represents a total concentration for chlorobenzenes (mono, di, tri, tetra, penta, and hexachlorobenzene).

(3) The value represents a total concentration for all chlorophenols (mono, di, tri, tetra, and pentachlorophenol).

(4) The value represents a total concentration for all phthalates.

(5) Low molecular weight PAHs are defined by the USEPA (2007a) as PAH compounds composed of fewer than four rings. The low molecular weight PAH compounds analyzed for in SWMU 69 soil were 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene.

(6) High molecular weight PAHs are defined by the USEPA (2007a) as PAH compounds composed of four or more rings. The high molecular weight PAH compounds analyzed for in SWMU 69 soil were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene.

Table References:

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TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table References (continued):

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USEAP. 2007a. Ecological Soil Screening Levels for Pentachlorophenol (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-58.

USEPA. 2007b. Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons (PAHs) (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-78.

USEAP. 2007c. Ecological Soil Screening Levels for Copper (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-68.

USEAP. 2007d. Ecological Soil Screening Levels for Nickel (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-76.

USEAP. 2007e. Ecological Soil Screening Levels for Selenium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-72.

USEPA. 2007f. Ecological Soil Screening Levels for Zinc (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-73.

USEPA. 2006. Ecological Soil Screening Levels for Silver (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWEER Directive 9285.7-77.

USEPA. 2005a. Ecological Soil Screening Levels for Antimony (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-61.

USEPA. 2005b. Ecological Soil Screening Levels for Arsenic (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-62.

USEPA. 2005c. Ecological Soil Screening Levels for Barium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

USEPA. 2005d. Ecological Soil Screening Levels for Beryllium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-64.

USEPA. 2005e. Ecological Soil Screening Levels for Cadmium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-65.

USEPA. 2005f. Ecological Soil Screening Levels for Cobalt (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-67

USEPA. 2005g. Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

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TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment [2]
Volatile Organics (µg/L):			
1,1,1,2-Tetrachloroethane	200 [3]	USEPA 2007a	Minimum acute value (96-hour LC_{50} for *Lepomis macrochirus* [bluegill]) with a safety factor of 100
1,1,1-Trichloroethane	312	USEPA 2001	USEPA Region 4 chronic screening value
1,1,2,2-Tetrachloroethane	90.2	USEPA 2001	USEPA Region 4 chronic screening value
1,1,2-Trichloroethane	340	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Pleuronectes platessa* [sand dab]) with a safety factor of 100
1,1-Dichloroethane	47.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
1,1-Dichloroethene	2,240	USEPA 2001	USEPA Region 4 chronic screening value
1,2,3-Trichloropropane	274 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
1,2-Dibromo-3-chloropropane	100	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Mercenaria mercenaria* [hard clam]) with a safety factor of 100
1,2-Dichloroethane	1,130	USEPA 2001	USEPA Region 4 chronic screening value
1,2-Dichloropropane	2,400	USEPA 2001	USEPA Region 4 chronic screening value
2-Butanone (MEK)	13,333	USEPA 2007a	Minimum acute value (96-hour NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 30
2-Chloro-1,3-butadiene	NA	---	---
2-Hexanone	99.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
3-Chloro-1-propene	3.40 [3]	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Xenopus laevis* [clawed toad]) with a safety factor of 100
4-Methyl-2-pentanone (MIBK)	170 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Acetone	1,000	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Lumbriculus variegatus* [Oligochaete]) with a safety factor of 100
Acetonitrile	12,000 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Acrolein	0.55	USEPA 2001	USEPA Region 4 chronic screening value
Acrylonitrile	58.1	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Benzene	109	USEPA 2001	USEPA Region 4 chronic screening value
Bromoform	640	USEPA 2001	USEPA Region 4 chronic screening value
Bromomethane	120	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
Carbon disulfide	15.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Carbon tetrachloride	1,500	USEPA 2001	USEPA Region 4 chronic screening value
Chlorobenzene	105	USEPA 2001	USEPA Region 4 chronic screening value
Chlorodibromomethane	340 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Cyprinus carpio* [common carp] with a safety factor of 100
Chloroethane	NA	---	---
Chloroform	815	USEPA 2001	USEPA Region 4 chronic screening value
Chloromethane	2,700	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
cis-1,3-Dichloropropene	7.90	USEPA 2001	USEPA Region 4 chronic screening value (cis and trans)
Dibromomethane	1,280	Buchman 2008	Chronic LOEL for chemical class with a safety factor of 5
Dichlorobromomethane	2,400 [3]	USEPA 2007a	Minimum acute value (24-hr LC_{50} for *Tetrahymena pyriformis* [ciliate]) with a safety factor of 100
Dichlorodifluoromethane	1,280	---	Value for trichlorofluoromethane used as a surrogate
Ethylbenzene	4.30	USEPA 2001	USEPA Region 4 chronic screening value
Ethylene dibromide	48.0	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 100
Ethyl methacrylate	18,000 [3]	USEPA 2007a	Minimum chronic value (21-day NOEC for *Daphnia magna* [cladoceron] based on reproduction [progeny counts])
Iodomethane	NA	---	---
Isobutyl alcohol	10,000	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Alburnus alburnus* [bleak]) with a safety factor of 100
Methacrylonitrile	NA	---	---
Methylene chloride	2,560	USEPA 2001	USEPA Region 4 chronic screening value
Methyl methacrylate	2,800 [3]	USEPA 2003	USEPA Region 5 ecological screening level

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment [2]
Volatile Organics (µg/L):			
Pentachloroethane	56.2	Buchman 2008	Chronic LOEL with a safety factor of 5
Propionitrile	15,200 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
Styrene	170	USEPA 2007a	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 30
Tetrachloroethene	45.0	USEPA 2001	USEPA Region 4 chronic screening value
Toluene	37.0	USEPA 2001	USEPA Region 4 chronic screening value
trans-1,2-dichloroethene	4,480	Buchman 2008	Acute LOEL (summation of all isomers) with a safety factor of 50
trans-1,3-Dichloropropene	7.90	USEPA 2001	USEPA Region 4 chronic screening value (cis and trans)
trans-1,4-Dichloro-2-butene	NA	---	---
Trichloroethene	40.0	Buchman 2008	Acute LOEL with a safety factor of 50
Trichlorofluoromethane	1,280	Buchman 2008	Chronic LOEL for chemical class with a safety factor of 5
Vinyl acetate	100	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Crangon crangon* [sand shrimp]) with a safety factor of 100
Vinyl chloride	930 [3]	USEPA 2003	USEPA Region 5 ecological screening level
o-Xylene	27.0 [3]	---	Value for total xylene used as a surrogate
m,p-Xylene	27.0 [3]	---	Value for total xylene used as a surrogate
Xylenes, total	27.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Semi-Volatile Organics (µg/L):			
1,2,4,5-Tetrachlorobenzene	10.0	USEPA 2007a	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 30
1,2,4-Trichlorobenzene	4.50	USEPA 2001	USEPA Region 4 chronic screening value
1,3,5-Trinitrobenzene	80.0 [3]	USEPA 2007a	Minimum chronic value (71-day NOEC for *Oncorhynchus mykiss* [rainbow trout] based on reproduction)
1,1-Biphenyl	230 [3]	USEPA 2007a	Minimum chronic value (21-day MATC for *Daphnia magna* [cladoceron] based on reproduction)
1,2-Dichlorobenzene	19.7	USEPA 2001	USEPA Region 4 chronic screening value
1,3-Dichlorobenzene	28.5	USEPA 2001	USEPA Region 4 chronic screening value
1,3-Dinitrobenzene	22.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
1,4-Dichlorobenzene	19.9	USEPA 2001	USEPA Region 4 chronic screening value
1,4-Dioxane	67,000	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
1,4-Naphthoquinone	NA	---	---
2,3,4,6-Tetrachlorophenol	8.80	Buchman 2008	Acute LOEL with a safety factor of 50
2,4,5-Trichlorophenol	11.0	Buchman 2008	Proposed Criteria Continuous Concentration
2,4,6-Trichlorophenol	12.1	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Palaemonetes pugio* [daggerblade grass shrimp]) with a safety factor of 100
2,2'-Oxybis(1-chloropropane)	NA	---	---
2,4-Dichlorophenol	1.67	USEPA 2007a	Minimum acute value (96-hr NOEC for *Allorchestes compressa* [scud]) with a safety factor of 30
2,4-Dimethylphenol	131	USEPA 2007a	Minimum chronic value (28-day NOEC for *Menidia beryllina* [inland silverside] based on survival)
2,4-Dinitrophenol	48.5	USEPA 2001	USEPA Region 4 chronic screening value
2,4-Dinitrotoluene	44.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
2,6-Dichlorophenol	54.0	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Platichthys flesus* [european flounder]) with a safety factor of 100
2,6-Dinitrotoluene	81.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
1-Naphthylamine	70.0 [3]	USEPA 2007a	Minimum acute value (48-hour LC_{50} for *Oryzias latipes* [medaka high eyes]) with a safety factor of 100
2-Acetylaminofluorene	20.0 [3]	USEPA 2007a	Minimum acute value (96-hr LOEC for *Xenopus laevis* [clawed toad]) with a safety factor of 50
2-Chloronaphthalene	0.15	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50
2-Chlorophenol	53.0	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Crangon septemspinosa* [bay shrimp]) with a safety factor of 100
2-Methylphenol	102	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Elasmopus pectinicrus* [scud]) with a safety factor of 100

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment [2]
Semi-Volatile Organics (µg/L):			
2-Naphthylamine	NA	---	---
2-Nitroaniline	48.9 [3]	USEPA 2007a	Minumum acute value (48-hr EC_{50} for *daphnia magna* [cladoceron]) with a safety factor of 100
2-Nitrophenol	10,000	USEPA 2007a	Minimum chronic value (28-day MATC for *Cyprinodon variegatus* [sheepshead minnow] based on egg hatchability)
2-Picoline	8,979 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
2-Toluidine	5.20 [3]	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Daphnia magna* [cladoceron]) with a safety factor of 100
3,4-Methylphenol	33.6	---	Value for 4-methylphenol used as a surrogate
3,3'-Dichlorobenzidine	4.50 [3]	USEPA 2003	USEPA Region 5 ecological screening level
3,3'-Dimethylbenzidine	160 [3]	USEPA 2007a	Minimum chronic value (21-day NOEC for *Daphnia magna* [cladoceron] based on behavior [equilibrium])
3-Methylcholanthrene	NA	---	---
3-Methylphenol	300	USEPA 2007a	Minimum acute value (96-hr EC50 for *gadus morhua* [Atlantic cod] based on multiple effects) with a safety factor of 100
3-Nitroaniline	9.80 [3]	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) with a safety factor of 100
4,6-Dinitro-2-methylphenol	23.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
4-Aminobiphenyl	NA	---	---
4-Bromophenyl phenyl ether	1.50 [3]	USEPA 2003	USEPA Region 5 ecological screening level
4-Chloro-3-methylphenol	0.30 [3]	USEPA 2003	USEPA Region 5 ecological screening level
4-Chloroaniline	10.0 [3]	USEPA 2007a	Minimum chronic value (21-day NOEC for *Daphnia magna* [cladoceron]) based on reproduction)
4-Chlorophenyl phenyl ether	7.30 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Salvelinus fontinalis* [brook trout]) with a safety factor of 100
4-Methylphenol	33.6	USEPA 2007a	Minimum acute value (96-hr LC50 for Oncorhynchus goruscha [pink salmon]) with a safety factor of 100
4-Nitroaniline	170 [3]	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) with a safety factor of 100
4-Nitrophenol	71.7	USEPA 2001	USEPA Region 4 chronic screening value
4-Nitroquinoline-1-oxide	NA	---	---
7,12-Dimethylbenz(a)anthracene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Acetophenone	1,550 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
A,A-Dimethyl phenethylamine	NA	---	---
Aniline	294	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Crangon septemspinosa* [sand shrimp]) with a safety factor of 100
Aramite, total	3.09 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Benzyl alcohol	150	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
bis(2-Chloroethoxy)methane	1840 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
bis(2-Chloroethyl)ether	2,380 [3]	USEPA 2001	USEPA Region 4 chronic screeing value
bis(2-Ethylhexyl)phthalate	360	Buchman 2008	Proposed Criteria Continuous Concentration
Butyl benzyl phthalate	29.4	USEPA 2001	USEPA Region 4 chronic screening value
cis-Diallate	82.0 [3]	---	Value for total diallate used as a surrogate
trans-Diallate	82.0 [3]	---	Value for total diallate used as a surrogate
Diallate (total)	82.0 [3]	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Rasbora heteromorpha* [harlequinfish]) with a safety factor of 100
Dibenzofuran	33.3	USEPA 2007a	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 30
Diethyl phthalate	75.9	USEPA 2001	USEPA Region 4 chronic screening value
Dimethyl phthalate	580	USEPA 2001	USEPA Region 4 chronic screening value
Di-n-butyl phthalate	3.40	USEPA 2001	USEPA Region 4 chronic screening value (lowest reported plant value)
Di-n-octyl phthalate	1,150	USEPA 2007a	Minimum acute value (96-hr NOEC for *Americamysis bahia* [opossum shrimp]) with a safety factor of 30
Dinoseb	1.70	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100

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SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment [2]
Semi-Volatile Organics (µg/L):			
Ethyl methanesulfonate	40.0 [3]	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Clarias batrachus* [walking catfish]) with a safety factor of 100
Hexachlorobenzene	0.077	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Crassostrea virginica* [Virginia oyster]) with a safety factor of 100
Hexachlorobutadiene	0.32	USEPA 2001	USEPA Region 4 chronic screening value
Hexachlorocyclopentadiene	0.07	USEPA 2001	USEPA Region 4 chronic screening value
Hexachloroethane	9.40	USEPA 2001	USEPA Region 4 chronic screening value
Hexachlorophene	8.80 [3]	USEPA 2007a	Minimum chronic value (34-day NOEC for *Pimephales promelas* [fathead minnow] based on survival and growth)
Hexachloropropene	NA	---	---
Isophorone	129	USEPA 2001	USEPA Region 4 chronic screening value
Isosafrole	NA	---	---
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
Nitrobenzene	66.8	USEPA 2001	USEPA Region 4 chronic screening value
N-Nitro-o-toluidine	220 [3]	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron] based on immobilization) with a safety factor of 100
N-Nitrosodiethylamine	768 [3]	USEPA 2003	USEPA Region 5 ecological screening level
N-Nitrosodimethylamine	25.0 [3]	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitroso-di-n-butylamine	25.0 [3]	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitroso-di-n-propylamine	25.0 [3]	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitrosodiphenylamine	25.0 [3]	USEPA 2007b	Indiana Department of Environmental Management Great Lakes Basin Tier II chronic criterion
N-Nitrosomethylethylamine	25.0 [3]	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---
p-Dimethylamino azobenzene	NA	---	---
Pentachlorobenzene	129	USEPA 2001	USEPA Region 4 chronic screening value
Pentachloronitrobenzene	0.12	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Pentachlorophenol	7.90	PREQB 2010	Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Phenacetin	NA	---	---
Phenol	58.0	USEPA 2001	USEPA Region 4 chronic screening value
p-Phenylene diamine	200 [3]	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Oryzias latires* [medika, high-eyes]) with a safety factor of 100
Pronamide	35.0	USEPA 2007a	Minimum acute value (96-hr EC_{50} for *Crassostrea virginica* [Virginia oyster]) with a safety factor of 100
Pyridine	500	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Crangon septemspinosa* [sand shrimp]) with a safety factor of 100
Safrole	NA	---	---
PAHs (µg/L):			
2-Methylnaphthalene	6.00	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Penaeus aztecus* [brown shrimp]) with a safety factor of 100
Acenaphthene	9.70	USEPA 2001	USEPA Region 4 chronic screening value
Acenaphthylene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for low molecular weight PAHs)
Anthracene	5.35	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Benzo(a)anthracene	0.025 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Benzo(a)pyrene	10.0	USEPA 2004	Acute value (LC_{50}) with a safety factor of 100
Benzo(b)fluoranthene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Benzo(g,h,i)perylene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)

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SWMU 69 - AIRCRAFT PARKING AREA
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Chemical	Surface Water Screening Value [1]	Reference	Comment [2]
PAHs (µg/L):			
Benzo(k)fluoranthene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Chrysene	10.0	USEPA 2004	Acute value (LC_{50}) with a safety factor of 100
Dibenzo(a,h)anthracene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Fluoranthene	11.0	USEPA 1996	Final Chronic Value
Fluorene	10.0	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Nereis arenaceodentata* [polychaete]) with a safety factor of 100
Indeno(1,2,3-cd)pyrene	6.00	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Naphthalene	23.5	USEPA 2001	USEPA Region 4 chronic screening value
Phenanthrene	8.30	USEPA 1996	Final Chronic Value
Pyrene	0.248	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Total Recoverable Metals (µg/L):			
Antimony	500	Buchman 2008	Proposed Criteria Continuous Concentration
Arsenic	36.0	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Barium	16,667	USEPA 2007a	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 30
Beryllium	167	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Fundulus heteroclitus* [mummichog]) with a safety factor of 100
Cadmium	8.85	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Chromium, total	50.4 [5]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Cobalt	45.0	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Nitocra spinipes* [Harpacticoid copepod]) with a safety factor of 100
Copper	3.73	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Lead	8.52	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Mercury	1.11	USEPA 2009	Total recoverable Criteria Continuous Concentration
Nickel	8.28	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Selenium	71.1	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Silver	2.24	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters
Thallium	21.3	USEPA 2001	USEPA Region 4 chronic screening value
Tin	180 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Vanadium	12.0 [3]	USEPA 2003	USEPA Region 5 ecological screening level
Zinc	85.6	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SB coastal and estuarine waters

Notes:

NA = Not Available
PREQB = Puerto Rico Environmental Quality Board
USEPA = United States Environmental Protection Agency
PAH = Polynuclear Aromatic Hydrocarbon
LOEL = Lowest Observed Effect Level

MATC = Maximum Acceptable Toxicant Concentration
NOEC = No Observed Effect Concentration
EC_{50} = Median Effective Concentration
LC_{50} = Median Lethal Concentration
µg/L = microgram per liter

[1] The values shown are marine/estuarine screening values unless otherwise noted. Estuarine/marine surface water screening values were preferentially used as groundwater screening values since groundwater flow at SWMU 69 is toward an estuarine wetland.

[2] The safety factors applied to acute endpoints (i.e., LC_{50}, EC_{50}, NOEC, and LOEL values) and chronic endpoints (i.e., LOELs) are those recommended by Wentsel et al. (1996).

[3] The chemical lacks a marine/estuarine surface water screening value/literature-based toxicity value. The value shown is a freshwater screening value/toxicity value.

[4] The value shown is for 4-methylphenol.

[5] The value shown is for hexavalent chromium.

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MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
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TABLE 7-6
TOXICITY REFERENCE VALUES FOR BIRDS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	NOAEL (mg/kg/d)	MATC [1] (mg/kg/d)	LOAEL (mg/kg/d)	Source Document [2]	Comments
Volatile Organics:											
1,1,1,2-Tetrachloroethane	---	---	---	---	---	---	NA	NA	NA	---	---
Carbon tetrachloride	---	---	---	---	---	---	NA	NA	NA	---	---
Chlorobenzene	---	---	---	---	---	---	NA	NA	NA	---	---
Chloroform	---	---	---	---	---	---	NA	NA	NA	---	---
Ethylbenzene	---	---	---	---	---	---	NA	NA	NA	---	---
Pentachloroethane	---	---	---	---	---	---	NA	NA	NA	---	---
Styrene	---	---	---	---	---	---	NA	NA	NA	---	---
Toluene	---	---	---	---	---	---	NA	NA	NA	---	---
Trichloroethene	---	---	---	---	---	---	NA	NA	NA	---	---
Xylenes, total	Quail	0.191	Unknown	Oral in diet	Mortality	---	40.5 [3]	90.7	203 [4]	Hill and Camardese 1986	---
Semi-Volatile Organics:											
1,2,4,5-Tetrachlorobenzene	---	---	---	---	---	---	NA	NA	NA	---	---
1,2,4-Trichlorobenzene	---	---	---	---	---	---	NA	NA	NA	---	---
1,1-Biphenyl	---	---	---	---	---	---	NA	NA	NA	---	---
1,2-Dichlorobenzene	---	---	---	---	---	---	16.0	35.8	80.0	---	Values for 1,4-dichlorobenzene used as surrogates
1,3-Dichlorobenzene	---	---	---	---	---	---	16.0	35.8	80.0	---	Values for 1,4-dichlorobenzene used as surrogates
1,4-Dichlorobenzene	Northern bobwhite	0.157	14 days	Oral (gavage)	Mortality	Not Applicable	16.0 [3]	35.8	80.0 [4]	USEPA 2004 [13]	---
2,3,4,6-Tetrachlorophenol	---	---	---	---	---	---	NA	NA	NA	---	---
2,4,5-Trichlorophenol	---	---	---	---	---	---	NA	NA	NA	---	---
2,4,6-Trichlorophenol	---	---	---	---	---	---	NA	NA	NA	---	---
2,4-Dichlorophenol	---	---	---	---	---	---	NA	NA	NA	---	---
2-Acetylaminofluorene	---	---	---	---	---	---	NA	NA	NA	---	---
2-Chloronaphthalene	---	---	---	---	---	---	NA	NA	NA	---	---
3,3'-Dichlorobenzidine	---	---	---	---	---	---	NA	NA	NA	---	---
3,3-Dimethylbenzidine	---	---	---	---	---	---	NA	NA	NA	---	---
3-Methylcholanthrene	---	---	---	---	---	---	NA	NA	NA	---	---
4-Bromophenyl phenyl ether	---	---	---	---	---	---	NA	NA	NA	---	---
4-Chloro-3-methylphenol	---	---	---	---	---	---	NA	NA	NA	---	---
4-Chlorophenyl phenyl ether	---	---	---	---	---	---	NA	NA	NA	---	---
7-12-Dimethylbenz(a)anthracene	European starling	0.055	5 days	Oral (gavage)	Growth	---	2.00	6.32	20.0	USEPA 2007a [13]	---
Aramite, total	---	---	---	---	---	---	NA	NA	NA	---	---
bis(2-Ethylhexyl) phthalate	Ringed dove	0.155	4 weeks	Oral in diet	Reproduction	Not Applicable	1.11	2.48	5.55 [4]	Sample et al. 1996 [13]	---
Butyl benzyl phthalate	---	---	---	---	---	---	NA	NA	NA	---	---
Diallate	---	---	---	---	---	---	NA	NA	NA	---	---
Dibenzofuran	---	---	---	---	---	---	NA	NA	NA	---	---
Diethyl phthalate	---	---	---	---	---	---	NA	NA	NA	---	---
Di-n-butyl phthalate	Ringed dove	0.155	4 weeks	Oral in diet	Reproduction	Not Applicable	0.222 [5]	0.50	1.11	Sample et al. 1996 [13]	---
Di-n-octyl phthalate	Ring-necked pheasant	1.00	5 days	Oral	Mortality	Not Applicable	50 [3]	112	250 [4]	USEPA 2007b [13]	---
Dinoseb	Ring-necked pheasant	Unknown	14 days	Oral (gavage)	Mortality	Not Applicable	0.264 [3]	0.590	1.32 [4]	USEPA 2004 [13]	---
Hexachlorobenzene	Japanese quail	0.15	90 days	Oral	Reproduction	Not Applicable	0.11	0.25	0.57	Coulston and Kolbye 1994	---
Hexachlorobutadiene	Japanese quail	0.15	90days	Oral	Reproduction	Not Applicable	3.39	7.59	17.0 [4]	Coulston and Kolbye 1994	---
Hexachlorocyclopentadiene	---	---	---	---	---	---	NA	NA	NA	---	---
Hexachloroethane	---	---	---	---	---	---	NA	NA	NA	---	---
Hexachlorophene	---	---	---	---	---	---	NA	NA	NA	---	---
Hexachloropropene	---	---	---	---	---	---	NA	NA	NA	---	---
Isosafrole	---	---	---	---	---	---	NA	NA	NA	---	---
N-Nitrosodiphenylamine	---	---	---	---	---	---	NA	NA	NA	---	---
p-Dimethylamino azobenzene	---	---	---	---	---	---	NA	NA	NA	---	---
Pentachlorobenzene	---	---	---	---	---	---	NA	NA	NA	---	---
Pentachloronitrobenzene	Chicken	1.50	35 weeks	Oral in diet	Reproduction	Not Applicable	7.07	22.4	70.7	Sample et al. 1996 [13]	---
Pentachlorophenol	Chicken	0.66	1 week	Oral in diet	Growth	Pentachlorophenol (purified)	6.73 [6]	21.3	67.3	USEPA 2007c [13]	---

TABLE 7-6
TOXICITY REFERENCE VALUES FOR BIRDS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	NOAEL (mg/kg/d)	MATC [1] (mg/kg/d)	LOAEL (mg/kg/d)	Source Document [2]	Comments
Semi-Volatile Organics:											
Pronamide	---	---	---	---	---	---	NA	NA	NA	---	---
PAHs:											
2-Methylnaphthalene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Acenaphthene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Acenaphthylene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Anthracene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Benzo(a)anthracene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Benzo(a)pyrene	White leghorn chicken	1.50	35 days	Oral in diet	Reproduction	Not Applicable	39.5	88.4	198 [5]	Rigdon and Neal 1963	---
Benzo(b)fluoranthene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Benzo(g,h,i)perylene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Benzo(k)fluoranthene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Chrysene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Dibenz(a,h)anthracene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Fluoranthene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Fluorene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Naphthalene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Phenanthrene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Pyrene	---	---	---	---	---	---	39.5	88.4	198	---	Values for benzo(a)pyrene used as surrogates
Metals:											
Antimony	Northern bobwhite	0.19	6 weeks	Oral	Unknown	Unknown	4,740	14,989	47,400	Opresko et al. 1993	---
Arsenic	Chicken	1.6	19 days	Oral in diet	Growth	Arsenic oxide	2.24 [6]	3.18	4.51 [7]	USEPA 2005a [13]	---
Barium	One-day old chicks	0.121	4 weeks	Oral in diet	Mortality	Barium hydroxide	20.8	29.5	41.7	Sample et al. 1996 [13]	---
Beryllium	---	---	---	---	---	---	NA	NA	NA	---	---
Cadmium	Multiple species	Various	Various	Oral in diet/water	Reproduction/growth	Cadmium, cadmium sulfate, and cadmium chloride	1.47 [8]	3.06	6.36 [9]	USEPA 2005b	---
Chromium, total	Multiple species	Various	Various	Oral in diet	Reproduction/growth	Sodium and potassium dichromate	2.66 [8][10]	6.44	15.6 [9]	USEPA 2008	---
Cobalt	Multiple species	Various	Various	Oral in diet	Growth	Cobalt, cobalt chloride, and cobalt carbonate	7.61 [8]	11.8	18.3 [9]	USEPA 2005c	---
Copper	Chicken	1.52	84 days	Oral in diet	Reproduction	Copper	4.05 [11]	7.00	12.1	USEPA 2007d [13]	---
Lead	Chicken	1.81	4 weeks	Oral in diet	Reproduction	Lead acetate	1.63 [11]	2.31	3.26	USEPA 2005d [13]	---
Mercury	Mallard duck	1.00	3 generations	Oral in diet	Reproduction	Methyl mercury dicyandiamide	0.026	0.045	0.078	USEPA 1997a [13]	---
Nickel	Multiple species	Various	Various	Oral in diet	Reproduction/growth	Nickel acetate, chloride, and sulfate	6.71 [8]	11.2	18.6 [9]	USEPA 2007e	---
Selenium	Chicken	0.328	2 weeks	Oral in diet	Mortality	Sodium selenite	0.29 [11]	0.410	0.579	USEPA 2007f [13]	---
Silver	Turkey	0.662	5 weeks	Oral in diet	Growth	Silver acetate	2.02 [12]	6.39	20.2	USEPA 2006	---
Thallium	European starling	Unknown	acute	Oral	Survival	Unknown	0.35 [3]	0.78	1.75 [4]	USEPA 1999 [13]	---
Tin	Japanese quail	0.15	6 weeks	Oral in diet	Reproduction	bis(Tributyltin)-oxide	6.80	11	16.9	Sample et al. 1996 [13]	---
Vanadium	Chicken	1.042	5 weeks	Oral in diet	Growth	Sodium metavanadate	0.344 [11]	0.486	0.688	USEPA 2005e [13]	---
Zinc	Multiple species	Various	Various	Oral in diet	Reproduction/growth	Zinc carbonate, oxide, and sulfate	66.1 [8]	106	171 [9]	USEPA 2007g	---

Notes:

PAH = Polynuclear Aromatic Hydrocarbon
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level

MATC = Maximum Acceptable Toxicant Concentration
USEPA = United States Environmental Protection Agency
mg/kg/d = milligram per kilogram-body weight per day

NA = Not Available
kg = kilogram

[1] MATC values were derived by calculating the geometric mean of the NOAEL and LOAEL values (values were calculated by Baker Environmental, Inc.).
[2] Source documents for NOAEL and LOAEL values represent primary data sources (as reported by original authors) unless otherwise noted.
[3] The chronic NOAEL value was estimated by applying a safety factor of 100 to a LD_{50} value (Wentsel et al., 1996 and USEPA, 1997b).

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Notes (continued):

(4) A chronic LOAEL value was not available from the study used as the source of the chronic NOAEL value. Therefore, a chronic LOAEL value was estimated by applying a safety factor of 5 to the chronic NOAEL value (Wentsel et al., 1996).

(5) A chronic NOAEL value was not available from the study used as the source of the chronic LOAEL value. Therefore, the chronic NOAEL value shown was estimated by applying a safety factor of 5 to the chronic LOAEL value (Wentsel et al., 1996).

(6) The NOAEL value represents the lowest value of all reproduction, growth, and survival-based NOAEL values listed in the cited ecological soil screening levels document that meet the required data evaluation score. The value was used by the USEPA to derive the avian ecological soil screening level. It is noted that a geometric mean of NOAEL values for growth and reproduction could not be calculated by the USEPA because insufficient NOAEL values meeting the minimum required data evaluation score were identified from the literature.

(7) A LOAEL value was not available from the study chosen by the USEPA as the source of the NOAEL value selected as the ecological soil screening level. Therefore, the LOAEL value represents a geometric mean of all reproduction- and growth-based LOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score (value was calculated by Baker Environmental, Inc.).

(8) The NOAEL value represents the geometric mean of all reproduction and growth-based NOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score. Because this value is lower than the lowest bounded LOAEL for reproduction, growth, or survival, it was selected by the USEPA as the toxicity reference value for avian ecological soil screening level development.

(9) The NOAEL value selected by the USEPA as the ecological soil screening level represents a geometric mean of all reproduction and growth-based NOAEL values that meet the minimum required data evaluation score. Therefore, the LOAEL value shown represents a geometric mean of all reproduction and growth-based LOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score (value was calculated by Baker Environmental, Inc.).

(10) The NOAEL value shown is for trivalent chromium.

(11) The NOAEL value shown represents the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival listed within the cited ecological soil screening levels that meet the minimum required data evaluation score. The value was used by the USEPA as the toxicity reference value for avian ecological soil screening value development. It is noted that a geometric mean of available NOAEL values for growth and reproduction was not used as the toxicity reference value by the USEPA for ecological soil screening value development since the geometric mean is higher than the lowest bounded LOAEL for reproduction, growth, and survival.

(12) The NOAEL is equal to the lowest value of all reproduction- and growth-based LOAELs listed in the cited ecological soil screening levels document that meet the minimum required data evaluation score divided by ten. The value was used by the USEPA to derive the avian ecological soil screening level. It is noted that a geometric mean of NOAEL values for growth and reproduction could not be calculated by the USEPA based on the lack of NOAEL values for reproduction and growth.

(13) The data reference represents a secondary data source.

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USEPA. 2007e. Ecological Soil Screening Levels for Nickel (Interim Final. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-76

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Table References (continued):

USEPA. 2005c. Ecological Soil Screening Levels for Cobalt (Interim Final. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-67

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TABLE 7-7
TOXICITY REFERENCE VALUES FOR MAMMALS
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
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Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	NOAEL (mg/kg/d)	MATC [1] (mg/kg/d)	LOAEL (mg/kg/d)	Source Document [2]
Volatile Organics:										
1,1,1,2-Tetrachloroethane	---	---	---	---	---	---	NA	NA	NA	---
Carbon tetrachloride	Rat	0.35	2 years	Oral in diet	Reproduction	Not Applicable	16	35.8	80 [3]	Sample et al. 1996 [18]
Chlorobenzene	Dog	12.7	13 weeks	Oral	Liver toxicity	Not Applicable	27.25	38.5	54.5	USEPA 2010 [18]
Chloroform	Rat	0.35	13 weeks	Oral (intubation)	Liver toxicity	Not Applicable	15 [4]	33.5	75 [3]	Sample et al. 1996 [18]
Ethylbenzene	Rat	0.35	182 days	Oral (gavage)	Liver/kidney toxicity	Not Applicable	136	236	408	USEPA 2010 [18]
Pentachloroethane	---	---	---	---	---	---	NA	NA	NA	---
Styrene	Rat	0.35	90 days	Oral in water	Reproduction	Not Applicable	35	78.3	175 [3]	Beliles et al. 1985
Toluene	Mouse	0.03	Days 6-12 of gestation	Oral (gavage)	Reproduction	Not Applicable	52 [4]	116	260	Sample et al. 1996 [18]
Trichloroethene	Mouse	0.03	6 weeks	Oral (gavage)	hepatotoxicity	Not Applicable	5.0 [5]	3.5	2.5 [3]	Sample et al. 1996 [18]
Xylenes, total	Mouse	0.03	Days 6-15 of gestation	Oral (gavage)	Reproduction	Not Applicable	2.06	2.31	2.58	Sample et al. 1996 [18]
Semi-Volatile Organics:										
1,2,4,5-Tetrachlorobenzene	---	---	---	---	---	---	NA	NA	NA	---
1,2,4-Trichlorobenzene	Rat	0.35	3 generations	Oral in water	Reproduction	Not Applicable	53	80	106	Coulston and Kolbye 1994
1,1-Biphenyl	---	---	---	---	---	---	NA	NA	NA	---
1,2-Dichlorobenzene	Rat	0.35	chronic	Oral (gavage)	Liver/kidney toxicity	Not Applicable	171 [5]	383	857	Coulston and Kolbye 1994
1,3-Dichlorobenzene	---	0.35	---	---	---	---	171 [6]	383 [6]	857 [6]	---
1,4-Dichlorobenzene	Rat	0.35	Days 6-15 of gestation	Oral (gavage)	Reproduction (fetal development)	Not Applicable	250	354.0	500	Coulston and Kolbye 1994
2,3,4,6-Tetrachlorophenol	---	---	---	---	---	---	NA	NA	NA	---
2,4,5-Trichlorophenol	Rat	0.35	98 days	Oral in diet	Liver/kidney toxicity	Not Applicable	160 [5]	358	800	McCollister et al. 1961
2,4,6-Trichlorophenol	---	---	---	---	---	---	160 [7]	358 [7]	800 [7]	---
2,4-Dichlorophenol	Rat	0.35	103 weeks	Oral in diet	Reproduction	Not Applicable	88 [5]	198	440	NTP 1989
2-Acetylaminofluorene	---	---	---	---	---	---	NA	NA	NA	---
2-Chloronaphthalene	---	---	---	---	---	---	NA	NA	NA	---
3,3'-Dichlorobenzidine	---	---	---	---	---	---	NA	NA	NA	---
3,3-Dimethylbenzidine	---	---	---	---	---	---	NA	NA	NA	---
3-Methylcholanthrene	---	---	---	---	---	---	NA	NA	NA	---
4-Bromophenyl phenyl ether	---	---	---	---	---	---	NA	NA	NA	---
4-Chloro-3-methylphenol	---	---	---	---	---	---	NA	NA	NA	---
4-Chlorophenyl phenyl ether	---	---	---	---	---	---	NA	NA	NA	---
7-12-Dimethylbenz(a)anthracene	---	---	---	---	---	---	NA	NA	NA	---
Aramite, total	---	---	---	---	---	---	NA	NA	NA	---
bis(2-Ethylhexyl) phthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	18.3	57.9	183.3	Sample et al. 1996 [18]
Butyl benzyl phthalate	Rat	0.35	2 years	Oral in diet	Liver toxicity	Not Applicable	480 [5]	1,073	2,400	NTP 1997
Diallate	---	---	---	---	---	---	NA	NA	NA	---
Dibenzofuran	---	---	---	---	---	---	NA	NA	NA	---
Diethyl phthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	4,583	10,248	22,915 [3]	Sample et al. 1996 [18]
Di-n-butyl phthalate	Mouse	0.03	105 days	Oral in diet	Reproduction (litter size and offspring mortality)	Not Applicable	550	1,004	1,833	Sample et al. 1996 [18]
Di-n-octyl phthalate	Mouse	0.03	105 days	Oral in diet	Reproduction	Not Applicable	55 [8]	174	550 [8]	Sample et al. 1996 [18]

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Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	NOAEL (mg/kg/d)	MATC [1] (mg/kg/d)	LOAEL (mg/kg/d)	Source Document [2]
Semi-Volatile Organics:										
Dinoseb	---	---	---	---	---	---	NA	NA	NA	---
Hexachlorobenzene	Rat	0.35	4 generations	Oral	Reproduction (decreased fertility)	Not Applicable	8	11.3	16	ATSDR 2002 [18]
Hexachlorobutadiene	Rat	0.35	90 days +	Oral	Reproduction	Not Applicable	4.0 [5]	8.9	20	IPCS 1994 [18]
Hexachlorocyclopentadiene	Rat	0.35	Days 6-15 of gestation	Oral	Reproduction	Not Applicable	10	17.3	30	USEPA 1984 [18]
Hexachloroethane	---	---	---	---	---	---	NA	NA	NA	---
Hexachlorophene	Rat	0.35	Not reported	Oral	Mortality	Not Applicable	5.6 [9]	13	28 [3]	USEPA 1999 [18]
Hexachloropropene	---	---	---	---	---	---	NA	NA	NA	---
Isosafrole	---	---	---	---	---	---	NA	NA	NA	---
N-Nitrosodiphenylamine	Rat	0.35	8 to 11 weeks	Oral in diet	Systemic toxicity	Not Applicable	300 [5]	671	1,500	ATSDR 1993 [18]
p-Dimethylamino azobenzene	---	---	---	---	---	---	NA	NA	NA	---
Pentachlorobenzene	Rat	0.35	180 days	Oral	Not reported	Not Applicable	7.25	16.21	36.25 [3]	USEPA 1999 [18]
Pentachloronitrobenzene	---	---	---	---	---	---	NA	NA	NA	---
Pentachlorophenol	Various	Various	Various	Oral in diet or gavage	Reproduction/growth	Pentachlorophenol (purified, technical, or purity not specified)	8.42 [10]	13.81	22.65 [11]	USEPA 2007a
Pronamide	---	---	---	---	---	---	NA	NA	NA	---
PAHs:										
2-Methylnaphthalene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Acenaphthene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Acenaphthylene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Anthracene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Benzo(a)anthracene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Benzo(a)pyrene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Benzo(b)fluoranthene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Benzo(g,h,i)perylene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Benzo(k)fluoranthene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Chrysene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Dibenz(a,h)anthracene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Fluoranthene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Fluorene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Indeno(1,2,3-cd)pyrene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Naphthalene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Phenanthrene	Norway rat	0.247	6 weeks	Oral in diet	Growth (body weight)	1-Naphthaleneacetic acid	65.6 [12]	147	328	USEPA 2007b [18]
Pyrene	House mouse	0.038	65 weeks	Oral in diet	Mortality	Benzo(a)pyrene	0.615 [12]	1.36	3.01	USEPA 2007b [18]
Metals:										
Antimony	Norway rat	0.33	31 days	Oral in water	Reproduction (progeny weight)	Antimony trichloride	0.059 [12]	0.19	0.59	USEPA 2005a [18]
Arsenic	Dog	10.1	8 weeks	Oral in diet	Growth (body weight)	Sodium arsenite	1.04 [12]	1.31	1.66	USEPA 2005b [18]

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Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	NOAEL (mg/kg/d)	MATC [1] (mg/kg/d)	LOAEL (mg/kg/d)	Source Document [2]
Metals:										
Barium	House mouse/Norway rat	Various	Various	Oral in diet/water or gavage	Reproduction/Growth	Barium acetate, barium chloride, and barium chloride dihydrate	51.8 [10]	65.5	82.7 [11]	USEPA 2005c
Beryllium	Norway rat	0.486	4 years	Oral in diet	Mortality (life span)	Beryllium sulfate	0.532 [13]	0.549	0.567 [14]	USEPA 2005d [18]
Cadmium	Norway rat	0.43	57 days	Oral in water	Growth (body weight)	Cadmium acetate	0.77 [12]	2.43	7.7	USEPA 2005e [18]
Chromium, total	Various	Various	Various	Oral in diet/water	Reproduction/growth	Various	2.4 [15][16]	11.85	58.53 [11]	USEPA 2005f
Cobalt	Various	Various	Various	Oral in diet/water or gavage	Reproduction/growth	Various	7.33 [10]	11.77	18.9 [11]	USEPA 2005g
Copper	Pig	100	4 weeks	Oral in diet	Growth (body weight)	Copper sulfate pentahydrate	5.6 [12]	7.23	9.34	USEPA 2007c [18]
Lead	Noway rat	0.3	7 weeks	Oral in water	Growth (body weight)	Lead acetate	4.7 [12]	6.47	8.90	USEPA 2005h [18]
Mercury	Rat	0.35	3 generations	Oral in diet	Reproduction (pup viability)	Methyl mercury chloride	0.032	0.072	0.16	Sample et al. 1996 [18]
Nickel	House mouse	0.025	35 days	Oral	Reproduction (sperm cell counts)	Nickelous chloride	1.7 [12]	2.40	3.40	USEPA 2007d [18]
Selenium	Pig	17.800	37 days	Oral in diet	Growth (body weight)	Sodium selenite	0.143 [12]	0.175	0.215	USEPA 2007e [18]
Silver	Pig	8.86	40 days	Oral in diet	Growth (body weight)	Silver acetate	6.02 [17]	19.04	60.2	USEPA 2006 [18]
Thallium	Rat	0.365	60 days	Oral in water	Reproduction (male testicular function)	Tallium sufate	0.0074	0.023	0.074	Sample et al. 1996 [18]
Tin	Mouse	0.03	Days 6-15 of gestation	Oral (intubation)	Reproduction (fetal weight and survival)	bis(Tributyltin) oxide	23.4	28.6	35.0	Sample et al. 1996 [18]
Vanadium	House mouse	0.0471	12 days	Oral (gavage)	Reproduction (offspring development)	Sodium orthovanadate	4.16 [12]	5.88	8.31	USEPA 2005i [18]
Zinc	Various	Various	Various	Oral in diet or gavage	Reproduction/growth	Various	75.4 [10]	26.96	82.3 [11]	USEPA 2007f

Notes:

PAH = Polynuclear Aromatic Hydrocarbon
ATSDR = Agency for Toxic Substances and Disease Registry
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
USEPA = United States Environmental Protection Agency

mg/kg/d = milligram per kilogram-body weight per day
IPCS = International Programme on Chemical Safety
NTP = National Toxicology Program
NA = Not Available
kg = kilogram

[1] MATC values were derived by calculating the geometric mean of the NOAEL and LOAEL values (values were calculated by Baker Environmental, Inc.).
[2] Source documents for NOAEL and LOAEL values represent primary data sources (as reported by original authors) unless otherwise noted.
[3] A chronic LOAEL value was not available from the study used as the source of the chronic NOAEL value. Therefore, a chronic LOAEL value was estimated by applying a safety factor of 5 to the chronic NOAEL value (Wentsel et al., 1996).
[4] A chronic NOAEL value was not available from the study used as the source of the chronic LOAEL value. Therefore, the chronic NOAEL value shown was estimated by applying a safety factor of 10 to the subchronic NOAEL value (Wentsel et al., 1996).
[5] A chronic NOAEL value was not available from the study used as the source of the chronic LOAEL value. Therefore, the chronic NOAEL value shown was estimated by applying a safety factor of 5 to the chronic LOAEL value (Wentsel et al., 1996).
[6] Value for 1,2-dichlorobenzene used as a surrogate.
[7] Value for 2,4,5-trichlorophenol used as a surrogate
[8] Value for di-n-hexylphthalate reported in Sample et al. (1996) used as a surrogate (value based on a 105-day reproductive study using mice).

TABLE 7-7
TOXICITY REFERENCE VALUES FOR MAMMALS
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Notes (continued):

(9) The chronic NOAEL value was estimated by applying a safety factor of 100 to a LD_{50} value (Wentsel et al., 1996 and USEPA, 1997).

(10) The NOAEL value represents the geometric mean of all reproduction and growth-based NOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score. Because this value is lower than the lowest bounded LOAEL for reproduction, growth, or survival, it was selected by the USEPA as the toxicity reference value for avian ecological soil screening level development.

(11) The NOAEL value selected by the USEPA as the ecological soil screening level represents a geometric mean of all reproduction and growth-based NOAEL values that meet the minimum required data evaluation score. Therefore, the LOAEL value shown represents a geometric mean of all reproduction and growth-based LOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score (value was calculated by Baker Environmental, Inc.).

(12) The NOAEL value shown represents the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, or survival listed within the cited ecological soil screening levels that meet the minimum required data evaluation score. The value was was used by the USEPA as the toxicity reference value for avian ecological soil screening value development. It is noted that a geometric mean of available NOAEL values for growth and reproduction was not used as the toxicity reference value by the USEPA for ecological soil screening value development since the geometric mean is higher than the lowest bounded LOAEL for reproduction, growth, and survival.

(13) The NOAEL value represents the lowest value of all reproduction, growth, and survival-based NOAEL values listed in the cited ecological soil screening levels document that meet the required data evaluation score. The value was used by the USEPA to derive the avian ecological soil screening level. It is noted that a geometric mean of NOAEL values for growth and reproduction could not be calculated by the USEPA because insufficient NOAEL values meeting the minimum required data evaluation score were identified from the literature.

(14) A LOAEL value was not available from the study chosen by the USEPA as the source of the NOAEL value selected as the ecological soil screening level. Therefore, the LOAEL value represents a geometric mean of all reproduction- and growth-based LOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score (value was calculated by Baker Environmental, Inc.).

(15) The NOAEL value represents the geometric mean of all reproduction and growth-based NOAEL values listed within the cited ecological soil screening level document that meet the minimum required data evaluation score. It is noted that there were no bounded LOAEL values for reproduction, growth, or mortality for comparison.

(16) The NOAEL value shown is for trivalent chromium.

(17) The NOAEL is equal to the lowest value of all reproduction- and growth-based LOAELs listed in the cited ecological soil screening levels document that meet the minimum required data evaluation score divided by ten. The value was used by the USEPA to derive the avian ecological soil screening level. It is noted that a geometric mean of NOAEL values for growth and reproduction could not be calculated by the USEPA based on the lack of NOAEL values for reproduction and growth.

(18) The data reference represents a secondary data source.

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TABLE 7-7
TOXICITY REFERENCE VALUES FOR MAMMALS
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TABLE 7-8
SOIL TO PLANT AND SOIL TO EARTHWORM BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN TERRESTRIAL PLANT AND INVERTEBRATE TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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	Soil-Plant BAF (dry weight) or Uptake Equation (dry weight)			Soil-Invertebrate BAF (dry weight) or Uptake Equation (dry weight)		
Chemical	**BAF Value/Uptake Equation**	**Source Document**	**Description**	**BAF Value/Uptake Equation**	**Source Document**	**Description**
Volatile Organics:						
1,1,1,2-Tetrachloroethane	5.176	USEPA 2007	Regression-based BAF (1)	3.151	USEPA 2007	Modeled BAF (10)
Carbon tetrachloride	4.715	USEPA 2007	Regression-based BAF (1)	3.070	USEPA 2007	Modeled BAF (10)
Chlorobenzene	4.175	USEPA 2007	Regression-based BAF (1)	2.968	USEPA 2007	Modeled BAF (10)
Chloroform	10.047	USEPA 2007	Regression-based BAF (1)	3.790	USEPA 2007	Modeled BAF (10)
Ethylbenzene	3.214	USEPA 2007	Regression-based BAF (1)	2.759	USEPA 2007	Modeled BAF (10)
Pentachloroethane	3.464	USEPA 2007	Regression-based BAF (1)	2.818	USEPA 2007	Modeled BAF (10)
Styrene	3.875	USEPA 2007	Regression-based BAF (1)	2.907	USEPA 2007	Modeled BAF (10)
Toluene	4.627	USEPA 2007	Regression-based BAF (1)	3.054	USEPA 2007	Modeled BAF (10)
Trichloroethene	4.803	USEPA 2007	Regression-based BAF (1)	3.086	USEPA 2007	Modeled BAF (10)
Xylene, total	3.245	USEPA 2007	Regression-based BAF (1)	2.766	USEPA 2007	Modeled BAF (10)
Semi-Volatile Organics:						
1,1-Biphenyl	1.467	USEPA 2007	Regression-based BAF (1)	2.218	USEPA 2007	Modeled BAF (10)
1,2,4,5-Tetrachlorobenzene	0.792	USEPA 2007	Regression-based BAF (1)	1.868	USEPA 2007	Modeled BAF (10)
1,2,4-Trichlorobenzene	1.426	USEPA 2007	Regression-based BAF (1)	2.200	USEPA 2007	Modeled BAF (10)
1,2-Dichlorobenzene	2.452	USEPA 2007	Regression-based BAF (1)	2.559	USEPA 2007	Modeled BAF (10)
1,3-Dichlorobenzene	2.092	USEPA 2007	Regression-based BAF (1)	2.448	USEPA 2007	Modeled BAF (10)
1,4,-Dichlorobenzene	2.475	USEPA 2007	Regression-based BAF (1)	2.565	USEPA 2007	Modeled BAF (10)
2,3,4,6-Tetrachlorophenol	0.945	USEPA 2007	Regression-based BAF (1)	1.962	USEPA 2007	Modeled BAF (10)
2,4,5-Trichlorophenol	1.870	USEPA 2007	Regression-based BAF (1)	2.373	USEPA 2007	Modeled BAF (10)
2,4,6-Trichlorophenol	1.905	USEPA 2007	Regression-based BAF (1)	2.385	USEPA 2007	Modeled BAF (10)
2,4-Dichlorophenol	3.400	USEPA 2007	Regression-based BAF (1)	2.803	USEPA 2007	Modeled BAF (10)
2-Acetylaminofluorene	3.275	USEPA 2007	Regression-based BAF (1)	2.774	USEPA 2007	Modeled BAF (10)
2-Chloronaphthalene	2.569	USEPA 2007	Regression-based BAF (1)	2.592	USEPA 2007	Modeled BAF (10)
3,3'-Dichlorobenzidine	2.275	USEPA 2007	Regression-based BAF (1)	2.506	USEPA 2007	Modeled BAF (10)
3,3'-Dimethylbenzidine	4.940	USEPA 2007	Regression-based BAF (1)	3.110	USEPA 2007	Modeled BAF (10)
3-Methylcholanthrene	0.150	USEPA 2007	Regression-based BAF (1)	1.175	USEPA 2007	Modeled BAF (10)
4-Bromophenyl phenyl ether	0.566	USEPA 2007	Regression-based BAF (1)	1.701	USEPA 2007	Modeled BAF (10)
4-Chloro-3-methylphenol	3.337	USEPA 2007	Regression-based BAF (1)	2.788	USEPA 2007	Modeled BAF (10)
4-Chlorophenyl phenyl ether	0.593	USEPA 2007	Regression-based BAF (1)	1.723	USEPA 2007	Modeled BAF (10)
7,12-Dimethylbenz(a)anthracene	0.125	USEPA 2007	Regression-based BAF (1)	1.116	USEPA 2007	Modeled BAF (10)
Aramite, total	0.669	USEPA 2007	Regression-based BAF (1)	1.782	USEPA 2007	Modeled BAF (10)
Bis(2-ethylhexyl)phthalate	0.066	USEPA 2007	Regression-based BAF (1)	0.935	USEPA 2007	Modeled BAF (10)
Butyl benzyl phthalate	0.657	USEPA 2007	Regression-based BAF (1)	1.773	USEPA 2007	Modeled BAF (10)

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SOIL TO PLANT AND SOIL TO EARTHWORM BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN TERRESTRIAL PLANT AND INVERTEBRATE TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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	Soil-Plant BAF (dry weight) or Uptake Equation (dry weight)			Soil-Invertebrate BAF (dry weight) or Uptake Equation (dry weight)		
Chemical	**BAF Value/Uptake Equation**	**Source Document**	**Description**	**BAF Value/Uptake Equation**	**Source Document**	**Description**
Semi-Volatile Organics:						
Diallate	0.911	USEPA 2007	Regression-based BAF (1)	1.942	USEPA 2007	Modeled BAF (10)
Dibenzofuran	1.194	USEPA 2007	Regression-based BAF (1)	2.094	USEPA 2007	Modeled BAF (10)
Diethyl phthalate	5.845	USEPA 2007	Regression-based BAF (1)	3.259	USEPA 2007	Modeled BAF (10)
Di-n-butyl phthalate	0.814	USEPA 2007	Regression-based BAF (1)	1.882	USEPA 2007	Modeled BAF (10)
Di-n-octyl phthalate	0.032	USEPA 2007	Regression-based BAF (1)	0.767	USEPA 2007	Modeled BAF (10)
Dinoseb	1.923	USEPA 2007	Regression-based BAF (1)	2.391	USEPA 2007	Modeled BAF (10)
Hexachlorobenzene	0.246	USEPA 2007	Regression-based BAF (1)	1.349	USEPA 2007	Modeled BAF (10)
Hexachlorobutadiene	0.675	USEPA 2007	Regression-based BAF (1)	1.787	USEPA 2007	Modeled BAF (10)
Hexachlorocyclopentadiene	0.393	USEPA 2007	Regression-based BAF (1)	1.536	USEPA 2007	Modeled BAF (10)
Hexachloroethane	1.439	USEPA 2007	Regression-based BAF (1)	2.206	USEPA 2007	Modeled BAF (10)
Hexachlorophene	0.053	USEPA 2007	Regression-based BAF (1)	0.878	USEPA 2007	Modeled BAF (10)
Hexachloropropene	1.009	USEPA 2007	Regression-based BAF (1)	1.998	USEPA 2007	Modeled BAF (10)
Isosafrole	2.593	USEPA 2007	Regression-based BAF (1)	2.599	USEPA 2007	Modeled BAF (10)
n-Nitrosodiphenylamine	3.155	USEPA 2007	Regression-based BAF (1)	2.745	USEPA 2007	Modeled BAF (10)
p-Dimethylamino azobenzene	0.837	USEPA 2007	Regression-based BAF (1)	1.897	USEPA 2007	Modeled BAF (10)
Pentachlorobenzene	0.444	USEPA 2007	Regression-based BAF (1)	1.589	USEPA 2007	Modeled BAF (10)
Pentachloronitrobenzene	0.792	USEPA 2007	Regression-based BAF (1)	1.868	USEPA 2007	Modeled BAF (10)
Pentachlorophenol	46.02	USEPA 2007	Maximum BAF (2)	88.12	USEPA 2007	90th percentile BAF (11)
Pronamide	2.275	USEPA 2007	Regression-based BAF (1)	2.506	USEPA 2007	Modeled BAF (10)
PAHs:						
2-Methylnaphthalene	1.580	USEPA 2007	Regression-based BAF (1)	2.264	USEPA 2007	Modeled BAF (10)
Acenaphthene	$\ln(C_p) = -0.8556[\ln[C_s]) - 5.562$	USEPA 2007	Uptake equation (3)	2.252	USEPA 2007	Modeled BAF (10)
Acenaphthylene	1.311	USEPA 2007	Regression-based BAF (1)	2.149	USEPA 2007	Modeled BAF (10)
Anthracene	$\ln(C_p) = 0.7784[\ln(C_s)] - 0.9887$	USEPA 2007	Uptake equation (3)	1.912	USEPA 2007	Modeled BAF (10)
Benzo(a)anthracene	$\ln(C_p) = 0.5944[\ln(C_s)] - 2.7078$	USEPA 2007	Uptake equation (3)	1.417	USEPA 2007	Modeled BAF (10)
Benzo(a)pyrene	$\ln(C_p) = 0.975[\ln(C_s)] - 2.0615$	USEPA 2007	Uptake equation (3)	1.274	USEPA 2007	Modeled BAF (10)
Benzo(b)fluoranthene	0.48	USEPA 2007	Maximum BAF (4)	1.245	USEPA 2007	Modeled BAF (10)
Benzo(g,h,i)perylene	$\ln(C_p) = 1.1829[\ln(C_s)] - 0.9313$	USEPA 2007	Uptake equation (3)	1.093	USEPA 2007	Modeled BAF (10)
Benzo(k)fluoranthene	$\ln(C_p) = 0.8595[\ln(C_s)] - 2.1579$	USEPA 2007	Uptake equation (3)	1.245	USEPA 2007	Modeled BAF (10)
Chrysene	$\ln(C_p) = 0.5944[\ln(C_s)] - 2.7078$	USEPA 2007	Uptake equation (3)	1.417	USEPA 2007	Modeled BAF (10)
Dibenzo(a,h)anthracene	0.23	USEPA 2007	Maximum BAF (4)	1.096	USEPA 2007	Modeled BAF (10)
Fluoranthene	6.0	USEPA 2007	Maximum BAF (4)	1.648	USEPA 2007	Modeled BAF (10)
Fluorene	$\ln(C_p) = -0.8556[\ln[C_s]) - 5.562$	USEPA 2007	Uptake equation (3)	2.089	USEPA 2007	Modeled BAF (10)

TABLE 7-8
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Chemical	Soil-Plant BAF (dry weight) or Uptake Equation (dry weight)			Soil-Invertebrate BAF (dry weight) or Uptake Equation (dry weight)		
	BAF Value/Uptake Equation	Source Document	Description	BAF Value/Uptake Equation	Source Document	Description
PAHs:						
Indeno(1,2,3-cd)pyrene	0.15	USEPA 2007	Maximum BAF (4)	1.107	USEPA 2007	Modeled BAF (10)
Naphthalene	48	USEPA 2007	Maximum BAF (4)	2.606	USEPA 2007	Modeled BAF (10)
Phenanthrene	$\ln(C_p) = 0.6203[\ln(C_s)] - 0.1665$	USEPA 2007	Uptake equation (3)	1.912	USEPA 2007	Modeled BAF (10)
Pyrene	3.7	USEPA 2007	Maximum BAF (4)	1.653	USEPA 2007	Modeled BAF (10)
Metals:						
Antimony	$\ln(C_p) = 0.938[\ln(C_s)] - 3.233$	USEPA 2007	Uptake equation (5)	1.00	USEPA 2007	Assumed BAF
Arsenic	$\ln(C_p) = 0.564[\ln[C_s]) - 1.992$	Bechtel Jacobs 1998	Uptake equation (6)	$\ln(C_e) = 0.706[\ln(C_s)] - 1.421$	USEPA 2007	Uptake equation (12)
Barium	0.447	Bechtel Jacobs 1998	90th percentile BAF (7)	0.16	Sample et al. 1998	90th percentile BAF (13)
Beryllium	$\ln(C_p) = 0.7345[\ln[C_s]) - 0.5361$	USEPA 2007	Uptake equation (8)	1.182	Sample et al. 1998	90th percentile BAF (13)
Cadmium	$\ln(C_p) = 0.546[\ln(C_s)] - 0.475$	USEPA 2007	Uptake equation (9)	$\ln(C_e) = 0.795[\ln(C_s)] + 2.114$	USEPA 2007	Uptake equation (12)
Chromium, total	0.0839	Bechtel Jacobs 1998	90th percentile BAF (7)	3.162	Sample et al. 1998	90th percentile BAF (14)
Cobalt	0.0248	Bechtel Jacobs 1998	90th percentile BAF (7)	0.291	Sample et al. 1998	90th percentileBAF (13)
Copper	$\ln(C_p) = 0.394[\ln(C_s)] + 0.668$	USEPA 2007	Uptake equation (9)	$\ln(C_e) = 0.264[\ln(C_s)] + 1.675$	Sample et al. 1998	Uptake equation (15)
Lead	$\ln(C_p) = 0.561[\ln(C_s)] - 1.328$	USEPA 2007	Uptake equation (9)	$\ln(C_e) = 0.807[\ln(C_s)] - 2.18$	USEPA 2007	Uptake equation (12)
Mercury	$\ln(C_p) = 0.544[\ln[C_s]) - 0.996$	Bechtel Jacobs 1998	Uptake equation (6)	20.63	Sample et al. 1998	90th percentile BAF (14)
Nickel	$\ln(C_p) = 0.748[\ln(C_s)] - 2.224$	USEPA 2007	Uptake equation (9)	4.73	Sample et al. 1998	90th percentile BAF (16)
Selenium	$\ln(C_p) = 0.1.104[\ln(C_s)] - 0.678$	USEPA 2007	Uptake equation (9)	$\ln(C_e) = 0.733[\ln(C_s)] - 0.075$	USEPA 2007	Uptake equation (12)
Silver	0.0367	Bechtel Jacobs 1998	90th percentile BAF (7)	15.338	Sample et al. 1998	90th percentile BAF (13)
Thallium	0.004	Baes et al. 1984	Geometric mean BAF	1.00	---	Assumed BAF
Tin	0.03	Baes et al. 1984	Geometric mean BAF	1.00	---	Assumed BAF
Vanadium	0.0097	Bechtel Jacobs 1998	90th percentile BAF (7)	0.088	Sample et al. 1998	90th percentile BAF (13)
Zinc	$\ln(C_p) = 0.555[\ln(C_s)] + 1.575$	USEPA 2007	Uptake equation (9)	$\ln(C_e) = 0.328[\ln(C_s)] + 4.449$	USEPA 2007	Uptake equation (12)

Notes:

USEPA = United States Environmental Protection Agency
BAF = Bioaccumulation Factor (unitless)
PAH = Polynuclear Aromatic Hydrocarbon
ln = natural logarithm
C_e = Concentration in earthworm tissue (mg/kg - dry weight)
C_p = Concentration in plant tissue (mg/kg - dry weight)
C_s = Maximum concentration in soil (mg/kg - dry weight)

(1) BAF value was estimated using an inter-chemical regression equation for non-ionic organics based on rinsed plant foliage BAF data: $\log BAF = -0.4057(\log K_{ow}) + 1.781$, where BAF is the bioaccumulation factor and K_{ow} is the octanol-water partition coefficient (see Figure 5, Panel B in USEPA, 2007). The K_{ow} value used in the estimation of the BAF value is listed in Table 7-3.

(2) Maximum BAF value listed in Appendix F, Table F-1 of USEPA (2007).

TABLE 7-8
SOIL TO PLANT AND SOIL TO EARTHWORM BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN TERRESTRIAL PLANT AND INVERTEBRATE TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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Notes Continued:

(3) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) based on rinsed plant foliage BAF data (see Appendix C in USEPA, 2007).

(4) Maximum BAF value for rinsed plant foliage data listed in Appendix C of USEPA (2007).

(5) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation; see Table 4a of USEPA[2007]) derived from measured BAF data (see Appendix A, Table A-1 of USEPA, 2007).

(6) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) listed in Table 7 of Bechtel Jacobs (1998).

(7) 90th percentile BAF value listed in Appendix D, Table D-1 of Bechtel Jacobs (1998).

(8) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation; see Table 4a of USEPA, 2007) derived from measured BAF data (see Appendix A, Table A-2 of USEPA, 2007).

(9) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) developed by Bechtel Jacobs (1998) and cited in Table 4a of USEPA (2007).

(10) BAF value was estimated using the relationship BAF = K_{ww}/K_d where K_{ww} is the biota to soil pore water partition coefficient (L soil pore water/kg ww tissue; converted to L soil pore water/kg dw tissue by assuming 16 percent solids [USEPA, 1993] and dividing by 0.16) and K_d is the soil to pore water partition coefficient (L soil pore water/kg dw soil) (relationship developed by Jager, 1998 and cited in USEPA, 2007). Chemical-specific values for K_{ww} and K_d were derived using the following relationships:

$\log(K_{ww}) = 0.87(\log K_{ow}) - 2.0$ where K_{ow} is the octanol-water partition coefficient (K_{ow} value listed in Table 7-3)

$K_d = (f_{oc})(K_{oc})$ where f_{oc} is the fraction of organic carbon in soil (assumed to be 0.01 [one percent]) and K_{oc} is the organic carbon partition coefficient (K_{oc} value listed in Table 7-3)

(11) 90th percentile BAF calculated from individual BAF values listed in Appendix F-2 of USEPA (2007).

(12) The concentration in earthworm tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) developed by Sample et al. (1998 and 1999) and cited in Table 4a of USEPA (2007).

(13) 90th percentile BAF listed in Appendix C, Table C.1 of Sample et al. (1998).

(14) 90th percentile BAF value listed in Table 11 of Sample et al. (1998).

(15) The concentration in earthworm tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) listed in Table 12 of Sample et al. (1998).

Table References:

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USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

TABLE 7-9
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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Chemical	Soil-Small Mammal BAF (dry weight) or Uptake Equation (dry weight)		
	BAF Value/Uptake Equation	Source Document	Description
Volatile Organics:			
1,1,1,2-Tetrachloroethane	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Carbon tetrachloride	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Chlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Chloroform	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Ethylbenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Pentachloroethane	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Styrene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Toluene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Trichloroethene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Xylenes, total	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Semi-Volatile Organics:			
1,2,4,5-Tetrachlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
1,2,4-Trichlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
1,2-Dichlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
1,3-Dichlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
1,4,-Dichlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
2,3,4,6-Tetrachlorophenol	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
2,4,5-Trichlorophenol	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
2,4,6-Trichlorophenol	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
2,4-Dichlorophenol	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
2-Acetylaminofluorene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
2-Chloronaphthalene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
3,3'-Dichlorobenzidine	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
3,3'-Dimethylbenzidine	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
3-Methylcholanthrene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)

TABLE 7-9
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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Chemical	Soil-Small Mammal BAF (dry weight)		
	BAF Value/Uptake Equation	Source Document	Description
Semi-Volatile Organics:			
4-Bromophenyl phenyl ether	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
4-Chloro-3-methylphenol	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
4-Chlorophenyl phenyl ether	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
7,12-Dimethylbenz(a)anthracene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Aramite, total	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Bis(2-ethylhexyl)phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Butyl benzyl phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Diallate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Dibenzofuran	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Diethyl phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Di-n-butyl phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Di-n-octyl phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Dinoseb	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Hexachlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Hexachlorobutadiene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Hexachlorocyclopentadiene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Hexachloroethane	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Hexachlorophene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Hexachloropropene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Isosafrole	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
n-Nitrosodiphenylamine	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
p-Dimethylamino azobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Pentachlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Pentachloronitrobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
Pentachlorophenol	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)

TABLE 7-9
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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Chemical	Soil-Small Mammal BAF (dry weight)		
	BAF Value/Uptake Equation	**Source Document**	**Description**
Semi-Volatile Organics:			
Pronamide	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 (1)
PAHs:			
2-Methylnaphthalene	0.000	---	BAF value for other PAH compounds used as a surrogate
Acenaphthene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Acenaphthylene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Anthracene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Benzo(a)anthracene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Benzo(a)pyrene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Benzo(b)fluoranthene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Benzo(g,h,i)perylene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Benzo(k)fluoranthene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Chrysene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Dibenzo(a,h)anthracene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Fluoranthene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Fluorene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Indeno(1,2,3-cd)pyrene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Naphthalene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Phenanthrene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Pyrene	0.000	USEPA 2007	Bioaccumulation is assumed to be negligible
Metals:			
Antimony	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1
Arsenic	$\ln(C_m) = 0.8188[\ln(C_s)] - 4.8471$	USEPA 2007	Regression-based uptake equation for all small mammals (2)
Barium	0.1121	Sample et al. 1998	90th percentile BAF for all small mammals (3)
Beryllium	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1
Cadmium	$\ln(C_m) = 0.4865[\mathrm{In}(C_s)] - 0.4306$	Sample et al. 1998	Regression-based uptake equation for all small mammals (4)
Chromium, total	$\ln(C_m) = 0.7338[\ln(C_s)] - 1.4599$	USEPA 2007	Regression-based uptake equation for all small mammals (2)
Cobalt	$\ln(C_m) = 1.3070[\ln(C_s)] - 4.4669$	USEPA 2007	Regression-based uptake equation for all small mammals (2)
Copper	$\ln(C_m) = 0.1444[\ln(C_s)] + 0.2042$	USEPA 2007	Regression-based uptake equation for all small mammals (2)
Lead	$\ln(C_m) = 0.4422[\ln(C_s)] + 0.0761$	USEPA 2007	Regression-based uptake equation for all small mammals (2)

TABLE 7-9
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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Chemical	Soil-Small Mammal BAF (dry weight)		
	BAF Value/Uptake Equation	**Source Document**	**Description**
Semi-Volatile Organics:			
Mercury	0.192	Sample et al. 1998	90th percentile BAF for all small mammals [5]
Nickel	$\ln(C_m) = 0.4658[\ln(C_s)] - 0.2462$	USEPA 2007	Regression-based uptake equation for all small mammals [2]
Selenium	$\ln(C_m) = 0.3764[\ln(C_s)] - 0.4158$	USEPA 2007	Regression-based uptake equation for all small mammals [2]
Silver	0.5013	Sample et al. 1998	90th percentile BAF for all small mammals [3]
Thallium	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1
Tin	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1
Vanadium	0.0179	Sample et al. 1998	90th percentile BAF for all small mammals [3]
Zinc	$\ln(C_m) = 0.0738[\ln(C_s)] + 4.4713$	Sample et al. 1998	Regression-based uptake equation for all small mammals [4]

Notes:

USEPA = United States Environmental Protection Agency
PAH = Polynuclear Aromatic Hydrocarbon
BAF = Bioaccumulation Factor
C_m = Concentration in small mammal tissue (mg/kg - dry weight)
C_s = Maximum concentration in soil (mg/kg - dry weight)
BAF_d = diet-to-small mammal bioaccumulation factor (wet weight)
DI = Small mammal dietary intake (mg/kg-BW/day)

(1) Most chemical exposure for small mammals is via the diet. Therefore, it is assumed that the concentration of the chemical in the small mammal's tissues is equal to the chemical concentration in its diet multiplied by a diet to whole-body BAF (BAF_d - wet weight basis). In the absence of literature-based diet to whole-body BAF, a value of 1.0 was assumed. The resulting tissue concentration was converted to a dry weight basis using an estimated solids content for small mammals of 0.32 (USEPA, 1993). Additional explanation is provided in Section 7.5.2.2.1.

(2) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation for all small mammals (i.e., regression equation) developed by Sample et al. (1998) and cited in Table 4a of USEPA (2007).

(3) 90th percentile BAF value for all small mammals listed in Appendix C, Table C-1 of Sample et al. (1998).

TABLE 7-9
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
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Notes (continued):

(4) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation for all small mammals (i.e., regression equation) listed in Table 8 of Sample et al. (1998).

(5) 90th percentile BAF value for all small mammals listed in Table 7 of Sample et al. (1998).

Table References:

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter II. 1998. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-219.

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United States Environmental Protection Agency (USEPA). 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.2007.

TABLE 7-10
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 2 SCREENING LEVEL RISK CALCULATION
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Receptor	Habitat	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Water Ingestion Rate (L/day)		Area Use Factor
		Value	Reference	Value	Reference	Value	Reference	
Birds:								
American robin	Terrestrial	0.056 [1]	Dunning 2008	0.01503	Allometric equation from Nagy (2001) for insectivorous birds[6]: $[0.540((BW*1000)^{0.705})]/1000$	0.01361	Allometric equation from Calder and Braun (1983) for all birds[6]: $0.059(BW)^{0.67}$	1.00
Mourning dove	Terrestrial	0.115 [2]	Dunning 2008	0.01723	Allometric equation from Nagy (2001) for all birds[6]: $[0.638((BW*1000)^{0.685})]/1000$	0.01449	Allometric equation from Calder and Braun (1983) for all birds[6]: $0.059(BW)^{0.67}$	1.00
Red-tailed hawk	Terrestrial	0.923 [3]	Dunning 2008	0.09679	Allometric equation from Nagy (2001) for carnivorous birds[6]: $[0.849((BW*1000)^{0.663})]/1000$	0.06910	Allometric equation from Calder and Braun (1983) for all birds[6]: $0.059(BW)^{0.67}$	1.00
Mammals:								
Brown flower bat	Terrestrial	0.016 [4]	Gannon et al. 2005	0.00277	Allometric equation from Nagy (2001) for bats[7]: $[0.365((BW*1000)^{0.671})]/1000$	0.00299	Allometric equation from Calder and Braun (1983) for all mammals[7]: $0.099(BW)^{0.90}$	1.00
Norway rat (prey item for red-tailed hawk)	Terrestrial	0.200 [5]	Jackson 1992	0.04075	Allometric equation from Nagy (2001) for rodents[8]: $[0.332((BW*1000)^{0.774})]/1000$	0.05305	Allometric equation from Calder and Braun (1983) for all mammals[8]: $0.099(BW)^{0.90}$	1.00

Notes:

BW = Body Weight
kg = kilogram
L/day = liter per day
kg/day - dry = kilogram per day - dry weight basis
USEPA = United States Environmental Protection Agency

TABLE 7-10
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 2 SCREENING LEVEL RISK CALCULATION
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Notes (continued):

(1) Minimum body weight for males and females from the western United States (n = 255).
(2) Minimum mean body weight for females from Illinois (n = 95)
(3) Minimum mean body weight for males from the western United States (n = 26)
(4) Minimum body weight for males and females in Puerto Rico (n = 20)
(5) Minimum body weight within the range of reported values (sex and location not specified).
(6) Food and drinking water ingestion rates for avian receptors were calculated using maximum body weights: 0.123 kg for the mourning dove, 0.112 kg for the American robin, and 1.266 kg for the red-tailed hawk (Dunning, 2008).
(7) Food and drinking water ingestion rate for the brown flower bat were calculated using a maximum body weight of 0.0205 kg (Gannon et al., 2005).
(8) Food and drinking water ingestion rate for the Norway rat were calculated using the maximum body weight within the range of reported values: 0.500 kg (Jackson, 1992).

Table References:

Calder, W.A. and E.J. Braun. 1983. Scaling of Osmotic Regulation in Mammals and Birds. Am. J. Physiol. 244:R601-R606.

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TABLE 7-11
DIETARY COMPOSITION FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Receptor	Dietary Composition (percent)						Soil/Sediment Ingestion (percent)	
	Terrestrial Plants	Soil Invertebrates	Small Mammals	Aquatic Invertebrates	Fish	Reference	Value	Reference
Birds:								
American robin	0	89.5	0	0	0	Assumed [1]	10.5 [3]	Sample and Suter II 1994
Mourning dove	95.0	0	0	0	0	Tomlinson et al. 1994	5.0	Assumed
Red-tailed hawk	0	0	100	0	0	USEPA 1993; Sample and Suter II 1994	0	Sample and Suter II 1994
Mammals:								
Brown flower bat	100	0	0	0	0	Gannon et al. 2005	0 [4]	Assumed
Norway rat (prey item for red-tailed hawk)	0	98.0	0	0	0	Assumed [2]	2.0	Assumed

Notes:

USEPA = United States Environmental Protection Agency

[1] Although the American robin is omnivorous (USEPA, 1993, Sample et al., 1997, Wheelwright et al., 1986, and Martin et al., 1951), an exclusive diet of terrestrial invertebrates (i.e., earthworms) is assumed for the screening level risk calculation.

[2] Although the Norway rat is omnivorous (Jackson, 1992), an exclusive diet of terrestrial invertebrates (i.e., earthworms) is assumed for the screening level risk calculation.

[3] The percentage of soil in the diet of the American robin was estimated using the relationship presented in Sample and Sutter II (1994). An exclusive diet of earthworms extrapolates to a soil contribution of 10.5 percent to the total diet.

[4] Soil ingestion is considered negligible based on the arboreal feeding behavior of nectivorous bats.

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TABLE 7-11
DIETARY COMPOSITION FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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TABLE 7-12
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	0/25	ND	0.35U - 4.8UJ	0.504	4.8	100	CCME 2007	0.05	No	HQ < 1.0
1,1,1-Trichloroethane	0/25	ND	0.31U - 4.3UJ	0.452	4.3	100	CCME 2007	0.04	No	HQ < 1.0
1,1,2,2-Tetrachloroethane	0/25	ND	0.76U - 10UJ	1.080	10	100	CCME 2007	0.10	No	HQ < 1.0
1,1,2-Trichloroethane	0/25	ND	0.65U - 8.9UJ	0.943	8.9	100	CCME 2007	0.09	No	HQ < 1.0
1,1-Dichloroethane	0/25	ND	0.27U - 3.7UJ	0.391	3.7	100	CCME 2007	0.04	No	HQ < 1.0
1,1-Dichloroethene	0/25	ND	0.29U - 4UJ	0.421	4	100	CCME 2007	0.04	No	HQ < 1.0
1,2,3-Trichloropropane	0/25	ND	0.76U - 10UJ	1.080	10	NE	---	NA	Yes	No SSV
1,2-Dibromo-3-Chloropropane	0/25	ND	1.5U - 21UJ	2.200	21	NE	---	NA	Yes	No SSV
1,2-Dichloroethane	0/25	ND	0.54U - 7.4UJ	0.782	7.4	402	MHSPE 2000	0.02	No	HQ < 1.0
1,2-Dichloropropane	0/25	ND	0.6U - 8.2UJ	0.862	8.2	700,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2-Butanone (MEK)	0/25	ND	1.5U - 28U	4.708	28	NE	---	NA	Yes	No SSV
2-Chloro-1,3-butadiene	0/25	ND	0.31U - 4.2UJ	0.446	4.2	NE	---	NA	Yes	No SSV
2-Hexanone	0/25	ND	1.1U - 16UJ	1.648	16	NE	---	NA	Yes	No SSV
3-Chloro-1-propene	0/23	ND	0.81U - 11UJ	1.220	11	NE	---	NA	Yes	No SSV
4-Methyl-2-pentanone (MIBK)	1/25	7.7J - 7.7J	1.6U - 22UJ	2.522	7.7	NE	---	NA	Yes	No SSV
Acetone	16/23	9.1J - 260	5.8U - 33UJ	70.824	260	NE	---	NA	Yes	No SSV
Acetonitrile	0/16	ND	26U - 330UJ	42.313	330	NE	---	NA	Yes	No SSV
Acrolein	0/3	ND	14U - 25U	9.667	25	NE	---	NA	Yes	No SSV
Acrylonitrile	0/25	ND	12U - 170UJ	17.940	170	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Benzene	1/25	0.99J - 0.99J	0.43U - 5.9UJ	0.640	0.99	101	MHSPE 2000	<0.01	No	HQ < 1.0
Bromoform	0/25	ND	0.6U - 8.2UJ	0.862	8.2	NE	---	NA	Yes	No SSV
Bromomethane	0/25	ND	0.87UJ - 12UJ	1.249	12	NE	---	NA	Yes	No SSV
Carbon disulfide	0/25	ND	0.28U - 3.8UJ	0.399	3.8	NE	---	NA	Yes	No SSV
Carbon tetrachloride	0/25	ND	0.54U - 7.4UJ	0.782	7.4	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorobenzene	0/25	ND	0.4U - 5.4UJ	0.569	5.4	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorodibromomethane	0/25	ND	0.27U - 3.7UJ	0.391	3.7	NE	---	NA	Yes	No SSV
Chloroethane	0/25	ND	0.65U - 8.9UJ	0.943	8.9	NE	---	NA	Yes	No SSV
Chloroform	0/25	ND	0.27U - 3.7UJ	0.391	3.7	1,002	MHSPE 2000	<0.01	No	HQ < 1.0
Chloromethane	0/25	ND	0.39U - 5.3UJ	0.554	5.3	NE	---	NA	Yes	No SSV
cis-1,3-Dichloropropene	0/25	ND	0.47U - 6.5UJ	0.679	6.5	100	CCME 2007	0.07	No	HQ < 1.0
Dibromomethane	0/25	ND	0.65U - 8.9UJ	0.943	8.9	NE	---	NA	Yes	No SSV
Dichlorobromomethane	0/25	ND	0.45U - 6.2UJ	0.646	6.2	NE	---	NA	Yes	No SSV
Dichlorodifluoromethane	0/25	ND	0.48U - 6.6UJ	0.695	6.6	NE	---	NA	Yes	No SSV
Ethyl methacrylate	0/25	ND	1.2UJ - 16UJ	1.696	16	NE	---	NA	Yes	No SSV
Ethylbenzene	2/25	2.2J - 6.2J	0.41U - 3.1UJ	0.764	6.2	5,003	MHSPE 2000	<0.01	No	HQ < 1.0
Ethylene Dibromide	0/25	ND	0.81U - 11UJ	1.166	11	300	CCME 2007	0.04	No	HQ < 1.0
Iodomethane	0/25	ND	0.54U - 7.4UJ	0.782	7.4	NE	---	NA	Yes	No SSV
Methacrylonitrile	0/25	ND	13UJ - 180UJ	18.780	180	NE	---	NA	Yes	No SSV
Methyl methacrylate	0/25	ND	2UJ - 27UJ	2.880	27	NE	---	NA	Yes	No SSV
Methylene Chloride	0/25	ND	0.54U - 7.4UJ	0.782	7.4	1,040	MHSPE 2000	<0.01	No	HQ < 1.0
Pentachloroethane	0/25	ND	1.2U - 16UJ	1.708	16	NE	---	NA	Yes	No SSV
Propionitrile	0/16	ND	12U - 160UJ	19.906	160	NE	---	NA	Yes	No SSV
Styrene	0/25	ND	0.36U - 4.9UJ	0.513	4.9	10,030	MHSPE 2000	<0.01	No	HQ < 1.0
Tetrachloroethene	0/25	ND	0.4U - 5.4UJ	0.569	5.4	400	MHSPE 2000	0.01	No	HQ < 1.0
Toluene	3/25	0.53J - 3.3J	0.48U - 5.9UJ	0.750	3.3	13,001	MHSPE 2000	<0.01	No	HQ < 1.0
trans-1,2-Dichloroethene	0/25	ND	0.53U - 7.2UJ	0.755	7.2	100	CCME 2007	0.07	No	HQ < 1.0

TABLE 7-12
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Volatile Organic Compounds (ug/kg)										
trans-1,3-Dichloropropene	0/25	ND	0.47U - 6.5UJ	0.679	6.5	100	CCME 2007	0.07	No	HQ < 1.0
trans-1,4-Dichloro-2-butene	1/25	59J - 59J	1.7UJ - 23UJ	4.684	59	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Trichloroethene	0/25	ND	0.54U - 7.4UJ	0.782	7.4	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Trichlorofluoromethane	0/25	ND	0.81U - 11UJ	1.166	11	NE	---	NA	Yes	No SSV
Vinyl acetate	0/25	ND	0.81U - 11UJ	1.166	11	NE	---	NA	Yes	No SSV
Vinyl chloride	0/25	ND	0.31U - 4.3UJ	0.452	4.3	11.0	MHSPE 2000	0.39	No	HQ < 1.0
Xylenes, Total	5/25	4.9J - 28J	1.2U - 9.5UJ	3.658	28	2,510	MHSPE 2000	0.01	No	HQ < 1.0
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	0/25	ND	8.2U - 27UJ	5.406	27	NE	---	NA	Yes	No SSV
1,2,4,5-Tetrachlorobenzene	2/25	26J - 29J	7U - 23UJ	6.414	29	50	CCME 2007	0.58	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/25	ND	8.2U - 27UJ	5.406	27	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,2-Dichlorobenzene	0/25	ND	7.8U - 26UJ	5.136	26	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3,5-Trinitrobenzene	0/25	ND	19U - 62UJ	12.480	62	40,000	---	<0.01	No	HQ < 1.0
1,3-Dichlorobenzene	0/25	ND	6.6U - 22UJ	4.388	22	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/25	ND	4.3U - 14UJ	2.850	14	40,000	---	<0.01	No	HQ < 1.0
1,4-Dichlorobenzene	0/25	ND	6.9U - 23UJ	4.548	23	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,4-Dioxane	0/25	ND	8.9U - 29UJ	5.884	29	NE	---	NA	Yes	No SSV
1,4-Naphthoquinone	0/25	ND	4.3U - 14UJ	2.850	14	NE	---	NA	Yes	No SSV
2,2'-oxybis[1-chloropropane]	0/25	ND	7U - 23UJ	4.602	23	NE	---	NA	Yes	No SSV
2,3,4,6-Tetrachlorophenol	0/25	ND	4.7U - 15UJ	3.070	15	1,001	MHSPE 2000	0.01	No	HQ < 1.0
2,4,5-Trichlorophenol	0/25	ND	7.5U - 25UJ	4.964	25	4,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4,6-Trichlorophenol	0/25	ND	8.8U - 29UJ	5.784	29	10,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2,4-Dichlorophenol	0/25	ND	9U - 30UJ	5.918	30	1,001	MHSPE 2000	0.03	No	HQ < 1.0
2,4-Dimethylphenol	0/25	ND	19U - 62UJ	12.480	62	100	CCME 2007	0.62	No	HQ < 1.0
2,4-Dinitrophenol	0/25	ND	92UJ - 300UJ	60.920	300	20,000	Efroymson et al. 1997b	0.02	No	HQ < 1.0
2,4-Dinitrotoluene	0/25	ND	6.5UJ - 22UJ	4.332	22	NE	---	NA	Yes	No SSV
2,6-Dichlorophenol	0/25	ND	7.1U - 23UJ	4.680	23	1,001	MHSPE 2000	0.02	No	HQ < 1.0
2,6-Dinitrotoluene	0/25	ND	6.9U - 23UJ	4.548	23	NE	---	NA	Yes	No SSV
2-Acetylaminofluorene	0/25	ND	5.7U - 19UJ	3.750	19	NE	---	NA	Yes	No SSV
2-Chloronaphthalene	0/25	ND	6.9U - 23UJ	4.548	23	NE	---	NA	Yes	No SSV
2-Chlorophenol	0/25	ND	7.3U - 24UJ	4.826	24	1,001	MHSPE 2000	0.02	No	HQ < 1.0
2-Methylphenol	0/25	ND	9U - 30UJ	5.918	30	100	CCME 2007	0.30	No	HQ < 1.0
2-Naphthylamine	0/25	ND	22U - 73UJ	14.580	73	NE	---	NA	Yes	No SSV
2-Nitroaniline	0/25	ND	7.2U - 24UJ	4.754	24	NE	---	NA	Yes	No SSV
2-Nitrophenol	0/25	ND	8.1U - 27UJ	5.334	27	7,000	---	<0.01	No	HQ < 1.0
2-Picoline	0/25	ND	13U - 44UJ	8.760	44	NE	---	NA	Yes	No SSV
2-Toluidine	0/25	ND	10U - 34UJ	6.800	34	NE	---	NA	Yes	No SSV
3 & 4 Methylphenol	0/25	ND	8.1U - 27UJ	5.334	27	100	CCME 2007	0.27	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/25	ND	10U - 34UJ	6.740	34	NE	---	NA	Yes	No SSV
3,3'-Dimethylbenzidine	0/25	ND	200U - 660UJ	131.200	660	NE	---	NA	Yes	No SSV
3-Methylcholanthrene	0/25	ND	6.8U - 22UJ	4.468	22	NE	---	NA	Yes	No SSV
3-Nitroaniline	0/25	ND	5U - 16UJ	3.284	16	NE	---	NA	Yes	No SSV
4,6-Dinitro-2-methylphenol	0/25	ND	6.4UJ - 21UJ	4.234	21	NE	---	NA	Yes	No SSV
4-Aminobiphenyl	0/25	ND	14U - 48UJ	9.500	48	NE	---	NA	Yes	No SSV
4-Bromophenyl phenyl ether	0/25	ND	7.9U - 26UJ	5.198	26	NE	---	NA	Yes	No SSV
4-Chloro-3-methylphenol	0/25	ND	8.3U - 27UJ	5.480	27	NE	---	NA	Yes	No SSV

TABLE 7-12
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Semivolatile Organic Compounds (ug/kg)										
4-Chloroaniline	0/25	ND	6.6U - 22UJ	4.388	22	NE	---	NA	Yes	No SSV
4-Chlorophenyl phenyl ether	0/25	ND	6.9U - 23UJ	4.548	23	NE	---	NA	Yes	No SSV
4-Nitroaniline	0/25	ND	8.5UJ - 28UJ	5.636	28	NE	---	NA	Yes	No SSV
4-Nitrophenol	0/25	ND	37UJ - 120UJ	24.140	120	7,000	Efroymson et al. 1997a	0.02	No	HQ < 1.0
7,12-Dimethylbenz(a)anthracene	0/25	ND	10U - 34UJ	6.800	34	NE	---	NA	Yes	No SSV
Acetophenone	0/25	ND	9.5U - 31UJ	6.288	31	NE	---	NA	Yes	No SSV
alpha,alpha-Dimethyl phenethylamine	0/25	ND	65U - 220UJ	43.320	220	NE	---	NA	Yes	No SSV
Aniline	0/25	ND	7U - 23UJ	4.602	23	NE	---	NA	Yes	No SSV
Aramite, Total	0/25	ND	12U - 40UJ	8.100	40	NE	---	NA	Yes	No SSV
Benzyl alcohol	0/25	ND	8.9U - 29UJ	5.884	29	NE	---	NA	Yes	No SSV
Bis(2-chloroethoxy)methane	0/25	ND	7.5U - 25UJ	4.964	25	NE	---	NA	Yes	No SSV
Bis(2-chloroethyl)ether	0/25	ND	6.3U - 21UJ	4.178	21	NE	---	NA	Yes	No SSV
Bis(2-ethylhexyl) phthalate	9/25	9.4J - 1000J	18U - 80U	119.636	1,000	6,010	MHSPE 2000	0.17	No	HQ < 1.0
Butyl benzyl phthalate	11/25	16J - 300J	8U - 15UJ	42.224	300	6,010	MHSPE 2000	0.05	No	HQ < 1.0
Diallate	0/25	ND	11UJ - 35UJ	7.020	35	NE	---	NA	Yes	No SSV
Dibenzofuran	0/25	ND	4.7U - 15UJ	3.070	15	NE	---	NA	Yes	No SSV
Diethyl phthalate	0/25	ND	12U - 40UJ	8.100	40	100,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Dimethyl phthalate	0/25	ND	7.1U - 23UJ	4.680	23	200,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Di-n-butyl phthalate	0/25	ND	28U - 92UJ	18.300	92	200,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Di-n-octyl phthalate	1/25	26J - 26J	3.7U - 12UJ	3.376	26	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Dinoseb	0/25	ND	19U - 62UJ	12.480	62	NE	---	NA	Yes	No SSV
Ethyl methanesulfonate	0/25	ND	12U - 40UJ	8.100	40	NE	---	NA	Yes	No SSV
Hexachlorobenzene	0/25	ND	7.5U - 25UJ	4.964	25	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Hexachlorobutadiene	0/25	ND	10U - 33UJ	6.680	33	NE	---	NA	Yes	No SSV
Hexachlorocyclopentadiene	0/25	ND	16UJ - 51UJ	10.260	51	10,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Hexachloroethane	0/25	ND	8.2U - 27UJ	5.406	27	NE	---	NA	Yes	No SSV
Hexachlorophene	0/6	ND	970UJ - 1200UJ	537.500	1,200	NE	---	NA	Yes	No SSV
Hexachloropropene	0/25	ND	8UJ - 26UJ	5.258	26	NE	---	NA	Yes	No SSV
Isophorone	0/25	ND	6.9U - 23UJ	4.548	23	NE	---	NA	Yes	No SSV
Isosafrole	0/25	ND	7.9U - 26UJ	5.198	26	NE	---	NA	Yes	No SSV
Methapyrilene	0/25	ND	10UJ - 34UJ	6.800	34	NE	---	NA	Yes	No SSV
Methyl methanesulfonate	0/25	ND	10U - 34UJ	6.800	34	NE	---	NA	Yes	No SSV
Nitrobenzene	0/25	ND	7.6U - 25UJ	5.036	25	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitro-o-toluidine	0/25	ND	6.6U - 22UJ	4.388	22	NE	---	NA	Yes	No SSV
N-Nitrosodiethylamine	0/25	ND	13U - 44UJ	8.760	44	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodimethylamine	0/25	ND	11U - 36UJ	7.160	36	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-butylamine	0/25	ND	10UJ - 33UJ	6.680	33	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/25	ND	7.2U - 24UJ	4.754	24	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodiphenylamine	0/25	ND	7.9U - 26UJ	5.198	26	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitrosomethylethylamine	0/25	ND	6.3U - 21UJ	4.178	21	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosomorpholine	0/25	ND	7.3UJ - 24UJ	4.826	24	NE	---	NA	Yes	No SSV
N-Nitrosopiperidine	0/25	ND	9.4U - 31UJ	6.222	31	NE	---	NA	Yes	No SSV
N-Nitrosopyrrolidine	0/25	ND	9.9U - 33UJ	6.498	33	NE	---	NA	Yes	No SSV
p-Dimethylamino azobenzene	0/25	ND	7.9U - 26UJ	5.198	26	NE	---	NA	Yes	No SSV
Pentachlorobenzene	1/25	13J - 13J	6.9U - 23UJ	4.828	13	1,150	USEPA 1999	0.01	No	HQ < 1.0
Pentachloronitrobenzene	0/25	ND	6.5U - 22UJ	4.332	22	NE	---	NA	Yes	No SSV

TABLE 7-12
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Semivolatile Organic Compounds (ug/kg)										
Pentachlorophenol	0/25	ND	9.2U - 30UJ	6.092	30	5,000	USEPA 2007a	<0.01	No	HQ < 1.0
Phenacetin	0/25	ND	5.2U - 17UJ	3.440	17	NE	---	NA	Yes	No SSV
Phenol	0/25	ND	5.3U - 18UJ	3.526	18	30,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
p-Phenylene diamine	0/25	ND	180U - 590UJ	117.200	590	NE	---	NA	Yes	No SSV
Pronamide	0/25	ND	10U - 33UJ	6.620	33	NE	---	NA	Yes	No SSV
Pyridine	0/25	ND	12U - 40UJ	8.100	40	NE	---	NA	Yes	No SSV
Safrole, Total	0/25	ND	9.2U - 30UJ	6.092	30	NE	---	NA	Yes	No SSV
PAHs (ug/kg)										
Low Molecular Weight PAHs (3)	NA	NA	NA	NA	1,451.6	29,000	USEPA 2007b	0.05	No	HQ < 1.0
High Molecular Weight PAHs (4)	NA	NA	NA	NA	7,650	18,000	USEPA 2007b	0.43	No	HQ < 1.0
Metals (mg/kg)										
Antimony	1/25	2J - 2J	0.09UJ - 0.83UJ	0.207	2	78.0	USEPA 2005a	0.03	No	HQ < 1.0
Arsenic	25/25	1.4 - 5.4	ND	3.376	5.4	18.0	USEPA 2005b	0.30	No	HQ < 1.0
Barium	25/25	14 - 800	ND	77.840	800	330	USEPA 2005c	2.42	Yes	HQ > 1.0
Beryllium	25/25	0.037J - 0.35	ND	0.102	0.35	40.0	USEPA 2005d	<0.01	No	HQ < 1.0
Cadmium	24/25	0.051J - 36J	0.039UJ - 0.039UJ	3.238	36	32.0	USEPA 2005e	1.13	Yes	HQ > 1.0
Chromium	25/25	15J - 89J	ND	35.640	89	57.0	USEPA 2008	1.56	Yes	HQ > 1.0
Cobalt	25/25	5.7 - 18	ND	10.336	18	13.0	USEPA 2005f	1.38	Yes	HQ > 1.0
Copper	25/25	16 - 130J	ND	47.160	130	70.0	USEPA 2007c	1.86	Yes	HQ > 1.0
Lead	25/25	0.71 - 520	ND	57.502	520	120	USEPA 2005g	4.33	Yes	HQ > 1.0
Mercury	25/25	0.0066J - 0.16	ND	0.039	0.16	0.10	Efroymson et al. 1997a	1.60	Yes	HQ > 1.0
Nickel	25/25	4 - 34	ND	11.212	34	38.0	USEPA 2007d	0.89	No	HQ < 1.0
Selenium	21/25	0.13J - 1.8	0.13U - 0.18U	0.382	1.8	0.52	USEPA 2007e	3.46	Yes	HQ > 1.0
Silver	20/25	0.021J - 0.54	0.017U - 0.084U	0.086	0.54	560	USEPA 2006	<0.01	No	HQ < 1.0
Thallium	0/25	ND	0.12U - 0.42UJ	0.083	0.42	1.00	Efroymson et al. 1997b	0.42	No	HQ < 1.0
Tin	1/25	9J - 9J	4U - 14UJ	2.952	9	50.0	Efroymson et al. 1997b	0.18	No	HQ < 1.0
Vanadium	25/25	46J - 280	ND	116.360	280	20.0	USEPA 2005h	14.00	Yes	HQ > 1.0
Zinc	25/25	9 - 650	ND	77.440	650	120	USEPA 2007f	5.42	Yes	HQ > 1.0

Notes:

MHSPE = Ministry of Housing, Spatial Planning and Environment
CCME = Canadian Council of Ministries of the Environment
USEPA = United States Environmental Protection Agency
COPC = Chemical of Potential Concern
SSV = Soil Screening Value
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
HQ = Hazard Quotient
PAH = Polynuclear Aromatic Hydrocarbon
U = Not Detected
UJ = Not detected, estimated value
J = Estimated Value
NA = Not Available
ND = Not Detected

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(2) See Table 7-4 for reference citations.

(3) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum method detection limit for non-detected chemicals) divided by the screening value.

(4) Low molecular weight PAHs are defined by the USEPA (2007b) as PAH compounds composed of fewer than four rings. The low molecular weight PAH compounds analyzed for in SWMU 69 soil were 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene. Value was calculated by summing maximum detected concentration in site soil for each chemical. Maximum method detection limit was used if there were no detections.

(5) High molecular weight PAHs are defined by the USEPA (2007b) as PAH compounds composed of four or more rings. The high molecular weight PAH compounds analyzed for in SWMU 69 soil were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene. Value was calculated by summing maximum detected concentration in site soil for each chemical. Maximum method detection limits were used for non-detected PAHs.

TABLE 7-13
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [2]	Ecological COPC?	Comments
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	0/5	ND	0.65U - 0.71U	0.344	0.71	100	CCME 2007	<0.01	No	HQ < 1.0
1,1,1-Trichloroethane	0/5	ND	0.59U - 0.65U	0.311	0.65	100	CCME 2007	<0.01	No	HQ < 1.0
1,1,2,2-Tetrachloroethane	0/5	ND	1.4U - 1.6U	0.750	1.6	100	CCME 2007	0.02	No	HQ < 1.0
1,1,2-Trichloroethane	0/5	ND	1.2U - 1.3U	0.640	1.3	100	CCME 2007	0.01	No	HQ < 1.0
1,1-Dichloroethane	0/5	ND	0.51U - 0.56U	0.269	0.56	100	CCME 2007	<0.01	No	HQ < 1.0
1,1-Dichloroethene	0/5	ND	0.55U - 0.6U	0.290	0.6	100	CCME 2007	<0.01	No	HQ < 1.0
1,2,3-Trichloropropane	0/5	ND	1.4U - 1.6U	0.750	1.6	NE	---	NA	Yes	No SSV
1,2-Dibromo-3-Chloropropane	0/5	ND	2.8U - 3.1U	1.490	3.1	NE	---	NA	Yes	No SSV
1,2-Dichloroethane	0/5	ND	1U - 1.1UJ	0.540	1.1	402	MHSPE 2000	<0.01	No	HQ < 1.0
1,2-Dichloropropane	0/5	ND	1.1U - 1.2U	0.590	1.2	700,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2-Butanone (MEK)	0/5	ND	2.7U - 4.5UJ	1.600	4.5	NE	---	NA	Yes	No SSV
2-Chloro-1,3-butadiene	0/5	ND	0.58U - 0.64UJ	0.306	0.64	NE	---	NA	Yes	No SSV
2-Hexanone	0/5	ND	2.1U - 2.3UJ	1.130	2.3	NE	---	NA	Yes	No SSV
3-Chloro-1-propene	0/3	ND	1.5UJ - 1.6U	0.783	1.6	NE	---	NA	Yes	No SSV
4-Methyl-2-pentanone (MIBK)	0/5	ND	3U - 3.2U	1.560	3.2	NE	---	NA	Yes	No SSV
Acetone	5/5	9J - 47J	ND	24.000	47	NE	---	NA	Yes	No SSV
Acetonitrile	0/5	ND	46U - 50UJ	24.100	50	NE	---	NA	Yes	No SSV
Acrylonitrile	0/5	ND	23U - 26UJ	12.400	26	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Benzene	0/5	ND	0.8U - 0.88U	0.424	0.88	101	MHSPE 2000	<0.01	No	HQ < 1.0
Bromoform	0/5	ND	1.1U - 1.2U	0.590	1.2	NE	---	NA	Yes	No SSV
Bromomethane	0/5	ND	1.6U - 1.8UJ	0.850	1.8	NE	---	NA	Yes	No SSV
Carbon disulfide	1/5	0.59J - 0.59J	0.55U - 0.57U	0.340	0.59	NE	---	NA	Yes	No SSV
Carbon tetrachloride	0/5	ND	1U - 1.1U	0.540	1.1	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorobenzene	0/5	ND	0.74U - 0.81U	0.391	0.81	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorodibromomethane	0/5	ND	0.51U - 0.56U	0.269	0.56	NE	---	NA	Yes	No SSV
Chloroethane	0/5	ND	1.2U - 1.3U	0.640	1.3	NE	---	NA	Yes	No SSV
Chloroform	0/5	ND	0.51U - 0.56U	0.269	0.56	1,002	MHSPE 2000	<0.01	No	HQ < 1.0
Chloromethane	0/5	ND	0.72U - 0.79U	0.380	0.79	NE	---	NA	Yes	No SSV
cis-1,3-Dichloropropene	0/5	ND	0.89U - 0.97U	0.468	0.97	100	CCME 2007	<0.01	No	HQ < 1.0
Dibromomethane	0/5	ND	1.2U - 1.3U	0.640	1.3	NE	---	NA	Yes	No SSV
Dichlorobromomethane	0/5	ND	0.84U - 0.92U	0.444	0.92	NE	---	NA	Yes	No SSV
Dichlorodifluoromethane	0/5	ND	0.91U - 0.99U	0.478	0.99	NE	---	NA	Yes	No SSV
Ethyl methacrylate	0/5	ND	2.2U - 2.5U	1.190	2.5	NE	---	NA	Yes	No SSV
Ethylbenzene	0/5	ND	0.76U - 0.84U	0.403	0.84	5,003	MHSPE 2000	<0.01	No	HQ < 1.0
Ethylene Dibromide	0/5	ND	1.5U - 1.7U	0.800	1.7	300	CCME 2007	<0.01	No	HQ < 1.0
Iodomethane	0/5	ND	1UJ - 1.1UJ	0.540	1.1	NE	---	NA	Yes	No SSV
Methacrylonitrile	0/5	ND	24UJ - 27U	12.900	27	NE	---	NA	Yes	No SSV
Methyl methacrylate	0/5	ND	3.8UJ - 4.1U	1.990	4.1	NE	---	NA	Yes	No SSV
Methylene Chloride	0/5	ND	1U - 1.1U	0.540	1.1	1,040	MHSPE 2000	<0.01	No	HQ < 1.0
Pentachloroethane	0/5	ND	2.2UJ - 2.5U	1.190	2.5	NE	---	NA	Yes	No SSV
Propionitrile	0/5	ND	21U - 23U	11.300	23	NE	---	NA	Yes	No SSV
Styrene	0/5	ND	0.67U - 0.74U	0.355	0.74	10,030	MHSPE 2000	<0.01	No	HQ < 1.0
Tetrachloroethene	0/5	ND	0.74U - 0.81U	0.391	0.81	400	MHSPE 2000	<0.01	No	HQ < 1.0
Toluene	0/5	ND	0.8U - 0.88U	0.424	0.88	13,001	MHSPE 2000	<0.01	No	HQ < 1.0
trans-1,2-Dichloroethene	0/5	ND	0.99U - 1.1U	0.519	1.1	100	CCME 2007	0.01	No	HQ < 1.0
trans-1,3-Dichloropropene	0/5	ND	0.89U - 0.97U	0.468	0.97	100	CCME 2007	<0.01	No	HQ < 1.0

TABLE 7-13
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Soil Screening Values (SSV)	Reference (2)	Max. HQ (2)	Ecological COPC?	Comments
Volatile Organic Compounds (ug/kg)										
trans-1,4-Dichloro-2-butene	0/5	ND	3.2UJ - 3.5U	1.670	3.5	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Trichloroethene	0/5	ND	1U - 1.1U	0.540	1.1	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Trichlorofluoromethane	0/5	ND	1.5U - 1.7U	0.800	1.7	NE	---	NA	Yes	No SSV
Vinyl acetate	0/5	ND	1.5U - 1.7UJ	0.800	1.7	NE	---	NA	Yes	No SSV
Vinyl chloride	0/5	ND	0.59U - 0.65U	0.311	0.65	11.0	MHSPE 2000	0.06	No	HQ < 1.0
Xylenes, Total	0/5	ND	2.3U - 2.6U	1.240	2.6	2,510	MHSPE 2000	<0.01	No	HQ < 1.0
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	0/5	ND	9.1UJ - 9.6U	4.730	9.6	NE	---	NA	Yes	No SSV
1,2,4,5-Tetrachlorobenzene	0/5	ND	7.8UJ - 8.2U	4.030	8.2	50.0	CCME 2007	0.16	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/5	ND	9.1UJ - 9.6U	4.730	9.6	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,2-Dichlorobenzene	0/5	ND	8.6UJ - 9.1U	4.470	9.1	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3,5-Trinitrobenzene	0/5	ND	21UJ - 22U	10.900	22	40,000	---	<0.01	No	HQ < 1.0
1,3-Dichlorobenzene	0/5	ND	7.4UJ - 7.8U	3.840	7.8	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/5	ND	4.8UJ - 5.1U	2.490	5.1	40,000	---	<0.01	No	HQ < 1.0
1,4-Dichlorobenzene	0/5	ND	7.6UJ - 8U	3.960	8	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,4-Dioxane	0/5	ND	9.9UJ - 10U	4.990	10	NE	---	NA	Yes	No SSV
1,4-Naphthoquinone	0/5	ND	4.8UJ - 5.1U	2.490	5.1	NE	---	NA	Yes	No SSV
2,2'-oxybis[1-chloropropane]	0/5	ND	7.8UJ - 8.2U	4.030	8.2	NE	---	NA	Yes	No SSV
2,3,4,6-Tetrachlorophenol	0/5	ND	5.2UJ - 5.4U	2.680	5.4	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2,4,5-Trichlorophenol	0/5	ND	8.4UJ - 8.8U	4.350	8.8	4,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4,6-Trichlorophenol	0/5	ND	9.7UJ - 10U	4.970	10	10,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2,4-Dichlorophenol	0/5	ND	10UJ - 10UJ	5.000	10	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2,4-Dimethylphenol	0/5	ND	21UJ - 22U	10.900	22	100	CCME 2007	0.22	No	HQ < 1.0
2,4-Dinitrophenol	0/5	ND	100UJ - 110UJ	54.000	110	20,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4-Dinitrotoluene	0/5	ND	7.3UJ - 7.6U	3.770	7.6	NE	---	NA	Yes	No SSV
2,6-Dichlorophenol	0/5	ND	7.9UJ - 8.3U	4.090	8.3	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2,6-Dinitrotoluene	0/5	ND	7.6UJ - 8U	3.960	8	NE	---	NA	Yes	No SSV
2-Acetylaminofluorene	0/5	ND	6.3UJ - 6.6U	3.270	6.6	NE	---	NA	Yes	No SSV
2-Chloronaphthalene	0/5	ND	7.6UJ - 8U	3.960	8	NE	---	NA	Yes	No SSV
2-Chlorophenol	0/5	ND	8.1UJ - 8.6U	4.220	8.6	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2-Methylphenol	0/5	ND	10UJ - 10UJ	5.000	10	100	CCME 2007	0.10	No	HQ < 1.0
2-Naphthylamine	0/5	ND	25UJ - 26UJ	12.900	26	NE	---	NA	Yes	No SSV
2-Nitroaniline	0/5	ND	8UJ - 8.4U	4.160	8.4	NE	---	NA	Yes	No SSV
2-Nitrophenol	0/5	ND	9UJ - 9.5U	4.670	9.5	7,000	---	<0.01	No	HQ < 1.0
2-Picoline	0/5	ND	15UJ - 16U	7.700	16	NE	---	NA	Yes	No SSV
2-Toluidine	0/5	ND	11UJ - 12U	5.900	12	NE	---	NA	Yes	No SSV
3 & 4 Methylphenol	0/5	ND	9UJ - 9.5U	4.670	9.5	100	CCME 2007	0.10	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/5	ND	11UJ - 12UJ	5.900	12	NE	---	NA	Yes	No SSV
3,3'-Dimethylbenzidine	0/5	ND	220UJ - 230U	114.000	230	NE	---	NA	Yes	No SSV
3-Methylcholanthrene	0/5	ND	7.5UJ - 7.9UJ	3.900	7.9	NE	---	NA	Yes	No SSV
3-Nitroaniline	0/5	ND	5.6UJ - 5.8U	2.880	5.8	NE	---	NA	Yes	No SSV
4,6-Dinitro-2-methylphenol	0/5	ND	7.2UJ - 7.5UJ	3.720	7.5	NE	---	NA	Yes	No SSV
4-Aminobiphenyl	0/5	ND	16UJ - 17U	8.400	17	NE	---	NA	Yes	No SSV
4-Bromophenyl phenyl ether	0/5	ND	8.8UJ - 9.2U	4.540	9.2	NE	---	NA	Yes	No SSV
4-Chloro-3-methylphenol	0/5	ND	9.3UJ - 9.7U	4.800	9.7	NE	---	NA	Yes	No SSV
4-Chloroaniline	0/5	ND	7.4UJ - 7.8U	3.840	7.8	NE	---	NA	Yes	No SSV

TABLE 7-13
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [2]	Ecological COPC?	Comments
Semivolatile Organic Compounds (ug/kg)										
4-Chlorophenyl phenyl ether	0/5	ND	7.6UJ - 8U	3.960	8	NE	---	NA	Yes	No SSV
4-Nitroaniline	0/5	ND	9.5UJ - 10U	4.920	10	NE	---	NA	Yes	No SSV
4-Nitrophenol	0/5	ND	41UJ - 43U	21.100	43	7,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
7,12-Dimethylbenz(a)anthracene	0/5	ND	11UJ - 12UJ	5.900	12	NE	---	NA	Yes	No SSV
Acetophenone	0/5	ND	11UJ - 11UJ	5.500	11	NE	---	NA	Yes	No SSV
alpha,alpha-Dimethyl phenethylamine	0/5	ND	73UJ - 76U	37.700	76	NE	---	NA	Yes	No SSV
Aniline	0/5	ND	7.8UJ - 8.2U	4.030	8.2	NE	---	NA	Yes	No SSV
Aramite, Total	0/5	ND	14UJ - 14UJ	7.000	14	NE	---	NA	Yes	No SSV
Benzyl alcohol	0/5	ND	9.9UJ - 10U	4.990	10	NE	---	NA	Yes	No SSV
Bis(2-chloroethoxy)methane	0/5	ND	8.4UJ - 8.8U	4.350	8.8	NE	---	NA	Yes	No SSV
Bis(2-chloroethyl)ether	0/5	ND	7UJ - 7.4U	3.640	7.4	NE	---	NA	Yes	No SSV
Bis(2-ethylhexyl) phthalate	0/5	ND	18U - 47UJ	13.900	47	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Butyl benzyl phthalate	0/5	ND	8.9UJ - 9.3U	4.600	9.3	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Diallate	0/5	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
Dibenzofuran	0/5	ND	5.2UJ - 5.4U	2.680	5.4	NE	---	NA	Yes	No SSV
Diethyl phthalate	0/5	ND	14UJ - 14UJ	7.000	14	100,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Dimethyl phthalate	0/5	ND	7.9UJ - 8.3U	4.090	8.3	200,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Di-n-butyl phthalate	0/5	ND	31UJ - 32U	15.900	32	200,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Di-n-octyl phthalate	0/5	ND	4.1UJ - 4.3UJ	2.110	4.3	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Dinoseb	0/5	ND	21UJ - 22U	10.900	22	NE	---	NA	Yes	No SSV
Ethyl methanesulfonate	0/5	ND	14UJ - 14UJ	7.000	14	NE	---	NA	Yes	No SSV
Hexachlorobenzene	0/5	ND	8.4UJ - 8.8U	4.350	8.8	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Hexachlorobutadiene	0/5	ND	11UJ - 12U	5.900	12	NE	---	NA	Yes	No SSV
Hexachlorocyclopentadiene	0/5	ND	17UJ - 18U	8.900	18	10,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Hexachloroethane	0/5	ND	9.1UJ - 9.6U	4.730	9.6	NE	---	NA	Yes	No SSV
Hexachlorophene	0/2	ND	1000UJ - 1100UJ	525.000	1100	NE	---	NA	Yes	No SSV
Hexachloropropene	0/5	ND	8.9UJ - 9.3UJ	4.600	9.3	NE	---	NA	Yes	No SSV
Isophorone	0/5	ND	7.6UJ - 8UJ	3.960	8	NE	---	NA	Yes	No SSV
Isosafrole	0/5	ND	8.8UJ - 9.2U	4.540	9.2	NE	---	NA	Yes	No SSV
Methapyrilene	0/5	ND	11UJ - 12UJ	5.900	12	NE	---	NA	Yes	No SSV
Methyl methanesulfonate	0/5	ND	11UJ - 12U	5.900	12	NE	---	NA	Yes	No SSV
Nitrobenzene	0/5	ND	8.5UJ - 8.9U	4.410	8.9	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitro-o-toluidine	0/5	ND	7.4UJ - 7.8U	3.840	7.8	NE	---	NA	Yes	No SSV
N-Nitrosodiethylamine	0/5	ND	15UJ - 16U	7.700	16	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodimethylamine	0/5	ND	12UJ - 13U	6.400	13	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-butylamine	0/5	ND	11UJ - 12UJ	5.900	12	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/5	ND	8UJ - 8.4U	4.160	8.4	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodiphenylamine	0/5	ND	8.8UJ - 9.2U	4.540	9.2	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitrosomethylethylamine	0/5	ND	7UJ - 7.4U	3.640	7.4	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosomorpholine	0/5	ND	8.1UJ - 8.6UJ	4.220	8.6	NE	---	NA	Yes	No SSV
N-Nitrosopiperidine	0/5	ND	10UJ - 11UJ	5.400	11	NE	---	NA	Yes	No SSV
N-Nitrosopyrrolidine	0/5	ND	11UJ - 12UJ	5.600	12	NE	---	NA	Yes	No SSV
p-Dimethylamino azobenzene	0/5	ND	8.8UJ - 9.2U	4.540	9.2	NE	---	NA	Yes	No SSV
Pentachlorobenzene	0/5	ND	7.6UJ - 8U	3.960	8	1,150	USEPA 1999	<0.01	No	HQ < 1.0
Pentachloronitrobenzene	0/5	ND	7.3UJ - 7.6U	3.770	7.6	NE	---	NA	Yes	No SSV
Pentachlorophenol	0/5	ND	10UJ - 11U	5.400	11	5,000	USEPA 2007a	<0.01	No	HQ < 1.0

TABLE 7-13
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Soil Screening Values (SSV)	Reference [2]	Max. HQ [2]	Ecological COPC?	Comments
Semivolatile Organic Compounds (ug/kg)										
Phenacetin	0/5	ND	5.8UJ - 6.1U	3.010	6.1	NE	---	NA	Yes	No SSV
Phenol	0/5	ND	5.9UJ - 6.2U	3.070	6.2	30,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
p-Phenylene diamine	0/5	ND	200UJ - 210U	104.000	210	NE	---	NA	Yes	No SSV
Pronamide	0/5	ND	11UJ - 12U	5.900	12	NE	---	NA	Yes	No SSV
Pyridine	0/5	ND	14UJ - 14UJ	7.000	14	NE	---	NA	Yes	No SSV
Safrole, Total	0/5	ND	10UJ - 11U	5.400	11	NE	---	NA	Yes	No SSV
PAHs (ug/kg)										
Low Molecular Weight PAHs[3]	NA	13.520 - 13.520	NA	NA	13.52	29,000	USEPA 2007b	<0.01	No	HQ < 1.0
High Molecular Weight PAHs [4]	NA	12.890 - 12.890	NA	NA	12.89	18,000	USEPA 2007b	<0.01	No	HQ < 1.0
Metals (mg/kg)										
Antimony	0/5	ND	0.085UJ - 0.096U	0.046	0.096	78.0	USEPA 2005a	<0.01	No	HQ < 1.0
Arsenic	5/5	0.84 - 2	ND	1.258	2	18.0	USEPA 2005b	0.11	No	HQ < 1.0
Barium	5/5	18 - 120	ND	74.200	120	330	USEPA 2005c	0.36	No	HQ < 1.0
Beryllium	5/5	0.16 - 0.27	ND	0.226	0.27	40.0	USEPA 2005d	<0.01	No	HQ < 1.0
Cadmium	2/5	0.051J - 0.2J	0.035UJ - 0.037UJ	0.061	0.2	32.0	USEPA 2005e	<0.01	No	HQ < 1.0
Chromium	5/5	17 - 29	ND	21.800	29	57.0	USEPA 2008	0.51	No	HQ < 1.0
Cobalt	5/5	7.9 - 27	ND	14.600	27	13.0	USEPA 2005f	2.08	Yes	HQ > 1.0
Copper	5/5	72J - 110	ND	90.800	110	70.0	USEPA 2007c	1.57	Yes	HQ > 1.0
Lead	5/5	2.5 - 3.4	ND	2.880	3.4	120	USEPA 2005g	0.03	No	HQ < 1.0
Mercury	5/5	0.024 - 0.11	ND	0.062	0.11	0.10	Efroymson et al. 1997a	1.10	Yes	HQ > 1.0
Nickel	5/5	4.6 - 11	ND	8.180	11	38.0	USEPA 2007d	0.29	No	HQ < 1.0
Selenium	5/5	0.17J - 1.2	ND	0.528	1.2	0.52	USEPA 2007e	2.31	Yes	HQ > 1.0
Silver	3/5	0.03J - 0.068J	0.053U - 0.084U	0.045	0.068	560	USEPA 2006	<0.01	No	HQ < 1.0
Thallium	0/5	ND	0.14U - 0.15U	0.072	0.15	1.00	Efroymson et al. 1997b	0.15	No	HQ < 1.0
Tin	0/5	ND	4.6U - 5U	2.390	5	50.0	Efroymson et al. 1997b	0.10	No	HQ < 1.0
Vanadium	5/5	170 - 380	ND	244.000	380	20.0	USEPA 2005h	19.00	Yes	HQ > 1.0
Zinc	5/5	26 - 82	ND	55.400	82	120	USEPA 2007f	0.68	No	HQ < 1.0

Notes:

MHSPE = Ministry of Housing, Spatial Planning and Environment
CCME = Canadian Council of Ministries of the Environment
USEPA = United States Environmental Protection Agency
COPC = Chemical of Potential Concern
SSV = Soil Screening Value
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
HQ = Hazard Quotient
PAH = Polynuclear Aromatic Hydrocarbon
U = Not Detected
UJ = Not detected, estimated value
J = Estimated Value
NA = Not Available
ND = Not Detected

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(2) See Table 7-4 for reference citations.

(3) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum method detection limit for non-detected chemicals) divided by the screening value.

(4) Low molecular weight PAHs are defined by the USEPA (2007b) as PAH compounds composed of fewer than four rings. The low molecular weight PAH compounds analyzed for in SWMU 69 soil were 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene. Value was calculated by summing maximum detected concentration in site soil for each chemical. Maximum method detection limit was used if there were no detections.

(5) High molecular weight PAHs are defined by the USEPA (2007b) as PAH compounds composed of four or more rings. The high molecular weight PAH compounds analyzed for in SWMU 69 soil were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene. Value was calculated by summing maximum detected concentration in site soil for each chemical. Maximum method detection limits were used for non-detected PAHs.

TABLE 7-14
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Marine Surface Water Screening Values (SWSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Volatile Organic Compounds (ug/L)										
1,1,1,2-Tetrachloroethane	0/7	ND	0.29U - 0.29U	0.145	0.29	200	USEPA 2007a	<0.01	No	HQ < 1.0
1,1,1-Trichloroethane	0/7	ND	0.39U - 0.39U	0.195	0.39	312	USEPA 2001	<0.01	No	HQ < 1.0
1,1,2,2-Tetrachloroethane	0/7	ND	0.26U - 0.26U	0.130	0.26	90.2	USEPA 2001	<0.01	No	HQ < 1.0
1,1,2-Trichloroethane	0/7	ND	0.51U - 0.51U	0.255	0.51	340	USEPA 2007a	<0.01	No	HQ < 1.0
1,1-Dichloroethane	0/7	ND	0.32U - 0.32U	0.160	0.32	47.0	USEPA 2003	<0.01	No	HQ < 1.0
1,1-Dichloroethene	0/7	ND	0.36U - 0.36U	0.180	0.36	2,240	USEPA 2001	<0.01	No	HQ < 1.0
1,2,3-Trichloropropane	0/7	ND	0.42U - 0.42U	0.210	0.42	274	USEPA 2007a	<0.01	No	HQ < 1.0
1,2-Dibromo-3-Chloropropane	0/7	ND	0.48U - 0.48U	0.240	0.48	100	USEPA 2007a	<0.01	No	HQ < 1.0
1,2-Dichloroethane	0/7	ND	0.31U - 0.31U	0.155	0.31	1,130	USEPA 2001	<0.01	No	HQ < 1.0
1,2-Dichloropropane	0/7	ND	0.36U - 0.36U	0.180	0.36	2,400	USEPA 2001	<0.01	No	HQ < 1.0
2-Butanone (MEK)	0/7	ND	0.6U - 0.6U	0.300	0.6	13,333	USEPA 2007a	<0.01	No	HQ < 1.0
2-Chloro-1,3-butadiene	0/7	ND	0.35U - 0.35U	0.175	0.35	NE	---	NA	Yes	No SSV
2-Hexanone	1/7	1.1J - 1.1J	0.68U - 0.68U	0.449	1.1	99.0	USEPA 2003	0.01	No	HQ < 1.0
3-Chloro-1-propene	0/7	ND	0.46U - 0.46U	0.230	0.46	3.40	USEPA 2007a	0.14	No	HQ < 1.0
4-Methyl-2-pentanone (MIBK)	0/7	ND	0.6U - 0.6U	0.300	0.6	170	USEPA 2003	<0.01	No	HQ < 1.0
Acetone	1/7	15J - 15J	5U - 5U	4.286	15	1,000	USEPA 2007a	0.02	No	HQ < 1.0
Acetonitrile	0/7	ND	15U - 15U	7.500	15	12,000	USEPA 2003	<0.01	No	HQ < 1.0
Acrolein	0/5	ND	18UJ - 18UJ	9.000	18	0.55	USEPA 2009	32.73	Yes	HQ > 1.0
Acrylonitrile	0/7	ND	3.8UJ - 3.8UJ	1.900	3.8	58.1	USEPA 2007a	0.07	No	HQ < 1.0
Benzene	0/7	ND	0.32U - 0.32U	0.160	0.32	109	USEPA 2001	<0.01	No	HQ < 1.0
Bromoform	0/7	ND	0.41U - 0.41U	0.205	0.41	640	USEPA 2001	<0.01	No	HQ < 1.0
Bromomethane	0/7	ND	0.5UJ - 0.5UJ	0.250	0.5	120	USEPA 2007a	<0.01	No	HQ < 1.0
Carbon disulfide	0/7	ND	0.17U - 0.17U	0.085	0.17	15.0	USEPA 2003	0.01	No	HQ < 1.0
Carbon tetrachloride	0/7	ND	0.27U - 0.27U	0.135	0.27	1,500	USEPA 2001	<0.01	No	HQ < 1.0
Chlorobenzene	0/7	ND	0.34U - 0.34U	0.170	0.34	105	USEPA 2001	<0.01	No	HQ < 1.0
Chlorodibromomethane	0/7	ND	0.3U - 0.3U	0.150	0.3	340	USEPA 2007a	<0.01	No	HQ < 1.0
Chloroethane	0/7	ND	1U - 1U	0.500	1	NE	---	NA	Yes	No SSV
Chloromethane	1/7	1.5J - 1.5J	0.28U - 0.28U	0.334	1.5	2,700	USEPA 2007a	<0.01	No	HQ < 1.0
cis-1,3-Dichloropropene	0/7	ND	0.37U - 0.37U	0.185	0.37	7.90	USEPA 2001	0.05	No	HQ < 1.0
Dibromomethane	0/7	ND	0.29U - 0.29U	0.145	0.29	1,280	Buchman 2008	<0.01	No	HQ < 1.0
Dichlorobromomethane	0/7	ND	0.34U - 0.34U	0.170	0.34	2,400	USEPA 2007a	<0.01	No	HQ < 1.0
Dichlorodifluoromethane	0/7	ND	0.33UJ - 0.33UJ	0.165	0.33	1,280	---	<0.01	No	HQ < 1.0
Ethyl methacrylate	0/7	ND	1U - 1U	0.500	1	18,000	USEPA 2007a	<0.01	No	HQ < 1.0
Ethylbenzene	0/7	ND	0.3U - 0.3U	0.150	0.3	4.30	USEPA 2001	0.07	No	HQ < 1.0
Ethylene Dibromide	0/7	ND	0.3U - 0.3U	0.150	0.3	48.0	USEPA 2007a	<0.01	No	HQ < 1.0
Iodomethane	0/7	ND	1U - 1U	0.500	1	NE	---	NA	Yes	No SSV
Isobutyl alcohol	0/4	ND	19U - 19U	9.500	19	10,000	USEPA 2007a	<0.01	No	HQ < 1.0
Methacrylonitrile	0/7	ND	6.6U - 6.6U	3.300	6.6	NE	---	NA	Yes	No SSV
Methylene Chloride	0/7	ND	1U - 1U	0.500	1	2,560	USEPA 2001	<0.01	No	HQ < 1.0
Pentachloroethane	0/7	ND	1.3UJ - 1.3UJ	0.650	1.3	56.2	Buchman 2008	0.02	No	HQ < 1.0
Propionitrile	0/7	ND	9.2U - 9.2U	4.600	9.2	15,200	USEPA 2007a	<0.01	No	HQ < 1.0
Styrene	0/7	ND	0.36U - 0.36U	0.180	0.36	170	USEPA 2007a	<0.01	No	HQ < 1.0
Tetrachloroethene	0/7	ND	0.28U - 0.28U	0.140	0.28	45.0	USEPA 2001	<0.01	No	HQ < 1.0
Toluene	0/7	ND	0.31U - 0.31U	0.155	0.31	37.0	USEPA 2001	<0.01	No	HQ < 1.0
trans-1,2-Dichloroethene	0/7	ND	0.3U - 0.3U	0.150	0.3	4,480	Buchman 2008	<0.01	No	HQ < 1.0
trans-1,3-Dichloropropene	0/7	ND	0.27UJ - 0.27UJ	0.135	0.27	7.90	USEPA 2001	0.03	No	HQ < 1.0

TABLE 7-14
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Marine Surface Water Screening Values (SWSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Volatile Organic Compounds (ug/L)										
trans-1,4-Dichloro-2-butene	0/7	ND	0.83U - 0.83U	0.415	0.83	NE	---	NA	Yes	No SSV
Trichloroethene	0/7	ND	0.4U - 0.4U	0.200	0.4	40.0	Buchman 2008	0.01	No	HQ < 1.0
Trichlorofluoromethane	0/7	ND	0.29U - 0.29U	0.145	0.29	1,280	Buchman 2008	<0.01	No	HQ < 1.0
Vinyl acetate	0/7	ND	0.62UJ - 0.62UJ	0.310	0.62	100	USEPA 2007a	<0.01	No	HQ < 1.0
Vinyl chloride	0/7	ND	0.2U - 0.2U	0.100	0.2	930	USEPA 2003	<0.01	No	HQ < 1.0
Xylenes, Total	0/7	ND	0.87U - 0.87U	0.435	0.87	27.0	USEPA 2003	0.03	No	HQ < 1.0
Semivolatile Organic Compounds (ug/L)										
1,1'-Biphenyl	0/7	ND	0.17U - 0.17U	0.085	0.17	230	USEPA 2007a	<0.01	No	HQ < 1.0
1,2,4,5-Tetrachlorobenzene	0/7	ND	0.23U - 0.23U	0.115	0.23	10.0	USEPA 2007a	0.02	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/7	ND	0.13U - 0.13U	0.065	0.13	4.50	USEPA 2001	0.03	No	HQ < 1.0
1,2-Dichlorobenzene	0/7	ND	0.13U - 0.13U	0.065	0.13	19.7	USEPA 2001	<0.01	No	HQ < 1.0
1,3,5-Trinitrobenzene	0/7	ND	0.2U - 0.2U	0.100	0.2	80.0	USEPA 2007a	<0.01	No	HQ < 1.0
1,3-Dichlorobenzene	0/7	ND	0.12U - 0.12U	0.060	0.12	28.5	USEPA 2001	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/7	ND	0.22U - 0.22U	0.110	0.22	22.0	USEPA 2003	0.01	No	HQ < 1.0
1,4-Dichlorobenzene	0/7	ND	0.12U - 0.12U	0.060	0.12	19.9	USEPA 2001	<0.01	No	HQ < 1.0
1,4-Dioxane	0/7	ND	0.49U - 0.49U	0.245	0.49	67,000	USEPA 2007a	<0.01	No	HQ < 1.0
1,4-Naphthoquinone	0/7	ND	0.16U - 0.16U	0.080	0.16	NE	---	NA	Yes	No SSV
2,2'-oxybis[1-chloropropane]	0/7	ND	0.097U - 0.097U	0.049	0.097	NE	---	NA	Yes	No SSV
2,3,4,6-Tetrachlorophenol	0/7	ND	0.29U - 0.29U	0.145	0.29	8.80	Buchman 2008	0.03	No	HQ < 1.0
2,4,5-Trichlorophenol	0/7	ND	0.16U - 0.16U	0.080	0.16	11.0	Buchman 2008	0.01	No	HQ < 1.0
2,4,6-Trichlorophenol	0/7	ND	0.16U - 0.16U	0.080	0.16	12.1	USEPA 2007a	0.01	No	HQ < 1.0
2,4-Dichlorophenol	0/7	ND	0.15U - 0.15U	0.075	0.15	1.67	USEPA 2007a	0.09	No	HQ < 1.0
2,4-Dimethylphenol	0/7	ND	0.4U - 0.4U	0.200	0.4	131	USEPA 2007a	<0.01	No	HQ < 1.0
2,4-Dinitrophenol	0/7	ND	2.4U - 2.4U	1.200	2.4	48.5	USEPA 2001	0.05	No	HQ < 1.0
2,4-Dinitrotoluene	0/7	ND	0.17UJ - 0.17UJ	0.085	0.17	44.0	USEPA 2003	<0.01	No	HQ < 1.0
2,6-Dichlorophenol	0/7	ND	0.21U - 0.21U	0.105	0.21	54.0	USEPA 2007a	<0.01	No	HQ < 1.0
2,6-Dinitrotoluene	0/7	ND	0.15U - 0.15U	0.075	0.15	81.0	USEPA 2003	<0.01	No	HQ < 1.0
2-Acetylaminofluorene	0/7	ND	0.19U - 0.19U	0.095	0.19	20.0	USEPA 2007a	<0.01	No	HQ < 1.0
2-Chloronaphthalene	0/7	ND	0.12U - 0.12U	0.060	0.12	0.15	Buchman 2008	0.80	No	HQ < 1.0
2-Chlorophenol	0/7	ND	0.15U - 0.15U	0.075	0.15	53.0	USEPA 2007a	<0.01	No	HQ < 1.0
2-Methylnaphthalene	0/7	ND	0.022U - 0.022U	0.011	0.022	6.00	USEPA 2007a	<0.01	No	HQ < 1.0
2-Methylphenol	0/7	ND	0.15U - 0.15U	0.075	0.15	102	USEPA 2007a	<0.01	No	HQ < 1.0
2-Naphthylamine	0/7	ND	1.1U - 1.1U	0.550	1.1	NE	---	NA	Yes	No SSV
2-Nitroaniline	0/7	ND	0.14U - 0.14U	0.070	0.14	48.9	USEPA 2007a	<0.01	No	HQ < 1.0
2-Nitrophenol	0/7	ND	0.17U - 0.17U	0.085	0.17	10,000	USEPA 2007a	<0.01	No	HQ < 1.0
2-Picoline	0/7	ND	0.57U - 0.57U	0.285	0.57	8,979	USEPA 2007a	<0.01	No	HQ < 1.0
3 & 4 Methylphenol	1/7	2.1 - 2.1	0.15U - 0.15U	0.364	2.1	33.6	USEPA 2007a	0.06	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/7	ND	3.7U - 3.7U	1.850	3.7	4.50	USEPA 2003	0.82	No	HQ < 1.0
3,3'-Dimethylbenzidine	0/7	ND	3.7U - 3.7U	1.850	3.7	160	USEPA 2007a	0.02	No	HQ < 1.0
3-Methylcholanthrene	0/7	ND	0.2U - 0.2U	0.100	0.2	NE	---	NA	Yes	No SSV
3-Nitroaniline	0/7	ND	0.28U - 0.28U	0.140	0.28	9.80	USEPA 2007a	0.03	No	HQ < 1.0
4,6-Dinitro-2-methylphenol	0/7	ND	0.49UJ - 0.49UJ	0.245	0.49	23.0	USEPA 2003	0.02	No	HQ < 1.0
4-Aminobiphenyl	0/7	ND	0.68U - 0.68U	0.340	0.68	NE	---	NA	Yes	No SSV
4-Bromophenyl phenyl ether	0/7	ND	0.16U - 0.16U	0.080	0.16	1.50	USEPA 2003	0.11	No	HQ < 1.0
4-Chloro-3-methylphenol	0/7	ND	0.16U - 0.16U	0.080	0.16	0.30	USEPA 2003	0.53	No	HQ < 1.0
4-Chloroaniline	0/7	ND	0.4U - 0.4U	0.200	0.4	10.0	USEPA 2007a	0.04	No	HQ < 1.0

TABLE 7-14
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Marine Surface Water Screening Values (SWSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Semivolatile Organic Compounds (ug/L)										
4-Chlorophenyl phenyl ether	0/7	ND	0.15U - 0.15U	0.075	0.15	7.30	USEPA 2007a	0.02	No	HQ < 1.0
4-Nitroaniline	0/7	ND	0.26U - 0.26U	0.130	0.26	170	USEPA 2007a	<0.01	No	HQ < 1.0
4-Nitrophenol	0/7	ND	0.18UJ - 0.18UJ	0.090	0.18	71.7	USEPA 2001	<0.01	No	HQ < 1.0
7,12-Dimethylbenz(a)anthracene	0/7	ND	0.2U - 0.2U	0.100	0.2	6.00	Buchman 2008	0.03	No	HQ < 1.0
Acenaphthene	1/7	0.11J - 0.11J	0.019U - 0.019U	0.024	0.11	9.70	USEPA 2001	0.01	No	HQ < 1.0
Acenaphthylene	0/7	ND	0.049U - 0.049U	0.025	0.049	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Acetophenone	0/7	ND	0.19U - 0.19U	0.095	0.19	1,550	USEPA 2007a	<0.01	No	HQ < 1.0
alpha,alpha-Dimethyl phenethylamine	0/7	ND	1.3U - 1.3U	0.650	1.3	NE	---	NA	Yes	No SSV
Aniline	0/7	ND	0.4U - 0.4U	0.200	0.4	294	USEPA 2007a	<0.01	No	HQ < 1.0
Anthracene	0/7	ND	0.021U - 0.021U	0.011	0.021	5.35	USEPA 2007a	<0.01	No	HQ < 1.0
Aramite, Total	0/7	ND	0.49UJ - 0.49UJ	0.245	0.49	3.09	USEPA 2003	0.16	No	HQ < 1.0
Benzo[a]anthracene	0/7	ND	0.025U - 0.025U	0.013	0.025	0.025	USEPA 2003	1.00	No	HQ = 1.0
Benzo[a]pyrene	0/7	ND	0.024U - 0.024U	0.012	0.024	10.0	USEPA 2004	<0.01	No	HQ < 1.0
Benzo[b]fluoranthene	0/7	ND	0.036U - 0.036U	0.018	0.036	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzo[g,h,i]perylene	0/7	ND	0.023UJ - 0.023UJ	0.012	0.023	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzo[k]fluoranthene	0/7	ND	0.019U - 0.019U	0.010	0.019	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzyl alcohol	0/7	ND	0.16U - 0.16U	0.080	0.16	150	USEPA 2007a	<0.01	No	HQ < 1.0
Bis(2-chloroethoxy)methane	0/7	ND	0.15U - 0.15U	0.075	0.15	1,840	USEPA 2007a	<0.01	No	HQ < 1.0
Bis(2-chloroethyl)ether	0/7	ND	0.14U - 0.14U	0.070	0.14	2,380	USEPA 2001	<0.01	No	HQ < 1.0
Butyl benzyl phthalate	0/7	ND	0.17U - 0.17U	0.085	0.17	29.4	USEPA 2001	<0.01	No	HQ < 1.0
Chrysene	0/7	ND	0.027U - 0.027U	0.014	0.027	10.0	USEPA 2004	<0.01	No	HQ < 1.0
Diallate	0/7	ND	0.19U - 0.19U	0.095	0.19	82.0	USEPA 2007a	<0.01	No	HQ < 1.0
Dibenz(a,h)anthracene	0/7	ND	0.023UJ - 0.023UJ	0.012	0.023	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Dibenzofuran	1/7	0.36J - 0.36J	0.097U - 0.097U	0.093	0.36	33.3	USEPA 2007a	0.01	No	HQ < 1.0
Diethyl phthalate	0/7	ND	0.18U - 0.18U	0.090	0.18	75.9	USEPA 2001	<0.01	No	HQ < 1.0
Dimethyl phthalate	0/7	ND	0.17U - 0.17U	0.085	0.17	580	USEPA 2001	<0.01	No	HQ < 1.0
Di-n-butyl phthalate	0/7	ND	0.11U - 0.72U	0.160	0.72	3.40	USEPA 2001	0.21	No	HQ < 1.0
Di-n-octyl phthalate	0/7	ND	0.097U - 0.097U	0.049	0.097	1,150	USEPA 2007a	<0.01	No	HQ < 1.0
Dinoseb	0/7	ND	0.49U - 0.49U	0.245	0.49	1.70	USEPA 2007a	0.29	No	HQ < 1.0
Ethyl methanesulfonate	0/7	ND	0.23U - 0.23U	0.115	0.23	40.0	USEPA 2007a	<0.01	No	HQ < 1.0
Fluoranthene	0/7	ND	0.049U - 0.049U	0.025	0.049	11.0	USEPA 1996	<0.01	No	HQ < 1.0
Fluorene	1/7	0.083J - 0.083J	0.018U - 0.018U	0.020	0.083	10.0	USEPA 2007a	<0.01	No	HQ < 1.0
Hexachlorobenzene	0/7	ND	0.16U - 0.16U	0.080	0.16	0.077	USEPA 2007a	2.08	Yes	HQ > 1.0
Hexachlorobutadiene	0/7	ND	0.13U - 0.13U	0.065	0.13	0.32	USEPA 2001	0.41	No	HQ < 1.0
Hexachlorocyclopentadiene	0/7	ND	0.49U - 0.49U	0.245	0.49	0.07	USEPA 2001	7.00	Yes	HQ > 1.0
Hexachloroethane	0/7	ND	0.15U - 0.15U	0.075	0.15	9.40	USEPA 2001	0.02	No	HQ < 1.0
Hexachloropropene	0/7	ND	0.12UJ - 0.12UJ	0.060	0.12	NE	---	NA	Yes	No SSV
Indeno[1,2,3-cd]pyrene	0/7	ND	0.022U - 0.022U	0.011	0.022	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Isophorone	0/7	ND	0.15U - 0.15U	0.075	0.15	129	USEPA 2001	<0.01	No	HQ < 1.0
Isosafrole	0/7	ND	0.3U - 0.3U	0.150	0.3	NE	---	NA	Yes	No SSV
Methapyrilene	0/7	ND	0.26UJ - 0.26UJ	0.130	0.26	NE	---	NA	Yes	No SSV
Methyl methanesulfonate	0/7	ND	0.46U - 0.46U	0.230	0.46	NE	---	NA	Yes	No SSV
Naphthalene	0/7	ND	0.049U - 0.049U	0.025	0.049	23.5	USEPA 2001	<0.01	No	HQ < 1.0
Nitrobenzene	0/7	ND	0.14U - 0.14U	0.070	0.14	66.8	USEPA 2001	<0.01	No	HQ < 1.0
N-Nitro-o-toluidine	0/7	ND	0.24U - 0.24U	0.120	0.24	220	USEPA 2007a	<0.01	No	HQ < 1.0
N-Nitrosodiethylamine	0/7	ND	0.32U - 0.32U	0.160	0.32	768	USEPA 2003	<0.01	No	HQ < 1.0

TABLE 7-14
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]	Marine Surface Water Screening Values (SWSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Semivolatile Organic Compounds (ug/L)										
N-Nitrosodi-n-butylamine	0/7	ND	0.18UJ - 0.18UJ	0.090	0.18	25.0	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/7	ND	0.13U - 0.13U	0.065	0.13	25.0	---	<0.01	No	HQ < 1.0
N-Nitrosodiphenylamine	0/7	ND	0.17U - 0.17U	0.085	0.17	25	USEPA 2007b	<0.01	No	HQ < 1.0
N-Nitrosomethylethylamine	0/7	ND	0.28U - 0.28U	0.140	0.28	25.0	---	0.01	No	HQ < 1.0
N-Nitrosomorpholine	0/7	ND	0.19UJ - 0.19UJ	0.095	0.19	NE	---	NA	Yes	No SSV
N-Nitrosopiperidine	0/7	ND	0.22UJ - 0.22UJ	0.110	0.22	NE	---	NA	Yes	No SSV
N-Nitrosopyrrolidine	0/7	ND	0.25U - 0.25U	0.125	0.25	NE	---	NA	Yes	No SSV
p-Dimethylamino azobenzene	0/7	ND	0.6U - 0.6U	0.300	0.6	NE	---	NA	Yes	No SSV
Pentachlorobenzene	0/7	ND	0.27U - 0.27U	0.135	0.27	129	USEPA 2001	<0.01	No	HQ < 1.0
Pentachloronitrobenzene	0/7	ND	0.3U - 0.3U	0.150	0.3	0.12	USEPA 2007a	2.50	Yes	HQ > 1.0
Pentachlorophenol	0/7	ND	0.18U - 0.18U	0.090	0.18	7.90	USEPA 2009	0.02	No	HQ < 1.0
Phenacetin	0/7	ND	0.2U - 0.2U	0.100	0.2	NE	---	NA	Yes	No SSV
Phenanthrene	1/7	0.28 - 0.28	0.017U - 0.017U	0.047	0.28	8.30	USEPA 1996	0.03	No	HQ < 1.0
Phenol	0/7	ND	0.14U - 0.14U	0.070	0.14	58.0	USEPA 2001	<0.01	No	HQ < 1.0
p-Phenylene diamine	0/7	ND	2.4U - 2.4U	1.200	2.4	200	USEPA 2007a	0.01	No	HQ < 1.0
Pronamide	0/7	ND	0.25U - 0.25U	0.125	0.25	35.0	USEPA 2007a	<0.01	No	HQ < 1.0
Pyrene	0/7	ND	0.026U - 0.026U	0.013	0.026	0.248	USEPA 2007a	0.10	No	HQ < 1.0
Pyridine	0/7	ND	0.22U - 0.22U	0.110	0.22	500	USEPA 2007a	<0.01	No	HQ < 1.0
Safrole, Total	0/7	ND	0.23U - 0.23U	0.115	0.23	NE	---	NA	Yes	No SSV
Total Metals (ug/L)										
Antimony	0/7	ND	0.36U - 0.36U	0.180	0.36	500	Buchman 2008	<0.01	No	HQ < 1.0
Arsenic	4/7	0.34J - 0.56J	1.4U - 1.7U	0.584	0.56	36.0	PREQB 2010	0.02	No	HQ < 1.0
Barium	7/7	12J - 580J	NA	182.571	580	16,667	USEPA 2007a	0.03	No	HQ < 1.0
Beryllium	0/7	ND	0.065U - 0.065U	0.033	0.065	167	USEPA 2007a	<0.01	No	HQ < 1.0
Cobalt	4/7	0.81J - 11	0.24U - 0.32U	3.404	11	45.0	USEPA 2007a	0.24	No	HQ < 1.0
Copper	0/7	ND	1.2U - 2.5U	0.750	2.5	3.73	PREQB 2010	0.67	No	HQ < 1.0
Lead	0/7	ND	0.15U - 0.15U	0.075	0.15	8.52	PREQB 2010	0.02	No	HQ < 1.0
Mercury	0/4	ND	0.08U - 0.08U	0.040	0.08	1.11	USEPA 2009	0.07	No	HQ < 1.0
Nickel	7/7	0.44J - 0.9J	NA	0.599	0.9	8.28	PREQB 2010	0.11	No	HQ < 1.0
Selenium	0/7	ND	0.6U - 0.6U	0.300	0.6	71.1	PREQB 2010	<0.01	No	HQ < 1.0
Thallium	0/7	ND	0.55U - 0.55U	0.275	0.55	21.3	USEPA 2001	0.03	No	HQ < 1.0
Tin	0/7	ND	0.9U - 0.98UJ	0.456	0.98	180	USEPA 2003	<0.01	No	HQ < 1.0
Vanadium	7/7	2.7J - 6.9	NA	5.014	6.9	12.0	USEPA 2003	0.58	No	HQ < 1.0
Zinc	4/7	7.2J - 10J	6.5UJ - 6.5UJ	6.221	10	85.6	PREQB 2010	0.12	No	HQ < 1.0

Notes:

COPC = Chemical of Potential Concern
USEPA = United States Environmental Protection Agency
SWSV = Surface Water Screening Value

ug/L - microgram per liter
HQ = Hazard Quotient
ND = Not Detected

NA = Not Applicable
J = Estimated value
U = Not detected

[1] Maximum detected concentration (or maximum method detection limit for non-detected chemicals).
[2] See Table 7-5 for reference citations.
[3] For a given chemical, the hazard quotient (HQ) is the maximum detected concentration (or maximum method detection limit for non-detected chemicals) divided by the groundwater screening value.

TABLE 7-15
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES: SURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organic:												
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes, total	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Semi-Volatile Organics:												
1,1'-Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,3-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,4-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromopheny phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aramite, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	<0.01	<0.01	<0.01	0.23	0.05	0.10	0.02	<0.01	<0.01	0.06	0.01	0.03
Butyl benzyl phthalate	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 7-15
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES: SURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organics:												
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	<0.01	<0.01	<0.01	0.20	0.04	0.09	0.05	0.01	0.02	0.05	0.01	0.02
Di-n-octyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dinoseb	NA	NA	NA	0.14	0.03	0.06	0.07	0.01	0.03	0.04	<0.01	0.02
Hexachlorobenzene	<0.01	<0.01	<0.01	0.08	0.02	0.04	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Hexachlorobutadiene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachlorocyclopentadiene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	0.03	0.01	0.02	0.09	<0.01	0.03	0.03	<0.01	<0.01	0.03	<0.01	<0.01
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs:												
2-Methylnaphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	0.18	0.04	0.08	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	0.17	0.03	0.07	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	0.02	<0.01	<0.01	0.01	<0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	<0.01
Fluorene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.06	0.01	0.03	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TABLE 7-15
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES: SURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
PAHs:												
Pyrene	1.25	0.26	0.56	0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Metals:												
Antimony	0.22	0.02	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.06	0.04	0.05	0.15	0.08	0.11	0.04	0.02	0.03	<0.01	<0.01	<0.01
Barium	1.20	0.75	0.95	2.56	1.28	1.81	2.74	1.36	1.93	<0.01	<0.01	<0.01
Beryllium	0.09	0.08	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.99	0.10	0.31	24.07	5.56	11.57	0.61	0.14	0.29	0.27	0.06	0.13
Chromium, total	0.54	0.02	0.11	26.36	4.50	10.89	0.65	0.11	0.27	0.25	0.04	0.10
Cobalt	0.01	<0.01	<0.01	0.23	0.10	0.15	0.03	0.01	0.02	<0.01	<0.01	<0.01
Copper	0.41	0.25	0.32	2.05	0.69	1.19	0.71	0.24	0.41	0.40	0.13	0.23
Lead	0.33	0.17	0.24	11.58	5.79	8.19	3.16	1.58	2.24	1.10	0.55	0.78
Mercury	0.74	0.15	0.33	30.68	10.23	17.71	0.79	0.26	0.46	0.12	0.04	0.07
Nickel	0.15	0.08	0.11	5.90	2.13	3.54	0.07	0.03	0.04	0.06	0.02	0.04
Selenium	1.18	0.78	0.96	1.36	0.68	0.96	0.52	0.26	0.37	0.30	0.15	0.21
Silver	<0.01	<0.01	<0.01	0.99	0.10	0.31	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Thallium	0.04	<0.01	0.01	0.32	0.06	0.14	<0.01	<0.01	<0.01	0.08	0.02	0.04
Tin	<0.01	<0.01	<0.01	0.36	0.14	0.23	0.02	<0.01	<0.01	0.09	0.04	0.06
Vanadium	0.11	0.06	0.08	40.16	20.08	28.39	7.22	3.61	5.11	1.53	0.76	1.08
Zinc	0.38	0.34	0.36	2.88	1.11	1.79	0.43	0.16	0.27	0.22	0.09	0.14

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
PAH = Polynuclear Aromatic Hydrocarbon
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-16
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES: SUBSURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organic:												
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes, total	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Semi-Volatile Organics:												
1,1'-Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,3-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,4-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromopheny phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aramite, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butyl benzyl phthalate	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 7-16
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES: SUBSURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Semi-Volatile Organics:												
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	<0.01	<0.01	<0.01	0.07	0.01	0.03	0.02	<0.01	<0.01	0.02	<0.01	<0.01
Di-n-octyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dinoseb	NA	NA	NA	0.05	0.01	0.02	0.02	<0.01	0.01	0.01	<0.01	<0.01
Hexachlorobenzene	<0.01	<0.01	<0.01	0.03	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachlorobutadiene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachlorocyclopentadiene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	0.01	<0.01	<0.01	0.03	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs:												
2-Methylnaphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TABLE 7-16
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES: SUBSURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
PAHs:												
Pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metals:												
Antimony	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.03	0.02	0.03	0.07	0.03	0.05	0.02	<0.01	0.01	<0.01	<0.01	<0.01
Barium	0.18	0.11	0.14	0.38	0.19	0.27	0.41	0.20	0.29	<0.01	<0.01	<0.01
Beryllium	0.07	0.07	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.06	<0.01	0.02	0.38	0.09	0.18	0.03	<0.01	0.01	0.02	<0.01	0.01
Chromium, total	0.18	<0.01	0.04	8.59	1.46	3.55	0.21	0.04	0.09	0.11	0.02	0.04
Cobalt	0.02	<0.01	<0.01	0.35	0.14	0.22	0.04	0.02	0.03	0.01	<0.01	<0.01
Copper	0.38	0.23	0.30	1.86	0.62	1.08	0.64	0.21	0.37	0.39	0.13	0.23
Lead	0.02	0.01	0.01	0.10	0.05	0.07	0.06	0.03	0.04	0.12	0.06	0.08
Mercury	0.60	0.12	0.27	21.09	7.03	12.18	0.64	0.21	0.37	0.09	0.03	0.05
Nickel	0.07	0.03	0.05	1.91	0.69	1.15	0.03	<0.01	0.02	0.04	0.01	0.02
Selenium	0.75	0.50	0.61	1.00	0.50	0.70	0.34	0.17	0.24	0.26	0.13	0.18
Silver	<0.01	<0.01	<0.01	0.13	0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium	0.01	<0.01	<0.01	0.12	0.02	0.05	<0.01	<0.01	<0.01	0.03	<0.01	0.01
Tin	<0.01	<0.01	<0.01	0.20	0.08	0.13	<0.01	<0.01	<0.01	0.05	0.02	0.03
Vanadium	0.15	0.08	0.11	54.50	27.25	38.54	9.80	4.90	6.93	2.07	1.04	1.47
Zinc	0.12	0.11	0.12	1.35	0.52	0.84	0.12	0.05	0.08	0.19	0.07	0.12

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
PAH = Polynuclear Aromatic Hydrocarbon
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-17
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Receptor	Habitat	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Water Ingestion Rate (L/day)		Area Use Factor
		Value	Reference	Value	Reference	Value	Reference	
Birds:								
American robin	Terrestrial	0.0785 [1]	Dunning 2008	0.01033	Allometric equation from Nagy (2001) for omnivorous birds[6]: $[0.67((BW*1000)^{0.627})]/1000$	0.01073	Allometric equation from Calder and Braun (1983) for all birds[6]: $0.059(BW)^{0.67}$	1.00
Mourning dove	Terrestrial	0.115 [2]	Dunning 2008	0.01646	Allometric equation from Nagy (2001) for all birds[6]: $[0.638((BW*1000)^{0.685})]/1000$	0.01385	Allometric equation from Calder and Braun (1983) for all birds[6]: $0.059(BW)^{0.67}$	1.00
Red-tailed hawk	Terrestrial	1.0945 [3]	Dunning 2008	0.08788	Allometric equation from Nagy (2001) for carnivorous birds[6]: $[0.849((BW*1000)^{0.663})]/1000$	0.06268	Allometric equation from Calder and Braun (1983) for all birds[6]: $0.059(BW)^{0.67}$	1.00
Mammals:								
Brown flower bat	Terrestrial	0.0183 [4]	Gannon et al. 2005	0.00257	Allometric equation from Nagy (2001) for bats[7]: $[0.365((BW*1000)^{0.671})]/1000$	0.00270	Allometric equation from Calder and Braun (1983) for all mammals[7]: $0.099(BW)^{0.90}$	1.00
Norway rat (prey item for red-tailed hawk)	Terrestrial	0.350 [5]	Jackson 1992	0.03092	Allometric equation from Nagy (2001) for rodents[8]: $[0.332((BW*1000)^{0.774})]/1000$	0.03849	Allometric equation from Calder and Braun (1983) for all mammals[8]: $0.099(BW)^{0.90}$	1.00

Notes:

BW = Body Weight
kg = kilogram
L/day = liter per day
kg/day - dry = kilogram per day - dry weight basis
USEPA = United States Environmental Protection Agency

TABLE 7-17
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(1) Mean body weight for males and females from the western United States (n = 255)
(2) Mean mean body weight for males and females from Illinois (n = 95)
(3) Mean body weight for males and females from the western United States (n = 50)
(4) Mean body weight for males and females in Puerto Rico (n = 20)
(5) The body weight shown represents the midpoint within the range of reported values (sex and location not specified).
(6) Food and drinking water ingestion rates for avian receptors were calculated using mean body weights: 0.115 kg for the mourning dove, 0.0785 kg for the American robin, and 1.0945 kg for the red-tailed hawk (Dunning, 2008).
(7) Food and drinking water ingestion rate for the brown flower bat were calculated using a mean body weight of 0.0183 kg (Gannon et al., 2005).
(8) Food and drinking water ingestion rate for the Norway rat were calculated using the midpoint within the range of reported values: 0.350 kg (Jackson, 1992).

Table References:

Calder, W.A. and E.J. Braun. 1983. Scaling of Osmotic Regulation in Mammals and Birds. Am. J. Physiol. 244:R601-R606.

Dunning, J.B., Jr. (ed.). 2008. CRC Handbook of Avian Body Masses, Second Edition. CRC Press, Boca Raton, FL. 655 pp.

Gannon, M.R., A. Kurta, A. Rodriguez-Durán, and M.R. Willig. 2005. Bats of Puerto Rico: An Island Focus and a Caribbean Perspective. Texas Tech University Press, Lubbock, TX. 239 pp.

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Nagy, K. A. 2001. Food Requirements of Wild Animals: Predictive Equations for Free-Living Mammals, Reptiles, and Birds. Nutr. Abstr. Rev. Series B. 71:21R-31R.

TABLE 7-18
DIETARY COMPOSITION FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Receptor	Dietary Composition (percent)						Soil/Sediment Ingestion (percent)	
	Terrestrial Plants	Soil Invertebrates	Small Mammals	Aquatic Invertebrates	Fish	Reference	Value	Reference
Birds:								
American robin	7.3	83.0 (1)	0	0	0	Wheelwright et al. 1986	8.7 (2)	Sample and Suter II 1994
Mourning dove	95.0	0	0	0	0	Tomlinson et al. 1994	5.0	Assumed
Red-tailed hawk	0	0	100	0	0	USEPA 1993; Sample and Suter II 1994	0	Sample and Suter II 1994
Mammals:								
Brown flower bat	100	0	0	0	0	Gannon et al. 2005	0 (3)	Assumed
Norway rat (prey item for red-tailed hawk)	49.0	49.0	0	0	0	Assumed	2.0	Assumed

Notes:

USEPA = United States Environmental Protection Agency

(1) The value shown represents the highest seasonal percentage of invertebrates in the diet of the American robin as reported by Wheelwright et al. (1986).

(2) The percentage of soil in the diet of the American robin was estimated using the relationship presented in Sample and Sutter II (1994). A diet of 83 percent earthworms extrapolates to a soil contribution of 8.7 percent to the total diet.

(3) Soil ingestion is considered negligible based on the arboreal feeding behavior of nectivorous bats.

Table References:

Beyer, N., E. Connor, and S. Gerould. 1994. Estimates of Soil Ingestion by Wildlife. Patuxent Wildlife Research Center, Lauren, MD.

Gannon, M.R., A. Kurta, A. Rodriguez-Durán, and M.R. Willig. 2005. Bats of Puerto Rico: An Island Focus and a Caribbean Perspective. Texas Tech University Press, Lubbock, TX. 239 pp.

Sample, B.E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-125.

Tomlinson, R.E., D.D. Dolton, R.R. George, and R.R. Mirarchi. 1994. Mourning Dove. In T.C. Tacha and C.E. Braun (eds), Migratory Shore and Upland Game Bird Management in North America. Int. Assoc. Fish and Wildlife Agencies, Washington, D.C. pp. 1-26.

USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

Wheelwright, N. T. 1986. The Diet of American Robins: An Analysis of U.S. Biological Survey Records. Auk. 103: 710-725.

TABLE 7-19
SOIL TO PLANT AND SOIL TO EARTHWORM BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN TERRESTRIAL PLANT AND INVERTEBRATE TISSUE: STEP 3A RISK CALCULATION
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Chemical [1]	Soil-Plant BAF (dry weight) or Uptake Equation (dry weight)			Soil-Invertebrate BAF (dry weight) or Uptake Equation (dry weight)		
	BAF Value/Uptake Equation	Source Document	Description	BAF Value/Uptake Equation	Source Document	Description
Volatile Organics:						
Ethylbenzene	3.214	USEPA 2007	Regression-based BAF [1]	2.759	USEPA 2007	Modeled BAF [8]
Toluene	4.627	USEPA 2007	Regression-based BAF [1]	3.054	USEPA 2007	Modeled BAF [8]
Semi-Volatile Organics:						
1,2,4,5-Tetrachlorobenzene	0.792	USEPA 2007	Regression-based BAF [1]	0.50	Beyer 1996	Mean BAF
Butyl benzyl phthalate	0.657	USEPA 2007	Regression-based BAF [1]	1.773	USEPA 2007	Modeled BAF [8]
Pentachlorobenzene	0.444	USEPA 2007	Regression-based BAF [1]	1.589	USEPA 2007	Modeled BAF [8]
PAHs:						
Pyrene	0.72	USEPA 2007	Median BAF [2]	0.39	Beyer and Stafford 1993	Median value
Metals:						
Barium	0.156	USEPA 2007	Median BAF [3]	0.091	USEPA 2007	Median BAF [9]
Beryllium	$\ln(C_p) = 0.7345[\ln(C_s)] - 0.5361$	USEPA 2007	Uptake equation [4]	0.045	USEPA 2007	Median BAF [9]
Cadmium	$\ln(C_p) = 0.546[\ln(C_s)] - 0.475$	USEPA 2007	Uptake equation [5]	$\ln(C_e) = 0.795[\ln(C_s)] + 2.114$	USEPA 2007	Uptake equation [10]
Chromium, total	0.041	USEPA 2007	Median BAF [3]	0.306	USEPA 2007	Median BAF [11]
Copper	$\ln(C_p) = 0.394[\ln(C_s)] + 0.668$	USEPA 2007	Uptake equation [5]	$\ln(C_e) = 0.264[\ln(C_s)] + 1.675$	Sample et al. 1998	Median BAF [12]
Lead	$\ln(C_p) = 0.561[\ln(C_s)] - 1.328$	USEPA 2007	Uptake equation [5]	$\ln(C_e) = 0.807[\ln(C_s)] - 2.18$	USEPA 2007	Uptake equation [10]
Mercury	$\ln(C_p) = 0.544[\ln[C_s]) - 0.996$	Bechtel Jacobs 1998	Uptake equation [6]	1.693	Sample et al. 1998	Median BAF [13]
Nickel	$\ln(C_p) = 0.748[\ln(C_s)] - 2.224$	USEPA 2007	Uptake equation [5]	1.059	Sample et al. 1998	Median BAF [13]
Selenium	$\ln(C_p) = 0.1.104[\ln(C_s)] - 0.678$	USEPA 2007	Uptake equation [5]	$\ln(C_e) = 0.733[\ln(C_s)] - 0.075$	USEPA 2007	Uptake equation [10]
Vanadium	0.00485	USEPA 2007	Median BAF [7]	0.042	USEPA 2007	Median BAF [9]
Zinc	$\ln(C_p) = 0.554[\ln(C_s)] + 1.575$	USEPA 2007	Uptake equation [5]	$\ln(C_e) = 0.328[\ln(C_s)] + 4.449$	USEPA 2007	Uptake equation [10]

Notes:

USEPA = United States Environmental Protection Agency
BAF = Bioaccumulation Factor (unitless)
PAH = Polynuclear Aromatic Hydrocarbon
ln = natural logarithm
C_e = Concentration in earthworm tissue (mg/kg - dry weight)
C_p = Concentration in plant tissue (mg/kg - dry weight)
C_s = 95 percent UCL of the mean concentration in soil (mg/kg - dry weight) - maximum concentration is used if 95 percent UCL of the mean concentration exceeds the maximum concentration

(1) The chemicals listed are those detected in surface and/or subsurface soil and identified as ecological COPCs for the brown flower bat, American robin, and/or mourning dove because (1) maximum exposure doses exceed toxicity reference values or (2) the chemical lacks a toxicity reference value. Non-detected chemicals identified as ecological COPCs because maximum exposure doses exceed toxicity reference values also are listed.

(2) Median BAF value for rinsed plant foliage BAF data listed in Appendix C of USEPA (2007).

(3) Median BAF value listed in Table 4a of USEPA (2007). The value corresponds to the median BAF value listed in Appendix D, Table D-1 of Bechtel Jacobs (1998).

TABLE 7-19
SOIL TO PLANT AND SOIL TO EARTHWORM BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN TERRESTRIAL PLANT AND INVERTEBRATE TISSUE: STEP 3A RISK CALCULATION
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Notes (continued):

(4) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation; see Table 4a of USEPA, 2007) derived from measured BAF data (see Appendix A, Table A-2 of USEPA, 2007).

(5) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation; see Table 4a of USEPA[2007]) developed by Bechtel Jacobs (1998) and cited in Table 4a of USEPA (2007).

(6) The concentration in plant tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) listed in Table 7 of Bechtel Jacobs (1998).

(7) Median BAF value for rinsed plant foliage BAF data listed in Appendix C of USEPA (2007).

(8) BAF value was estimated using the relationship BAF = K_{ww}/K_d where K_{ww} is the biota to soil pore water partition coefficient (L soil pore water/kg ww tissue; converted to L soil pore water/kg dw tissue by assuming 16 percent solids [USEPA, 1993] and dividing by 0.16) and K_d is the soil to pore water partition coefficient (L soil pore water/kg dw soil) (relationship developed by Jager, 1998 and cited in USEPA, 2007). Chemical-specific values for K_{ww} and K_d were derived using the following relationships:

$\log(K_{ww}) = 0.87(\log K_{ow}) - 2.0$ where K_{ow} is the octanol-water partition coefficient (K_{ow} value listed in Table 7-3)

$K_d = (f_{oc})(K_{oc})$ where f_{oc} is the fraction of organic carbon in soil (assumed to be 0.01 [one percent]) and K_{oc} is the organic carbon partition coefficient (K_{oc} value listed in Table 7-3)

(9) Median BAF value listed in Table 4a of USEPA (2007). The value corresponds to the median BAF value listed in Appendix C, Table C-1 of Sample et al. (1998).

(10) The concentration in earthworm tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) developed by Sample et al. (1998 and 1999) and cited in Table 4a of USEPA (2007).

(11) Median BAF value listed in Table 4a of USEPA (2007). The value corresponds to the median BAF value listed in Table 11 of Sample et al. (1998).

(12) The concentration in earthworm tissue was estimated using a chemical-specific bioaccumulation uptake equation (i.e., regression equation) listed in Table 12 of Sample et al. (1998).

(13) Median BAF value listed in Table 11 of Sample et al. (1998).

Table References:

Bechtel Jacobs. 1998. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Prepared for U.S. Department of Energy. BJC/OR-133. September 1998.

Beyer, W.N. 1996. Accumulation of Chlorinated Benzenes in Earthworms. Bull. Environ. Contam. Toxicol. 57:729-736.

Beyer, W. N. and C. Stafford. 1993. Survey and Evaluation of Contaminants in Earthworms and in Soils Derived from Dredged Material at Confined Disposal Facilities in the Great Lakes Region. Environ. Monit. Assess. 24:151-165.

Jager, T. 1998. Mechanistic Approach for Estimating Bioconcentration of Organic Chemicals in Earthworms. Environ. Toxicol. Chem. 17:2080-2090

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-220.

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USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

TABLE 7-20
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical [1]	Soil-Small Mammal BAF (dry weight) or Uptake Equation (dry weight)		
	BAF Value/Uptake Equation	Source Document	Description
Volatile Organics:			
Ethylbenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [1]
Toluene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [1]
Semi-Volatile Organics:			
1,2,4,5-Tetrachlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [1]
Butyl benzyl phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [2]
Pentachlorobenzene	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [1]
Metals:			
Beryllium	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [1]
Lead	0.0659	Sample et al. 1998	Median BAF for omnivores [3]
Vanadium	0.01037	Sample et al. 1998	Median BAF for omnivores [3]

Notes:

BAF = Bioaccumulation Factor
C_m = Concentration in small mammal tissue (mg/kg - dry weight)
BAF_d = diet-to-small mammal bioaccumulation factor (wet weight)
DI = Small mammal dietary intake (mg/kg-BW/day)

[1] The chemicals listed are those detected in surface and/or subsurface soil and identified as ecological COPCs for the red-tailed hawk because (1) maximum exposure doses exceed toxicity reference values or (2) the chemical lacks a toxicity reference value. Non-detected chemicals identified as ecological COPCs because maximum exposure doses exceed toxicity reference values also are listed.

[2] Most chemical exposure for small mammals is via the diet. Therefore, it is assumed that the concentration of the chemical in the tissue of small mammals is equal to the chemical concentration in its diet multiplied by a diet-to-whole body BAF (BAF_d - wet weight basis). In the absence of literature-based diet-to whole-body BAF, a value of 1.0 was assumed. The resulting tissue concentration was converted to a dry weight basis using an estimated solids content for small mammals of 0.32 (USEPA, 1993). Additional explanation if provided in Section 7.5.2.2.1.

[3] Median BAF value for omnivores listed in Appendix C, Table C-1 of Sample et al. (1998).

Table References:

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter II. 1998. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-219.

United States Environmental Protection Agency (USEPA). 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.2007.

TABLE 7-21
FREQUENCY AND RANGE OF SURFACE SOIL DATA (95 PERCENT UCL OF THE MEAN CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES
SWMU 69 - AIRCRAFT PARKING AREA
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Analyte [1]	Contaminant Frequency/Range						Soil Screening Values (SSV)	Reference [4]	95% UCL HQ [5]
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	95% UCL of the Mean [2]	Value used in Step 2 Screen [3]			
Volatile Organic Compounds (µg/kg)									
4-Methyl-2-pentanone (MIBK)	1/25	7.7J - 7.7J	1.6U - 22UJ	2.5220	--	7.7	NE	---	--
Acetone	16/23	9.1J - 260	5.8U - 33UJ	70.8239	101.00	260	NE	---	NA
Metals (mg/kg)									
Barium	25/25	14 - 800	ND	77.8400	225.70	800	330	USEPA 2005c	0.68
Cadmium	24/25	0.051J - 36J	0.039UJ - 0.039UJ	3.2381	18.58	36	32	USEPA 2005e	0.58
Chromium	25/25	15J - 89J	ND	35.6400	42.19	89	57	USEPA 2008	0.74
Cobalt	25/25	5.7 - 18	ND	10.3360	11.61	18	13	USEPA 2005f	0.89
Copper	25/25	16 - 130J	ND	47.1600	58.37	130	70	USEPA 2007c	0.83
Lead	25/25	0.71 - 520	ND	57.5016	100.40	520	120	USEPA 2005g	0.84
Mercury	25/25	0.0066J - 0.16	ND	0.0394	0.05	0.16	0.1	Efroymson et al. 1997a	0.55
Selenium	21/25	0.13J - 1.8	0.13U - 0.18U	0.3816	0.52	1.8	0.52	USEPA 2007e	1.01
Vanadium	25/25	46J - 280	ND	116.3600	136.70	280	20	USEPA 2005h	6.84
Zinc	25/25	9 - 650	ND	77.4400	113.70	650	120	USEPA 2007f	0.95

Notes:

µg/kg = microgram per kilogram
COPC = Chemical of Potential Concern
HQ = Hazard Quotient
J = Estimated Value
mg/kg = milligram per kilogram
NA = Not Available
ND = Not Detected
SSV = Soil Screening Value
U = Not Detected
UJ = Not detected, estimated value
USEPA = United States Environmental Protection Agency

(1) The analytes shown are those that were detected in surface soil and identified as ecological COPCs by the Step 2 screening level risk calculation, and non-detected chemicals identified as COPCs because maximum detection limits exceed soil screening values.

(2) 95% Upper Conficence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).

(3) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(4) See Table 7-4 for reference citations.

(5) The 95% UCL HQ is the 95% UCL of the mean concentration divided by the screening value.

(6) Low molecular weight PAHs are defined by the USEPA (2007b) as PAH compounds composed of fewer than four rings. The low molecular weight PAH compounds analyzed for in SWMU soil were 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene. Value was calculated by summing maximum detected concentration in site soil for each chemical. Maximum method detection limit was used if there were no d

(7) High molecular weight PAHs are defined by the USEPA (2007b) as PAH compounds composed of four or more rings. The high molecular weight PAH compounds analyzed for in SWMU soil were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene. Value was calculated by summing maximum detected concentration in site soil for each chemical. Maximu method detection limits were used for non-detected PAHs.

Table References:

USEPA. 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm

TABLE 7-22
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]				Mean/Median of the Distribution	Right Tail of the Distribution [8]	
													Quantile Test	Slippage Test
Barium	SWMU 69	25/25	14 - 800	ND	77.84	33.91	225.70	--	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p < 0.0001)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[11], G(6.215)>Z(1.645), Elevated at α = 0.06	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	40/40	3.5 - 284	ND	86.23	11.63	111.80	233.30	Not normal at α = 0.05 (p = 0.0006)	Not lognormal at α = 0.05 (p = 0.0325)				
Beryllium	SWMU 69	25/25	0.037J - 0.35	ND	0.10	0.02	0.13	--	Not normal at α = 0.05 (p = 0.0001)	Lognormal at α = 0.05 (p = 0.0682)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[11], G(-2.378)<Z(1.645), Not elevated at α = 0.05	Test was not performed [16]	Not elevated at α = 0.05
	NAPR Background	35/37	0.052B - 0.81	0.04U - 0.1U	0.29	0.03	0.34	0.65	Not normal at α = 0.05 (p = 0.0377)	Not lognormal at α = 0.05 (p = 0.0294)				
Cadmium	SWMU 69	24/25	0.051J - 36J	0.039UJ - 0.039UJ	3.24	1.54	18.58	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan[12], G(5.289)>Z(1.645), Elevated at α = 0.05	Test was not performed [16]	Test was not performed [17]
	NAPR Background	13/40	0.099J - 0.92J	0.059U - 1.2U	0.25	0.03	0.28	0.65	Test was not performed [9]	Test was not performed [9]				
Chromium	SWMU 69	25/25	15J - 89J	ND	35.64	3.83	42.19	--	Not normal at α = 0.05 (p = 0.0003)	Lognormal at α = 0.05 (p = 0.2342)	Variances are not equal at α = 0.05 (p = 0.0154)	Satterthwaite t-test [13]; Elevated at α = 0.05 (p = 0.0079); Power = 0.7915	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	3.9 - 101J	ND	28.04	3.40	34.05	69.42	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.3681)				
Cobalt	SWMU 69	25/25	5.7 - 18	ND	10.34	0.74	11.61	--	Normal at α = 0.05 (p = 0.0564)	Lognormal at α = 0.05 (p = 0.2032)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[11], G(-1.541)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	36/37	0.83B - 64	1.2U - 1.2U	16.60	2.26	26.47	44.13	Not normal at α = 0.05 (p = 0.0006)	Not lognormal at α = 0.05 (p = 0.0443)				
Copper	SWMU 69	25/25	16 - 130J	ND	47.16	6.29	58.37	--	Not normal at α = 0.05 (p = 0.0003)	Lognormal at α = 0.05 (p = 0.3437)	Variances are equal at α = 0.05 (p = 0.2422)	Two sample t-test [14]; Not elevated at α = 0.05 (p = 0.9997); Power < 0.0001	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	36/36	13N - 260J	ND	95.07	10.85	115.00	225.21	Not normal at α = 0.05 (p = 0.0030)	Lognormal at α = 0.05 (p = 0.6148)				
Lead	SWMU 69	25/25	0.71 - 520	ND	57.50	22.97	100.40	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.9355)	Variances are not equal at α = 0.05 (p = 0.0010)	Satterthwaite t-test [13]; Elevated at α = 0.05 (p = 0.0002); Power = 0.9857	Elevated at α = 0.05	Elevated at α = 0.05
	NAPR Background	37/37	0.27J - 21J	ND	5.80	0.92	9.84	17.05	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.0504)				
Mercury	SWMU 69	25/25	0.0066J - 0.16	ND	0.04	0.01	0.0547	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan[12], G(-0.339)<Z(1.645), Not elevated at α = 0.05	Test was not performed [16]	Not elevated at α = 0.05
	NAPR Background	23/39	0.012B - 0.12J	0.0051UJ - 0.06U	0.04	0.00	0.0462	0.10	Test was not performed [9]	Test was not performed [9]				
Nickel	SWMU 69	25/25	4.0 - 34	ND	11.21	1.31	13.40	--	Not normal at α = 0.05 (p = 0.0001)	Lognormal at α = 0.05 (p = 0.5131)	Variances are not equal at α = 0.05 (p = 0.0120)	Satterthwaite t-test [13]; Elevated at α = 0.05 (p = 0.0180); Power = 0.6826	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	1.1J - 35.6	ND	9.25	1.15	14.25	23.20	Not normal at α = 0.05 (p = 0.0002)	Lognormal at α = 0.05 (p = 0.4024)				
Selenium	SWMU 69	21/25	0.13J - 1.8	0.13U - 0.18U	0.38	0.07	0.52	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [15]	Test was not performed [16]	Not elevated at α = 0.05
	NAPR Background	11/40	0.22J - 3.8J	0.13UJ - 2.1UJ	0.58	0.10	NA	1.85	Test was not performed [9]	Test was not performed [9]				
Vanadium	SWMU 69	25/25	46J - 280	ND	116.36	11.34	136.70	--	Not normal at α = 0.05 (p = 0.0063)	Lognormal at α = 0.05 (p = 0.9106)	Variances are equal at α = 0.05 (p = 0.1231)	Two sample t-test [11]; Not elevated at α = 0.05 (p = 0.9925); Power < 0.0001	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	25 - 410	ND	175.98	15.72	201.40	367.18	Not normal at α = 0.05 (p = 0.0110)	Lognormal at α = 0.05 (p = 0.0790)				
Zinc	SWMU 69	25/25	9 - 650	ND	77.44	26.38	113.70	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.1897)	Variances are equal at α = 0.05 (p = 0.2909)	Two sample t-test [11]; Not elevated at α = 0.05 (p = 0.2615); Power = 0.1564	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/38	3.9 - 140J	27U - 27U	47.22	5.35	70.61	113.23	Not normal at α = 0.05 (p = 0.0059)	Lognormal at α = 0.05 (p = 0.1774)				

TABLE 7-22
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL (2008)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes:

J = Estimated value
U = Not detected
UJ = Not detected, estimated value
NA = Not applicable
ND = Not detected
SE = Standard error
95% UCL = 95 percent Upper Confidence Limit of the mean

(1) Background airfield soil data taken from Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. (Baker, 2010).

(2) Units in mg/kg.

(3) For those data sets with non-detected results, one-half non-detected values were used in the calculation of mean concentrations.

(4) 95% Upper Conficence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).

(5) Upper limit of the mean concentration is equal to the mean plus two standard deviations.

(6) Normality and lognormality verified by the Shapiro-Wilks test. For a given metal, tests for normality and lognormality were performed if each individual data set (SWMU 69 and and background) has less than fifteen percent non-detected results (NFESC, 2002).

(7) Homogeneity of variance verified by F test. For a given metal, the test for homogeneity of variance was performed if each individual data set (SWMU 69 and background) has less than forty percent non-detected results (NFESC, 2002).

(8) Quantile and slippage tests only determine if a particular inorganic chemical is likely present at equivalent or elevated concentrations relative to background (NFESC, 2002).

(9) Test for normality/lognormality were not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds fifteen percent (NFESC, 2002).

(10) Test for homogeneity of variance was not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds forty percent (NFESC, 2002).

(11) The Gehan test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) the data sets are not both normally or both lognormally distributed; and (c) the SWMU 69 and background data sets do not have equal variances (NFESC, 2002).

(12) The Gehan test was used because the number of non-detected results in the SWMU 69 and/or background data set was greater than 40 percent and the number of non-detected results in the combined data set is less than fifty percent (NFESC, 2002).

(13) Satterthwaite t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data set (SWMU 69 and background); (b) each data set has a normal or lognormal distribution; and (c) the SWMU 69 and background data set variances are not equal (NFESC, 2002).

(14) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) each data set exhibits either a normal or lognormal distribution; and (c) the SWMU 69 and background data set distributions have equal variances (NFESC, 2002).

(15) Statistical evaluation of the mean/median of the distributions was not performed because there are greater than fifty percent non-detected results in the combined SWMU 69 and background data sets (NFESC, 2002).

(16) Quantile test was not performed because non-detected results within the SWMU 69 and/or background data set are greater than the smallest of the "r" largest detected results in the combined data set.

(17) The slippage test was not performed because the largest detected result for the background data set is less than the largest non-detected result (NFESC, 2002).

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Naval Facilities Engineering Service Center (NFESC). 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-209-ENV. April 2002.

USEPA, 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-23
COMPARISON OF SWMU 69 AND BACKGROUND SUBSURFACE SOIL ANALYTICAL DATA FOR INORGANIC (2008)
ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Ecological COPC [1]	SWMU 69 Contaminant Frequency/Range				Background Frequency/Range [2][3]				Is Maximum SWMU Concentration greater than the Upper Limit of the Mean Background Concentration?
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	No. of Positive Detects/No. of Samples	Range of Positive Detections	Range of Non-Detects	Upper Limit of the Mean Concentration	
Metals (mg/kg)									
Beryllium	5/5	0.16 - 0.27	NA	0.226	35/37	0.052B - 0.81	0.04U - 0.1U	0.65	No
Chromium	5/5	17 - 29	NA	21.8	37/37	3.9 - 101J	NA	69.42	No
Cobalt	5/5	7.9 - 27	NA	14.6	36/37	0.83B -64	1.2U -1.2U	44.13	No
Copper	5/5	72J - 110	NA	90.8	36/36	13N - 260J	NA	225.21	No
Mercury	5/5	0.024 - 0.11	NA	0.062	23/39	0.012B - 0.12J	0.0051UJ - 0.06U	0.10	Yes
Nickel	5/5	4.6 - 11	NA	8.18	37/37	1.1J - 35.6	NA	23.20	No
Selenium	5/5	0.17J - 1.2	NA	0.528	11/40	0.22J - 3.8J	0.13UJ - 2.1UJ	1.85	No
Vanadium	5/5	170 - 380	NA	244	37/37	25 - 410	NA	367.18	Yes
Zinc	5/5	26 - 82	NA	55.4	37/38	3.9 - 140J	27U -27U	113.23	No

Notes:

COPC = Chemical of Potential Concern
mg/kg = milligram per kilogram
B = The compound was detected at a concentration less than the reporting limit, but greater than the method detection limit
U = Not Detected
UJ = Not Detected (estimated value)
J = Detected (estimated value)
NA = Not Applicable

[1] The chemicals listed are those identified as ecological COPCs for terrestrial invertebrates and plants and/or avian food web exposures in Step 2 of the screening level ecological risk assessment.
[2] Background subsurface soil analytical data taken from Addendum B of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds(Baker, 2010).
[3] The descriptive statistics shown are for the background subsurface soil data set classified as "clay".

Table References:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Ricc. July 30, 2010.

TABLE 7-24
HAZARD QUOTIENT VALUES FOR MAMMALIAN DIETARY EXPOSURES TO CHEMICALS (2008)
IN SURFACE SOIL: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat [1]		
	NOAEL	LOAEL	MATC
Semi-Volatile Organics:			
1,2,4,5-Tetrachlorobenzene	NA	NA	NA
PAHs:			
Pyrene	0.19	0.04	0.09
Metals:			
Barium	0.10	0.06	0.08
Selenium	0.09	0.06	0.07

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
PAH = Polynuclear Aromatic Hydrocarbon
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

[1] Hazard quotient values are based on 95 percent upper confidence limit of the mean concentrations.

TABLE 7-25
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS (2008)
IN SURFACE SOIL: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin [1]			Mourning dove [1]			Red-tailed hawk [1]		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Volatile Organic:									
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organics:									
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals:									
Barium	0.25	0.12	0.18	0.31	0.15	0.22	0.04	0.02	0.03
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	6.45	1.49	3.10	0.37	0.09	0.18	0.15	0.03	0.07
Chromium, total	0.72	0.12	0.30	0.20	0.03	0.08	0.11	0.02	0.05
Copper	0.61	0.20	0.35	0.43	0.14	0.25	0.27	0.09	0.16
Lead	1.04	0.52	0.73	0.73	0.37	0.52	0.17	0.02	0.05
Mercury	0.44	0.15	0.25	0.41	0.14	0.24	<0.01	<0.01	<0.01
Nickel	0.25	0.09	0.15	0.03	0.01	0.02	0.03	0.01	0.02
Selenium	0.25	0.12	0.17	0.13	0.06	0.09	0.14	0.07	0.10
Vanadium	6.39	3.20	4.52	3.11	1.55	2.20	0.33	0.17	0.23
Zinc	0.70	0.27	0.43	0.14	0.06	0.09	0.15	0.06	0.09

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

[1] Hazard quotient values for metals are based on 95 percent upper confidence limit of the mean concentrations.

TABLE 7-26
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS (2008)
IN SUBSURFACE SOIL: STEP 3A RISK CALCULATION
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin [1]			Mourning dove [1]			Red-tailed hawk [1]		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Metals:									
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, total	0.49	0.08	0.20	0.14	0.02	0.06	0.08	0.01	0.03
Copper	0.84	0.28	0.49	0.61	0.20	0.35	0.30	0.10	0.17
Mercury	0.87	0.29	0.50	0.61	0.20	0.35	0.02	<0.01	0.01
Nickel	0.21	0.08	0.13	0.02	<0.01	0.01	0.02	<0.01	0.01
Vanadium	17.77	8.88	12.56	8.63	4.32	6.10	0.92	0.46	0.65
Zinc	0.62	0.24	0.39	0.12	0.05	0.07	0.06	0.02	0.03

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

[1] Hazard quotient values are based on maximum concentrations due to the low size of the SWMU 69 subsurface soil data set (n = 5).

TABLE 7-27
SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN AND ECOLOGICAL CHEMICALS OF CONCERN: 2008 DATA
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Lower Trophic Level Receptor Groups			Upper Trophic Level Receptor Groups			
				Mammalian		Avian	
Chemicals	**Surface Soil**	**Subsurface Soil**	**Groundwater**	**Surface Soil**	**Subsurface Soil**	**Surface Soil**	**Subsurface Soil**
Ecological Chemicals of Concern Recommended for Corrective Action Measures [1]	Barium Lead Zinc	None	None	None	None	Barium Cadmium Lead Zinc	None
Ecological Chemicals of Potential Concern Not Recommended for Further Evaluation Based on Step 3a of the Baseline Ecological Risk Assessment	4-Methyl-2-pentanone Acetone Barium Cadmium Chromium Cobalt Copper Lead Mercury Selenium Vanadium Zinc 25 non-detected VOCs [2] 57 non-detected SVOCs [2]	Acetone Carbon Disulfide Cobalt Copper Mercury Selenium Vanadium 24 non-detected VOCs [3] 54 non-detected SVOCs [3]	6 non-detected VOCs [4] 18 non-detected SVOCs [4]	Pyrene 1,2,4,5-Tetrachlorobenzene Barium Selenium 4 non-detected VOCs [5] 21 non-detected SVOCs [5]	4 non-detected VOCs [6] 21 non-detected SVOCs [6]	Ethylbenzene Toluene 1,2,4,5-Tetrachlorobenzene Butyl benzyl phthalate Pentachlorobenzene Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Vanadium 10 non-detected VOCs [5] 26 non-detected SVOCs [5]	Beryllium Chromium Copper Mercury Nickel Vanadium Zinc 12 non-detected VOCs [6] 29 non-detected SVOCs [6]

Notes:

SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

[1] Ecological chemicals of concern were identified based on the evaluations presented in Sections 7.9.1.1 through 7.9.1.4. The specific lines of evidence used to exclude ecological chemicals of potential concern from the list of ecological chemi is provided within these sections.
[2] See Table 7-12 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for surface soil.
[3] See Table 7-13 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for subsurface soil.
[4] See Table 7-14 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for groundwater.
[5] See Table 7-15 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for dietary exposures to chemicals in surface soil.
[6] See Table 7-16 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for dietary exposures to chemicals in subsurface soil.

TABLE 7-28
PRELIMINARY ASSESSMENT ENDPOINTS, RISK QUESTIONS, AND MEASUREMENT ENDPOINTS (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Assessment Endpoints	Risk Questions	Measurement Endpoints
Terrestrial Habitat: Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-related chemical concentrations in surface and subsurface soil sufficient to adversely affect terrestrial soil invertebrate communities?	Comparison of maximum chemical concentrations in surface and subsurface soil with soil screening values.
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related chemical concentrations in surface and subsurface soil sufficient to adversely affect terrestrial plant communities?	Comparison of maximum chemical concentrations in surface and subsurface soil with soil screening values.
Survival, growth, and reproduction of flying mammalian herbivores (i.e., bats).	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to flying mammal species (i.e., bats) that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.
Survival, growth, and reproduction of terrestrial avian herbivores.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.
Survival, growth, and reproduction of terrestrial avian omnivores.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume terrestrial plants and soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.
Survival, growth, and reproduction of terrestrial avian carnivores.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.

TABLE 7-28
PRELIMINARY ASSESSMENT ENDPOINTS, RISK QUESTIONS, AND MEASUREMENT ENDPOINTS (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Assessment Endpoints	Risk Questions	Measurement Endpoints
Terrestrial Habitat (continued): Survival, growth, and reproduction of terrestrial amphibian and reptile communities.	Are site-related chemical concentrations in surface and subsurface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to terrestrial reptiles?	Qualitative examination of exposures and risks to ecological receptors occupying similar trophic levels.
Wetland Habitat: Survival, growth, and reproduction of aquatic invertebrate communities.	Are site-related chemical concentrations in wetland sediment sufficient to adversely affect aquatic invertebrate communities?	Comparison of maximum chemical concentrations in sediment with sediment screening values.
Survival, growth, and reproduction of aquatic plant communities.	Are site-related chemical concentrations in wetland sediment sufficient to adversely affect aquatic plant communities?	Comparison of maximum chemical concentrations in sediment with sediment screening values.
Survival, growth, and reproduction of amphibian communities.	Are site-related chemical concentrations in wetland sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to aquatic amphibians?	Comparison of maximum chemical concentrations in sediment with sediment screening values.
Survival, growth, and reproduction of avian invertivores	Are site-related chemical concentrations in wetland sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian invertivore species that may consume aquatic invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in wetland sediment.

TABLE 7-29
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value [1]	Reference	Comment [2]
Metals (mg/kg):			
Antimony	2.00	Long and Morgan 1991	Effects Range-Low
Arsenic	9.79	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Barium	20.0	MacDonald et al. 2003	Threshold Effect Concentration
Beryllium	NA	---	---
Cadmium	0.99	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Chromium, total	43.4	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Cobalt	50.0	MacDonald et al. 2003	Threshold Effect Concentration
Copper	31.6	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Lead	35.8	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Mercury	0.18	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Nickel	22.7	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Selenium	2.00	Lemley 2002 (as cited in USEPA 2007)	USEPA Region 3 BTAG screening value
Silver	1.00	MacDonald et al. 2003	Threshold Effect Concentration
Thallium	NA	---	---
Tin	3.40 [3]	Buchman 2008	Minimum Apparent Effects Threshold (Neanthes bioassays)
Vanadium	57.0 [3]	Buchman 2008	Minimum Apparent Effects Threshold (infaunal community impacts)
Zinc	121	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration

Notes:

NA = Not Available
mg/kg = milligram per kilogram
USEPA = United States Environmental Protection Agency

[1] The values shown are freshwater screening values unless otherwise noted.

[2] EqP-based sediment screening values calculated using USEPA (1993 and 1996) methodology: $SV_{sed} = (K_{oc})(f_{oc})(SV_{sw})$ where K_{oc} is the organic carbon partition coefficient (L/kg), f_{oc} is the fraction of organic carbon (unitless), and SV_{sw} is the surface water screening value (ug/L). An f_{oc} of 0.01 was assumed.

[3] The chemical lacks a freshwater bulk sediment screening value. The value shown is a marine/estuarine bulk sediment screening valaue.

Table References:

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables. NOAA OR&R Report 08-1. National Oceanic and Atmospheric Administration, Office of Response and Restoration Division, Seattle, WA.

Lemley, A.D. 2002. Selenium Assessment in Aquatic Ecosystems. U.S. Forest Service, Blacksburg, VA.

TABLE 7-29
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table References (continued):

Long, E.R. and L.G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. National Oceanic and Atmospheric Administration, Seattle, WA. NOAA Technical Memorandum NOS OMA 52.

MacDonald, D.D, C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, G. Sloane, and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Prepared for Florida Department of Environmental Protection, Tallahassee, Florida. January 2003.

MacDonald, D.D., C.G. Ingersoll, T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

United States Environmental Protection Agency (USEPA). 2007. Freshwater sediment screening Benchmarks Table. http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm.

USEPA. 1996. Ecotox Thresholds. Eco Update, Volume 3, Number 2. Office of Solid Waste and Emergency Response, Washington, D.C. EPA/F-95/038.

USEPA. 1993. Technical Basis for Deriving Sediment Quality Criteria for Nonionic Organic Contaminants for the Protection of Benthic Organisms by Using Equilibrium Partitioning. Office of Water, Washington, D.C. EPA-822-R-93-011.

TABLE 7-30
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Soil Screening Values (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]					
Inorganics (mg/kg)										
Antimony	0/52	ND	2U - 3.2U	1.230	3.2	78.0	USEPA 2005a	0.04	No	HQ < 1.0
Arsenic	52/52	0.65 -6.2	ND	2.729	6.2	18.0	USEPA 2005b	0.34	No	HQ < 1.0
Barium	52/52	9J -470J	ND	41.783	470	330	USEPA 2005c	1.42	Yes	HQ > 1.0
Beryllium	36/52	0.056J -0.29	0.1U - 0.14U	0.122	0.29	40.0	USEPA 2005d	<0.01	No	HQ < 1.0
Cadmium	46/52	0.044J -5.3	0.1U - 0.13U	0.543	5.3	32.0	USEPA 2005e	0.17	No	HQ < 1.0
Chromium	52/52	4.2 -68	ND	22.658	68	57.0	USEPA 2008	1.19	Yes	HQ > 1.0
Cobalt	52/52	0.61 -64	ND	10.029	64	13.0	USEPA 2005f	4.92	Yes	HQ > 1.0
Copper	52/52	3 -120	ND	50.527	120	70.0	USEPA 2007c	1.71	Yes	HQ > 1.0
Lead	51/51	0.25J -71J	ND	9.316	71	120	USEPA 2005g	0.59	No	HQ < 1.0
Mercury	36/46	0.0086J -0.18	0.02U - 0.034UJ	0.051	0.18	0.10	Efroymson et al. 1997a	1.80	Yes	HQ > 1.0
Nickel	52/52	1.2J -19	ND	7.089	19	38.0	USEPA 2007d	0.50	No	HQ < 1.0
Selenium	12/52	0.58J -2.1	1U - 1.6U	0.700	2.1	0.52	USEPA 2007e	4.04	Yes	HQ > 1.0
Silver	4/52	0.15J -0.27	0.2U - 0.32U	0.128	0.27	560	USEPA 2006	<0.01	No	HQ < 1.0
Thallium	22/52	0.054J -0.32J	0.41U - 0.6U	0.186	0.32	1.00	Efroymson et al. 1997b	0.32	No	HQ < 1.0
Tin	0/52	ND	20U - 32U	12.298	32	50.0	Efroymson et al. 1997b	0.64	No	HQ < 1.0
Vanadium	52/52	9 -550	ND	145.731	550	20.0	USEPA 2005h	27.50	Yes	HQ > 1.0
Zinc	51/52	4.9 -200	4.3U - 4.3U	33.716	200	120	USEPA 2007f	1.67	Yes	HQ > 1.0

Notes:
USEPA = United States Environmental Protection Agency
COPC = Chemical of Potential Concern
SSV = Soil Screening Value
USEPA = United States Environmental Protection Agency
mg/kg = milligram per kilogram
HQ = Hazard Quotient
ND = Not Detected
U = Not Detected
UJ = Not detected, estimated value
J = Estimated Value

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).
(2) See Table 7-4 for reference citations.
(3) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum method detection limit for non-detected chemicals) divided by the screening value.

TABLE 7-31
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Contaminant Frequency/Range									
Analyte	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Soil Screening Values (SSV)	Reference (2)	Max. HQ (2)	Ecological COPC?	Comments
Inorganics (mg/kg)										
Antimony	0/104	ND	2.1UJ - 3.2UJ	1.247	3.2	78.0	USEPA 2005a	0.04	No	HQ < 1.0
Arsenic	104/104	0.27J - 5.9	ND	1.502	5.9	18.0	USEPA 2005b	0.33	No	HQ < 1.0
Barium	104/104	7.1 - 270J	ND	46.380	270	330	USEPA 2005c	0.82	No	HQ < 1.0
Beryllium	91/104	0.055J - 0.45	0.11U - 0.16U	0.169	0.45	40.0	USEPA 2005d	0.01	No	HQ < 1.0
Cadmium	61/104	0.031J - 0.27	0.11U - 0.14U	0.074	0.27	32.0	USEPA 2005e	<0.01	No	HQ < 1.0
Chromium	103/103	3J - 53J	ND	15.942	53	57.0	USEPA 2008	0.93	No	HQ < 1.0
Cobalt	103/103	0.38 - 34	ND	8.990	34	13.0	USEPA 2005f	2.62	Yes	HQ > 1.0
Copper	104/104	8.1J - 280	ND	87.972	280	70.0	USEPA 2007c	4.00	Yes	HQ > 1.0
Lead	103/103	0.44J - 9.7J	ND	2.457	9.7	120	USEPA 2005g	0.08	No	HQ < 1.0
Mercury	82/92	0.01J - 0.18	0.02U - 0.03U	0.057	0.18	0.10	Efroymson et al. 1997a	1.80	Yes	HQ > 1.0
Nickel	102/104	0.76J - 11	1.3U - 1.4U	5.092	11	38.0	USEPA 2007d	0.29	No	HQ < 1.0
Selenium	33/104	0.63J - 2.2	1U - 1.6U	0.765	2.2	0.52	USEPA 2007e	4.23	Yes	HQ > 1.0
Silver	5/104	0.17J - 0.96	0.21U - 0.32U	0.141	0.96	560	USEPA 2006	<0.01	No	HQ < 1.0
Thallium	61/104	0.06J - 0.23J	0.42U - 0.64U	0.167	0.23	1.00	Efroymson et al. 1997b	0.23	No	HQ < 1.0
Tin	0/104	ND	21U - 32U	12.466	32	50.0	Efroymson et al. 1997b	0.64	No	HQ < 1.0
Vanadium	102/102	48 - 580	ND	219.618	580	20.0	USEPA 2005h	29.00	Yes	HQ > 1.0
Zinc	98/104	5.4 - 100J	4.9U - 5.6U	28.637	100	120	USEPA 2007f	0.83	No	HQ < 1.0

Notes:

COPC = Chemical of Potential Concern
SSV = Soil Screening Value
USEPA = United States Environmental Protection Agency

mg/kg = milligram per kilogram
HQ = Hazard Quotient
ND = Not Detected

U = Not Detected
UJ = Not detected, estimated value
J = Estimated Value

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).
(2) See Table 7-4 for reference citations.
(3) For a given chemical, the Hazard Quotient (HQ) is the maximum detected concentration (or maximum method detection limit for non-detected chemicals) divided by the screening value.

TABLE 7-32
FREQUENCY AND RANGE OF PEM WETLAND SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Freshwater Sediment Screening Values (SDSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen [1]					
Inorganics (mg/kg)										
Antimony	0/14	ND	3.2U - 6.2UJ	2.079	6.2	2.0	Long and Morgan 1991	3.10	Yes	HQ > 1.0
Arsenic	14/14	1 - 4.8J	NA	2.807	4.8	9.8	MacDonald et al. 2000	0.49	No	HQ < 1.0
Barium	14/14	24J - 140J	NA	70.000	140	20.0	MacDonald et al. 2003	7.00	Yes	HQ > 1.0
Beryllium	14/14	0.098J - 0.33J	NA	0.203	0.33	NE	---	NA	Yes	No SDSV
Cadmium	14/14	0.38 - 24J	NA	5.079	24	1.0	MacDonald et al. 2000	24.24	Yes	HQ > 1.0
Chromium	14/14	10 - 99J	NA	35.857	99	43.4	MacDonald et al. 2000	2.28	Yes	HQ > 1.0
Cobalt	14/14	5.6J - 20J	NA	12.157	20	50.0	MacDonald et al. 2003	0.40	No	HQ < 1.0
Copper	14/14	38J - 160J	NA	101.286	160	31.6	MacDonald et al. 2000	5.06	Yes	HQ > 1.0
Lead	14/14	6.4 - 680J	NA	115.950	680	35.8	MacDonald et al. 2000	18.99	Yes	HQ > 1.0
Mercury	14/14	0.045 - 0.14J	NA	0.072	0.14	0.2	MacDonald et al. 2000	0.78	No	HQ < 1.0
Nickel	14/14	5.2 - 34J	NA	11.457	34	22.7	MacDonald et al. 2000	1.50	Yes	HQ > 1.0
Selenium	6/14	0.85J - 1.3J	1.8U - 3.1UJ	1.118	1.3	2.0	Lemley 2002 (as cited in USEPA 2007)	0.65	No	HQ < 1.0
Silver	3/14	0.25J - 0.7J	0.32U - 0.62UJ	0.259	0.7	1.0	MacDonald et al. 2003	0.70	No	HQ < 1.0
Thallium	1/14	0.11J - 0.11J	0.32U - 0.62UJ	0.199	0.11	NE	---	NA	Yes	No SDSV
Tin	0/14	ND	32U - 62UJ	20.786	62	3.4	Buchman 2008	18.24	Yes	HQ > 1.0
Vanadium	14/14	67J - 370J	NA	203.357	370	57.0	Buchman 2008	6.49	Yes	HQ > 1.0
Zinc	14/14	40 - 490J	NA	135.357	490	121.0	MacDonald et al. 2000	4.05	Yes	HQ > 1.0

Notes:

COPC = Chemical of Potential Concern
HQ = Hazard Quotient
SDSV = Sediment Screening Value
USEPA = United States Environmental Protection Agency

J = Estimated value
U = Not detected
UJ = Not detected, estimated value

mg/kg = milligram per kilogram
NA = Not Applicable
ND = Not Detected

[1] Maximum detected concentration (or maximum method detection limit for non-detected chemicals).
[2] See Table 7-4 for reference citations.
[3] For a given chemical, the hazard quotient (HQ) is the maximum detected concentration (or maximum method detection limit for non-detected chemicals) divided by the sediment screening value.

TABLE 7-33
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES TO CHEMICALS IN SURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Metals:												
Antimony	0.34	0.03	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.06	0.04	0.05	0.17	0.09	0.12	0.05	0.02	0.03	<0.01	<0.01	<0.01
Barium	0.70	0.44	0.56	1.51	0.75	1.06	1.61	0.80	1.14	<0.01	<0.01	<0.01
Beryllium	0.08	0.07	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.35	0.03	0.11	5.20	1.20	2.50	0.18	0.04	0.08	0.10	0.02	0.05
Chromium, total	0.41	0.02	0.08	20.14	3.43	8.32	0.50	0.08	0.21	0.20	0.03	0.08
Cobalt	0.04	0.01	0.02	0.83	0.34	0.53	0.09	0.04	0.06	0.04	0.02	0.02
Copper	0.40	0.24	0.31	1.96	0.65	1.13	0.67	0.23	0.39	0.40	0.13	0.23
Lead	0.11	0.06	0.08	1.75	0.87	1.24	0.58	0.29	0.41	0.46	0.23	0.32
Mercury	0.79	0.16	0.35	34.51	11.50	19.93	0.85	0.28	0.49	0.14	0.05	0.08
Nickel	0.10	0.05	0.07	3.30	1.19	1.98	0.04	0.02	0.03	0.05	0.02	0.03
Selenium	1.39	0.93	1.14	1.53	0.77	1.08	0.62	0.31	0.44	0.32	0.16	0.22
Silver	<0.01	<0.01	<0.01	0.50	0.05	0.16	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium	0.03	<0.01	<0.01	0.25	0.05	0.11	<0.01	<0.01	<0.01	0.06	0.01	0.03
Tin	<0.01	<0.01	<0.01	1.26	0.51	0.80	0.06	0.02	0.04	0.31	0.13	0.20
Vanadium	0.22	0.11	0.16	78.88	39.44	55.78	14.19	7.09	10.03	3.00	1.50	2.12
Zinc	0.20	0.18	0.19	1.85	0.72	1.15	0.21	0.08	0.13	0.21	0.08	0.13

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-34
HAZARD QUOTIENT VALUES FOR MAMMALIAN AND AVIAN DIETARY EXPOSURES TO CHEMICALS IN SUBSURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Metals:												
Antimony	0.34	0.03	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.06	0.04	0.05	0.16	0.08	0.12	0.04	0.02	0.03	<0.01	<0.01	<0.01
Barium	0.40	0.25	0.32	0.86	0.43	0.61	0.92	0.46	0.65	<0.01	<0.01	<0.01
Beryllium	0.11	0.10	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.07	<0.01	0.02	0.48	0.11	0.23	0.03	<0.01	0.01	0.02	<0.01	0.01
Chromium, total	0.32	0.01	0.06	15.70	2.68	6.48	0.39	0.07	0.16	0.17	0.03	0.07
Cobalt	0.02	<0.01	0.01	0.44	0.18	0.28	0.05	0.02	0.03	0.02	<0.01	0.01
Copper	0.56	0.33	0.43	3.35	1.12	1.94	1.15	0.38	0.66	0.45	0.15	0.26
Lead	0.03	0.02	0.03	0.27	0.14	0.19	0.13	0.06	0.09	0.19	0.09	0.13
Mercury	0.79	0.16	0.35	34.51	11.50	19.93	0.85	0.28	0.49	0.14	0.05	0.08
Nickel	0.07	0.03	0.05	1.91	0.69	1.15	0.03	<0.01	0.02	0.04	0.01	0.02
Selenium	1.47	0.98	1.20	1.58	0.79	1.12	0.65	0.33	0.46	0.32	0.16	0.23
Silver	<0.01	<0.01	<0.01	1.76	0.18	0.56	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Thallium	0.02	<0.01	<0.01	0.18	0.04	0.08	<0.01	<0.01	<0.01	0.04	<0.01	0.02
Tin	<0.01	<0.01	<0.01	1.26	0.51	0.80	0.06	0.02	0.04	0.31	0.13	0.20
Vanadium	0.23	0.12	0.17	83.18	41.59	58.82	14.96	7.48	10.58	3.16	1.58	2.24
Zinc	0.14	0.12	0.13	1.45	0.56	0.90	0.14	0.05	0.09	0.19	0.08	0.12

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-35
HAZARD QUOTIENT VALUES FOR AVIAN OMNIVORE DIETARY EXPOSURES TO CHEMICALS IN SEDIMENT: STEP 2 SCREENING LEVEL RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin		
	NOAEL	LOAEL	MATC
Metals:			
Antimony	<0.01	<0.01	<0.01
Arsenic	0.14	0.07	0.10
Barium	0.45	0.22	0.32
Beryllium	NA	NA	NA
Cadmium	17.39	4.02	8.36
Chromium, total	29.33	5.00	12.11
Cobalt	0.26	0.11	0.17
Copper	2.32	0.78	1.34
Lead	14.98	7.49	10.59
Mercury	26.84	8.95	15.50
Nickel	5.90	2.13	3.54
Selenium	1.06	0.53	0.75
Silver	1.29	0.13	0.41
Thallium	0.08	0.02	0.04
Tin	2.45	0.98	1.55
Vanadium	53.06	26.53	37.52
Zinc	2.58	1.00	1.60

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-36
FREQUENCY AND RANGE OF SURFACE SOIL DATA (95 PERCENT UCL OF THE MEAN CONCENTRATIONS)
COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte [1]	Contaminant Frequency/Range						Soil Screening Values (SSV)	Reference [4]	95% UCL HQ [5]
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	95% UCL of the Mean [2]	Value used in Step 2 Screen [3]			
Inorganics (mg/kg)									
Barium	52/52	9J - 470J	ND	41.783	46.96	470	330	USEPA 2005c	0.14
Chromium	52/52	4.2 - 68	ND	22.658	26.30	68	57.0	USEPA 2008	0.46
Cobalt	52/52	0.61 - 64	ND	10.029	12.15	64	13.0	USEPA 2005f	0.93
Copper	52/52	3 - 120	ND	50.527	57.30	120	70.0	USEPA 2007c	0.82
Mercury	36/46	0.0086J - 0.18	0.02U - 0.034UJ	0.051	0.06	0.18	0.10	Efroymson et al. 1997a	0.64
Selenium	12/52	0.58J - 2.1	1U - 1.6U	0.700	NA	2.1	0.52	USEPA 2007e	--
Vanadium	52/52	9 - 550	ND	145.731	171.80	550	20.0	USEPA 2005h	8.59
Zinc	51/52	4.9 - 200	4.3U - 4.3U	33.716	55.15	200	120	USEPA 2007f	0.46

Notes:

COPC = Chemical of Potential Concern
SSV = Soil Screening Value
USEPA = United States Environmental Protection Agency

U = Not Detected
UJ = Not detected, estimated value
J = Estimated Value

mg/kg = milligram per kilogram
HQ = Hazard Quotient

(1) The analytes shown are those that were detected in surface soil and identified as ecological COPCs by the Step 2 screening level risk calculation, and non-detected chemicals identified as COPCs because maximum detection limits exceed soil screening values.

(2) 95% Upper Confidence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).

(3) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(4) See Table 7-4 for reference citations.

(5) The 95% UCL HQ is the 95% UCL of the mean concentration divided by the screening value.

Table References:

USEPA. 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-37
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]				Mean/Median of the Distribution	Right Tail of the Distribution [8]	
													Quantile Test	Slippage Test
Barium	SWMU 69	52/52	9J -470J	ND	41.78	9.04	46.96	--	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p = 0.0056)	Variances are equal at α = 0.05 (p = 0.4163)	Wilcoxon Rank Sum test [13]; Not elevated at α = 0.05; (p = 0.9998)	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	40/40	3.5 -284	ND	86.23	11.63	111.80	233.30	Not normal at α = 0.05 (p = 0.0006)	Not lognormal at α = 0.05 (p = 0.0325)				
Beryllium	SWMU 69	36/52	0.056J -0.29	0.1U -0.14U	0.12	0.01	0.14	--	Test was not performed [9]	Test was not performed [9]	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[12], G(-5.055)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	35/37	0.052B -0.81	0.04U -0.1U	0.29	0.03	0.34	0.65	Test was not performed [9]	Test was not performed [9]				
Cadmium	SWMU 69	46/52	0.044J -5.3	0.1U -0.13U	0.54	0.13	1.13	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan[14], G(2.265)>Z(1.645), Elevated at α = 0.05	Elevated at α = 0.05	Test was not performed [19]
	NAPR Background	13/40	0.099J -0.92J	0.059U -1.2U	0.25	0.03	0.28	0.65	Test was not performed [9]	Test was not performed [9]				
Chromium	SWMU 69	52/52	4.2 -68	ND	22.66	1.85	26.30	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.1977)	Variances are not equal at α = 0.05 (p = 0.0410)	Satterthwaite t-test [15]; Not elevated at α = 0.05 (p = 0.7738); Power = 0.0084	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	3.9 -101J	ND	28.04	2.87	34.05	69.42	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.3681)				
Cobalt	SWMU 69	52/52	0.61 -64	ND	10.03	1.42	12.15	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.0636)	Variances are equal at α = 0.05 (p = 0.0532)	Wilcoxon Rank Sum test [13]; Not elevated at α = 0.05; (p = 0.9960)	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	36/37	0.83B -64	1.2U -1.2U	16.60	2.26	26.47	44.13	Not normal at α = 0.05 (p = 0.0006)	Not lognormal at α = 0.05 (p = 0.0443)				
Copper	SWMU 69	52/52	3 -120	ND	50.53	4.05	57.30	--	Not normal at α = 0.05 (p = 0.0259)	Not lognormal at α = 0.05 (p = 0.0008)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[16], G(-3.363)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	36/36	13N -260J	ND	95.07	10.85	115.00	225.21	Not normal at α = 0.05 (p = 0.0030)	Lognormal at α = 0.05 (p = 0.6148)				
Lead	SWMU 69	51/51	0.25J -71J	ND	9.32	1.81	17.22	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.9314)	Variances are equal at α = 0.05 (p = 0.1783)	Two sample t-test [17]; Not elevated at α = 0.05 (p = 0.1223); Power = 0.3147	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	0.27J -21J	ND	5.80	0.92	9.84	17.05	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.0504)				
Mercury	SWMU 69	36/46	0.0086J -0.18	0.02U -0.034UJ	0.05	0.01	0.06	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan[12], G(.353)<Z(1.645), Not elevated at α = 0.05	Elevated at α = 0.05	Elevated at α = 0.06
	NAPR Background	23/39	0.012B -0.12J	0.0051UJ -0.06U	0.04	0.00	0.0462	0.10	Test was not performed [9]	Test was not performed [9]				
Nickel	SWMU 69	52/52	1.2J -19	ND	7.09	0.52	8.06	--	Not normal at α = 0.05 (p = 0.0004)	Not lognormal at α = 0.05 (p = 0.0093)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[16], G(-0.854)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	1.1J -35.6	ND	9.25	1.15	14.25	23.20	Not normal at α = 0.05 (p = 0.0002)	Lognormal at α = 0.05 (p = 0.4024)				
Selenium	SWMU 69	12/52	0.58J -2.1	1U -1.6U	0.70	0.04	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [18]	Not elevated at α = 0.05
	NAPR Background	11/40	0.22J -3.8J	0.13UJ -2.1UJ	0.58	0.10	NA	1.85	Test was not performed [9]	Test was not performed [9]				

TABLE 7-37
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
												Mean/Median of the Distribution	Right Tail of the Distribution [8]	
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]					Quantile Test	Slippage Test
Tin	SWMU 69	0/52	ND	20U -32U	12.30	0.19	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [18]	Not elevated at α = 0.05
	NAPR Background	25/38	1.4 -4B	0.69U -1.9UJ	1.74	0.16	2.197	3.68	Test was not performed [9]	Test was not performed [9]				
Vanadium	SWMU 69	52/52	9 -550	ND	145.73	14.78	171.80	--	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p = 0.0272)	Variances are equal at α = 0.05 (p = 0.4980)	Wilcoxon Rank Sum test [13]; Not elevated at α = 0.05; (p = 0.9859)	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/37	25 -410	ND	175.98	15.72	201.40	367.18	Not normal at α = 0.05 (p = 0.0110)	Lognormal at α = 0.05 (p = 0.0790)				
Zinc	SWMU 69	51/52	4.9 -200	4.3U -4.3U	33.72	4.91	55.15	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.6281)	Variances are equal at α = 0.05 (p = 0.4593)	Two sample t-test [17]; Not elevated at α = 0.05 (p = 0.9937); Power < 0.0001	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	37/38	3.9 -140J	27U -27U	47.22	5.35	70.61	113.23	Not normal at α = 0.05 (p = 0.0059)	Lognormal at α = 0.05 (p = 0.1774)				

Notes:

J = Estimated value
U = Not detected
UJ = Not detected, estimated value
NA = Not applicable
ND = Not detected
SE = Standard error
95% UCL = 95 percent Upper Confidence Limit of the mean

(1) Background airfield soil data taken from Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. (Baker, 2010).
(2) Units in mg/kg.
(3) For those data sets with non-detected results, one-half non-detected values were used in the calculation of mean concentrations.
(4) 95% Upper Conficence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).
(5) Upper limit of the mean concentration is equal to the mean plus two standard deviations.
(6) Normality and lognormality verified by the Shapiro-Wilks test. For a given metal, tests for normality and lognormality were performed if each individual data set (SWMU 69 and and background) has less than fifteen percent non-detected results (NFESC, 2002).
(7) Homogeneity of variance verified by F test. For a given metal, the test for homogeneity of variance was performed if each individual data set (SWMU 69 and background) has less than forty percent non-detected results (NFESC, 2002).
(8) Quantile and slippage tests only determine if a particular inorganic chemical is likely present at equivalent or elevated concentrations relative to background (NFESC, 2002).
(9) Test for normality/lognormality were not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds fifteen percent (NFESC, 2002).
(10) Test for homogeneity of variance was not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds forty percent (NFESC, 2002).
(11) Statistical evaluation of the mean/median of the distributions were not be performed because the there are greater than fifty percent non-detected results in the combined SWMU 69 and background data sets (NFESC, 2002).
(12) The Gehan test was used because: (a) the number of non-detected results in the SWMU 69 and/or background data sets is greater than fifteen percent, (b) there are less than fifty percent non-detected results in the combined SWMU 69 and background data sets, and (c) there is more than one reporting limit for the non-detected values (NFESC, 2002).
(13) The Wilcoxon Rank Sum test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) the data sets are not both normally or both lognormally distributed; and (c) the SWMU 69 and background data sets have equal variances (NFESC, 2002).
(14) The Gehan test was used because the number of non-detected results in the SWMU 69 and/or background data set was greater than 40 percent and the number of non-detected results in the combined data set is less than fifty percent (NFESC, 2002).
(15) Satterthwaite t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data set (SWMU 69 and background); (b) each data set has a normal or lognormal distribution; and (c) the SWMU 69 and background data set variances are not equal (NFESC, 2002).
(16) The Gehan test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) the data sets are not both normally or both lognormally distributed; and (c) the SWMU 69 and background data sets do not have equal variances (NFESC, 2002).
(17) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) each data set exhibits either a normal or lognormal distribution; and (c) the SWMU 69 and background data set distributions have equal variances (NFESC, 2002).
(18) Quantile test was not performed because non-detected results within the SWMU 69 and/or background data set are greater than the smallest of the "r" largest detected results in the combined data set.
(19) The slippage test was not performed because the largest detected results for the background data set is less than the largest non-detected result (NFESC, 2002).

TABLE 7-37
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Naval Facilities Engineering Service Center (NFESC). 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-209-ENV. April 2002.

USEPA, 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-38
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (95 PERCENT UCL OF THE MEAN CONCENTRATIONS)
COMPARED TO SOIL SCREENING VALUES FOR TERRESTRIAL PLANTS AND INVERTEBRATES (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte [1]	Contaminant Frequency/Range						Soil Screening Values (SSV)	Reference [4]	95% UCL HQ [5]
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	95% UCL of the Mean [2]	Value used in Step 2 Screen [3]			
Inorganics (mg/kg)									
Cobalt	103/103	0.38 - 34	ND	8.990	12.36	34	13.0	USEPA 2005f	0.95
Copper	104/104	8.1J - 280	ND	87.972	107.00	280	70.0	USEPA 2007c	1.53
Mercury	82/92	0.01J - 0.18	0.02U - 0.03U	0.057	0.06	0.18	0.10	Efroymson et al. 1997a	0.64
Selenium	33/104	0.63J - 2.2	1U - 1.6U	0.765	0.98	2.2	0.52	USEPA 2007e	1.88
Vanadium	102/102	48 - 580	ND	219.618	237.00	580	20.0	USEPA 2005h	11.85

Notes:

COPC = Chemical of Potential Concern
SSV = Soil Screening Value
USEPA = United States Environmental Protection Agency

U = Not Detected
UJ = Not detected, estimated value
J = Estimated Value

mg/kg = milligram per kilogram
HQ = Hazard Quotient

(1) The analytes shown are those that were detected in subsurface soil and identified as ecological COPCs by the Step 2 screening level risk calculation, and non-detected chemicals identified as COPCs because maximum detection limits exceed soil screening values.

(2) 95% Upper Confidence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).

(3) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(4) See Table 7-4 for reference citations.

(5) The 95% UCL HQ is the 95% UCL of the mean concentration divided by the screening value.

Table References:

USEPA. 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-39
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SUBSURFACE SOIL (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]				Mean/Median of the Distribution	Right Tail of the Distribution [8]	
													Quantile Test	Slippage Test
Beryllium	SWMU 69	91/104	0.055J -0.45	0.11U -0.16U	0.17	0.01	0.19	--	Not normal at α = 0.05 (p = 0.0072)	Not lognormal at α = 0.05 (p < 0.0001)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[13], G(-3.866)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	35/37	0.052B -0.81	0.04U -0.1U	0.29	0.03	0.34	0.65	Not normal at α = 0.05 (p = 0.0377)	Not lognormal at α = 0.05 (p = 0.0294)				
Chromium	SWMU 69	103/103	3J -53J	ND	15.94	0.92	17.47	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.1646)	Variances are equal at α = 0.05 (p = 0.0728)	Two sample t-test [14]; Not elevated at α = 0.05 (p = 0.9999); Power < 0.0001	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	37/37	3.9 -101J	ND	28.04	2.87	34.05	69.42	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.3681)				
Cobalt	SWMU 69	103/103	0.38 -34	ND	8.99	0.77	12.36	--	Not normal at α = 0.05 (p = 0.0001)	Not lognormal at α = 0.05 (p = 0.0439)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[13], G(-3.341)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	36/37	0.83B -64	1.2U -1.2U	16.60	2.26	26.47	44.13	Not normal at α = 0.05 (p = 0.0006)	Not lognormal at α = 0.05 (p = 0.0443)				
Copper	SWMU 69	104/104	8.1J -280	ND	87.97	4.37	107.00	--	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p < 0.0001)	Variances are not equal at α = 0.05 (p = 0.0036)	Gehan[13], G(0.244)<Z(1.645), Not elevated at α = 0.06	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	36/36	13N -260J	ND	95.07	10.85	115.00	225.21	Not normal at α = 0.05 (p = 0.0030)	Lognormal at α = 0.05 (p = 0.6148)				
Mercury	SWMU 69	82/92	0.01J -0.18	0.02U -0.03U	0.06	0.00	0.06	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan[12], G(2.581)>Z(1.645), Elevated at α = 0.05	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	23/39	0.012B -0.12J	0.0051UJ -0.06U	0.04	0.00	0.0462	0.10	Test was not performed [9]	Test was not performed [9]				
Nickel	SWMU 69	102/104	0.76J -11	1.3U -1.4U	5.09	0.30	5.67	--	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p = 0.0124)	Variances are not equal at α = 0.05 (p < 0.0001)	Gehan[13], G(-3.448)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	37/37	1.1J -35.6	ND	9.25	1.15	14.25	23.20	Not normal at α = 0.05 (p = 0.0002)	Lognormal at α = 0.05 (p = 0.4024)				
Selenium	SWMU 69	33/104	0.63J -2.2	1U -1.6U	0.77	0.03	0.98	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [16]	Test was not performed [17]
	NAPR Background	11/40	0.22J -3.8J	0.13UJ -2.1UJ	0.58	0.10	NA	1.85	Test was not performed [9]	Test was not performed [9]				
Silver	SWMU 69	5/104	0.17J -0.96	0.21U -0.32U	0.14	0.01	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [16]	Test was not performed [17]
	NAPR Background	1/40	0.16B -0.16B	0.063U -1.3U	0.23	0.03	NA	0.64	Test was not performed [9]	Test was not performed [9]				
Thallium	SWMU 69	61/104	0.06J -0.23J	0.42U -0.64U	0.17	0.01	0.12	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [16]	Test was not performed [18]
	NAPR Background	3/38	0.1J -0.29J	0.08U -2.4U	0.24	0.04	0.13	0.78	Test was not performed [9]	Test was not performed [9]				
Tin	SWMU 69	0/104	ND	21U -32U	12.47	0.09	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [16]	Test was not performed [17]
	NAPR Background	25/38	1.4 -4B	0.69U -1.9UJ	1.74	0.16	2.197	3.68	Test was not performed [9]	Test was not performed [9]				

TABLE 7-39
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SUBSURFACE SOIL (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]				Mean/Median of the Distribution	Right Tail of the Distribution [8]	
													Quantile Test	Slippage Test
Vanadium	SWMU 69	102/102	48 -580	ND	219.62	11.01	237.00	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.1335)	Variances are equal at α = 0.05 (p = 0.2191)	Two sample t-test [14]; Elevated at α = 0.05 (p = 0.0081); Power = 0.7811	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	37/37	25 -410	ND	175.98	15.72	201.40	367.18	Not normal at α = 0.05 (p = 0.0110)	Lognormal at α = 0.05 (p = 0.0790)				
Zinc	SWMU 69	98/104	5.4 -100J	4.9U -5.6U	28.64	2.58	32.76	--	Not normal at α = 0.05 (p = 0.0006)	Not lognormal at α = 0.05 (p = 0.0022)	Variances are equal at α = 0.05 (p = 0.0774)	Wilcoxon Rank Sum test [15]; Not elevated at α = 0.05; (p = 0.9997)	Not elevated at α = 0.05	Test was not performed [17]
	NAPR Background	37/38	3.9 -140J	27U -27U	47.22	5.35	70.61	113.23	Not normal at α = 0.05 (p = 0.0059)	Lognormal at α = 0.05 (p = 0.1774)				

Notes:

J = Estimated value
U = Not detected
UJ = Not detected, estimated value
NA = Not applicable

ND = Not detected
SE = Standard error
95% UCL = 95 percent Upper Confidence Limit of the mean

(1) Background airfield soil data taken from Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. (Baker, 2010).
(2) Units in mg/kg.
(3) For those data sets with non-detected results, one-half non-detected values were used in the calculation of mean concentrations.
(4) 95% Upper Confidence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).
(5) Upper limit of the mean concentration is equal to the mean plus two standard deviations.
(6) Normality and lognormality verified by the D'Agostino Omnibus test for SWMU 69 (n>50) and by the Shapiro-Wilks test for the background data set (n<50). For a given metal, tests for normality and lognormality were performed if each individual data set (SWMU 69 and and background) has less than fifteen percent non-detected results (NFESC, 2002).
(7) Homogeneity of variance verified by F test. For a given metal, the test for homogeneity of variance was performed if each individual data set (SWMU 69 and background) has less than forty percent non-detected results (NFESC, 2002).
(8) Quantile and slippage tests only determine if a particular inorganic chemical is likely present at equivalent or elevated concentrations relative to background (NFESC, 2002).
(9) Test for normality/lognormality were not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds fifteen percent (NFESC, 2002).
(10) Test for homogeneity of variance was not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds forty percent (NFESC, 2002).
(11) Statistical evaluation of the mean/median of the distributions were not be performed because the there are greater than fifty percent non-detected results in the combined SWMU 69 and background data sets (NFESC, 2002).
(12) The Gehan test was used because: (a) the number of non-detected results in the SWMU 69 and/or background data sets is greater than fifteen percent, (b) there are less than fifty percent non-detected results in the combined SWMU 69 and background data sets, and (c) there is more than one reporting limit for the non-detected values (NFESC, 2002).
(13) The Gehan test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) the data sets are not both normally or both lognormally distributed; and (c) the SWMU 69 and background data sets do not have equal variances (NFESC, 2002).
(14) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) each data set exhibits either a normal or lognormal distribution; and (c) the SWMU 69 and background data set distributions have equal variances (NFESC, 2002).
(15) The Wilcoxon Rank Sum test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) the data sets are not both normally or both lognormally distributed; and (c) the SWMU 69 and background data sets have equal variances (NFESC, 2002).
(16) Quantile test was not performed because non-detected results within the SWMU 69 and/or background data set are greater than the smallest of the "r" largest detected results in the combined data set.
(17) The slippage test was not performed because the table of critical values is limited to number of site data points n < 50 (NFESC, 2002).

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Naval Facilities Engineering Service Center (NFESC). 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-209-ENV. April 2002.

USEPA, 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-40
FREQUENCY AND RANGE OF PEM1 WETLAND SEDIMENT DATA (95 PERCENT UCL OF THE MEAN CONCENTRATIONS)
COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte [1]	Contaminant Frequency/Range						Freshwater Sediment Screening Values (SDSV)	Reference [4]	95% UCL HQ [5]
	Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	95% UCL of the Mean [2]	Value used in Step 2 Screen [3]			
Inorganics (mg/kg)									
Antimony	0/14	ND	3.2U - 6.2UJ	2.079	NA	6.2	2.0	Long and Morgan 1991	--
Barium	14/14	24J - 140J	NA	70.000	88.65	140	20.0	MacDonald et al. 2003	4.43
Beryllium	14/14	0.098J - 0.33J	NA	0.203	0.23	0.33	NE	---	NA
Cadmium	14/14	0.38 - 24J	NA	5.079	13.44	24	1.0	MacDonald et al. 2000	13.58
Chromium	14/14	10 - 99J	NA	35.857	48.91	99	43.4	MacDonald et al. 2000	1.13
Copper	14/14	38J - 160J	NA	101.286	116.40	160	31.6	MacDonald et al. 2000	3.68
Lead	14/14	6.4 - 680J	NA	115.950	353.00	680	35.8	MacDonald et al. 2000	9.86
Nickel	14/14	5.2 - 34J	NA	11.457	21.47	34	22.7	MacDonald et al. 2000	0.95
Thallium	1/14	0.11J - 0.11J	0.32U - 0.62UJ	0.199	NA	0.11	NE	---	--
Tin	0/14	ND	32U - 62UJ	20.786	NA	62	3.4	Buchman 2008	--
Vanadium	14/14	67J - 370J	NA	203.357	247.20	370	57.0	Buchman 2008	4.34
Zinc	14/14	40 - 490J	NA	135.357	309.20	490	121.0	MacDonald et al. 2000	2.56

Notes:

COPC = Chemical of Potential Concern
HQ = Hazard Quotient
USEPA = United States Environmental Protection Agency
mg/kg = milligram per kilogram

NA = Not Applicable
ND = Not Detected
SDSV = Sediment Screening Value

U = Not detected
UJ = Not detected, estimated value
J = Estimated value

(1) The analytes shown are those that were detected in sediment and identified as ecological COPCs by the Step 2 screening level risk calculation, and non-detected chemicals identified as COPCs because maximum detection limits exceed sediment screening values.

(2) 95% Upper Confidence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).

(3) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(4) See Table 7-29 for reference citations.

(5) The 95% UCL HQ is the 95% UCL of the mean concentration divided by the screening value.

Table References:

USEPA. 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-41
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]				Mean/Median of the Distribution	Right Tail of the Distribution [8]	
													Quantile Test	Slippage Test
Antimony	SWMU 69	0/14	ND	3.2U -6.2UJ	2.08	0.11	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [15]	Not elevated at α = 0.05
	NAPR Background	9/20	0.53J -12.2J	0.21U -0.62UJ	2.14	0.76	3.64	8.90	Test was not performed [9]	Test was not performed [9]				
Barium	SWMU 69	14/14	24J -140J	ND	70.00	10.53	88.65	--	Normal at α = 0.05 (p = 0.1553)	Lognormal at α = 0.05 (p = 0.4079)	Variances are equal at α = 0.05 (p = 0.3387)	Two sample t-test [12]; Not elevated at α = 0.05 (p = 0.9948); Power < 0.0001	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	20/20	37.1J -227J	ND	109.24	11.69	131.90	213.80	Not normal at α = 0.05 (p = 0.0263)	Lognormal at α = 0.05 (p = 0.6975)				
Beryllium	SWMU 69	14/14	0.098J -0.33J	ND	0.20	0.02	0.23	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [15]	Test was not performed [16]
	NAPR Background	3/20	0.23 -0.28	0.1U -0.58U	0.20	0.02	NA	0.36	Test was not performed [9]	Test was not performed [9]				
Cadmium	SWMU 69	14/14	0.38 -24J	ND	5.08	1.92	13.44	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Elevated at α = 0.05	Test was not performed [16]
	NAPR Background	2/20	0.13J -0.32	0.04U -0.46UJ	0.07	0.02	NA	0.23	Test was not performed [9]	Test was not performed [9]				
Chromium	SWMU 69	14/14	10 -99J	ND	35.86	6.60	48.91	--	Not normal at α = 0.05 (p = 0.0037)	Lognormal at α = 0.05 (p = 0.3314)	Variances are equal at α = 0.05 (p = 0.0507)	Two sample t-test [12]; Not elevated at α = 0.05 (p = 0.7769); Power = 0.0082	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	20/20	17J -68.8J	ND	36.41	3.20	42.25	65.02	Not normal at α = 0.05 (p = 0.0110)	Lognormal at α = 0.05 (p = 0.3834)				
Copper	SWMU 69	14/14	38J -160J	ND	101.29	8.53	116.40	--	Normal at α = 0.05 (p = 0.9906)	Lognormal at α = 0.05 (p = 0.2421)	Variances are equal at α = 0.05 (p 0.7400)	Two sample t-test [12]; Not elevated at α = 0.05 (p = 0.1407); Power = 0.2836	Elevated at α = 0.03	Not elevated at α = 0.05
	NAPR Background	20/20	42.1J -183	ND	89.43	8.36	105.00	164.24	Not normal at α = 0.05 (p = 0.0137)	Lognormal at α = 0.05 (p = 0.3963)				
Lead	SWMU 69	14/14	6.4 -680J	ND	115.95	54.39	353.00	--	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.0647)	Variances are not equal at α = 0.05 (p = 0.1783)	Satterthwaite t-test [13]; Elevated at α = 0.05; (p = 0.0011); Power = 0.9708	Elevated at α = 0.04	Elevated at α = 0.05
	NAPR Background	20/20	3.8 -29.9J	ND	9.02	1.23	11.14	20.03	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.0682)				
Mercury	SWMU 69	14/14	0.045 -0.14J	ND	0.07	0.01	0.083	--	Not normal at α = 0.05 (p = 0.0048)	Lognormal at α = 0.05 (p = 0.1836)	Variances are equal at α = 0.05 (p = 0.0979)	Two sample t-test [12]; Not elevated at α = 0.05 (p = 0.8795); Power = 0.0024	Test was not performed [15]	Not elevated at α = 0.05
	NAPR Background	19/20	0.029 -0.17J	0.14UJ -0.14UJ	0.09	0.01	0.104	0.17	Not normal at α = 0.05 (p = 0.0431)	Lognormal at α = 0.05 (p = 0.3824)				
Nickel	SWMU 69	14/14	5.2 -34J	ND	11.46	2.30	21.47	--	Not normal at α = 0.05 (p = 0.0004)	Not lognormal at α = 0.05 (p = 0.0418)	Variances are not equal at α = 0.05 (p = 0.0004)	Gehan[14], G(-1.669)<Z(1.645), Not elevated at α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	20/20	6.2J -17.7J	ND	11.47	0.77	12.81	18.40	Normal at α = 0.05 (p = 0.3348)	Lognormal at α = 0.05 (p = 0.2015)				
Selenium	SWMU 69	6/14	0.85J -1.3J	1.8U -3.1UJ	1.12	0.05	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [15]	Not elevated at α = 0.05
	NAPR Background	17/20	0.72J -4.3J	0.5U -0.61UJ	1.53	0.24	2.02	3.72	Test was not performed [9]	Test was not performed [9]				
Silver	SWMU 69	3/14	0.25J -0.7J	0.32U -0.62UJ	0.26	0.04	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [15]	Test was not performed [17]
	NAPR Background	0/20	ND	0.043U -0.64UJ	0.06	0.02	NA	0.20	Test was not performed [9]	Test was not performed [9]				

TABLE 7-41
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]							Test for Normality [6]	Test for Lognormality [6]	Test for Homogeneity of Variance [7]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]	Upper Limit of Means [5]				Mean/Median of the Distribution	Right Tail of the Distribution [8]	
													Quantile Test	Slippage Test
Thallium	SWMU 69	1/14	0.11J -0.11J	0.32U -0.62UJ	0.20	0.01	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [15]	Not elevated at α = 0.05
	NAPR Background	5/20	0.19J -1.6J	0.19U -2.7UJ	0.54	0.09	NA	1.32	Test was not performed [9]	Test was not performed [9]				
Tin	SWMU 69	0/14	ND	32U -62UJ	20.79	1.11	NA	--	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [11]	Test was not performed [15]	Test was not performed [16]
	NAPR Background	12/20	4.3J -6.7J	2.1U -12.6UJ	4.32	0.38	5.37	7.76	Test was not performed [9]	Test was not performed [9]				
Vanadium	SWMU 69	14/14	67J -370J	ND	203.36	24.78	247.20	--	Normal at α = 0.05 (p = 0.0779)	Lognormal at α = 0.05 (p = 0.4586)	Variances are not equal at α = 0.05 (p = 0.0063)	Satterthwaite t-test [13]; Elevated at α = 0.05; (p = 0.0356); Power = 0.5794	Elevated at α = 0.04	Not elevated at α = 0.05
	NAPR Background	20/20	77J -230	ND	151.81	10.34	169.70	244.32	Normal at α = 0.05 (p = 0.2813)	Lognormal at α = 0.05 (p = 0.0696)				
Zinc	SWMU 69	14/14	40 -490J	ND	135.36	39.87	309.20	--	Not normal at α = 0.05 (p = 0.0001)	Not lognormal at α = 0.05 (p = 0.0170)	Variances are not equal at α = 0.05 (p < 0.0001)	Satterthwaite t-test [13]; Not elevated at α = 0.05; (p = 0.0971); Power = 0.3643	Not elevated at α = 0.05	Not elevated at α = 0.05
	NAPR Background	20/20	41.2J -203J	ND	79.90	8.04	93.50	151.82	Not normal at α = 0.05 (p = 0.0006)	Lognormal at α = 0.05 (p = 0.3527)				

Notes:

J = Estimated value
U = Not detected
UJ = Not detected, estimated value
NA = Not applicable
ND = Not detected
SE = Standard error
95% UCL = 95 percent Upper Confidence Limit of the mean

(1) Background airfield drainage ditch sediment data taken from Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. (Baker, 2010).
(2) Units in mg/kg.
(3) For those data sets with non-detected results, one-half non-detected values were used in the calculation of mean concentrations.
(4) 95% Upper Confidence Limit of the mean concentrations were calculated using USEPA ProUCL Version 4.00.05 software (USEPA, 2010).
(5) Upper limit of the mean concentration is equal to the mean plus two standard deviations.
(6) Normality and lognormality verified by the Shapiro-Wilks test. For a given metal, tests for normality and lognormality were performed if each individual data set (SWMU 69 and and background) has less than fifteen percent non-detected results (NFESC, 2002).
(7) Homogeneity of variance verified by F test. For a given metal, the test for homogeneity of variance was performed if each individual data set (SWMU 69 and background) has less than forty percent non-detected results (NFESC, 2002).
(8) Quantile and slippage tests only determine if a particular inorganic chemical is likely present at equivalent or elevated concentrations relative to background (NFESC, 2002).
(9) Test for normality/lognormality were not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds fifteen percent (NFESC, 2002).
(10) Test for homogeneity of variance was not performed because the number of non-detected results in the SWMU 69 and/or background data set exceeds forty percent (NFESC, 2002).
(11) Statistical evaluation of the mean/median of the distributions were not be performed because the there are greater than fifty percent non-detected results in the combined SWMU 69 and background data sets (NFESC, 2002).
(12) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) each data set exhibits either a normal or lognormal distribution; and (c) the SWMU 69 and background data set distributions have equal variances (NFESC, 2002).
(13) Satterthwaite t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data set (SWMU 69 and background); (b) each data set has a normal or lognormal distribution; and (c) the SWMU 69 and background data set variances are not equal (NFESC, 2002).
(14) The Gehan test was used because: (a) there are less than fifteen percent non-detected results in the SWMU 69 and background data sets; (b) the data sets are not both normally or both lognormally distributed; and (c) the SWMU 69 and background data sets do not have equal variances (NFESC, 2002).
(15) Quantile test was not performed because non-detected results within the SWMU 69 and/or background data set are greater than the smallest of the "r" largest detected results in the combined data set.
(16) The slippage test was not performed because the largest detected result for the background data set is less than the largest non-detected result (NFESC, 2002).
(17) The slippage test was not performed because there were 100 percent non-detected results in the background data set (NFESC, 2002).

TABLE 7-41
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Naval Facilities Engineering Service Center (NFESC). 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-209-ENV. April 2002.

USEPA, 2010. ProUCLVersion 4.00.05. May 2010. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-42
HAZARD QUOTIENT VALUES FOR MAMMALIAN DIETARY EXPOSURES TO CHEMICALS IN SURFACE SOIL: STEP 3A RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat		
	NOAEL	LOAEL	MATC
Metals:			
Selenium	0.42	0.28	0.34

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-43
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SURFACE SOIL: STEP 3A RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Metals:									
Barium	0.05	0.03	0.04	0.06	0.03	0.05	<0.01	<0.01	<0.01
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.69	0.16	0.33	0.07	0.02	0.03	0.01	<0.01	<0.01
Chromium, total	0.45	0.08	0.18	0.13	0.02	0.05	0.07	0.01	0.03
Copper	0.60	0.20	0.35	0.42	0.14	0.25	0.25	0.08	0.15
Lead	0.20	0.10	0.14	0.18	0.09	0.13	0.02	<0.01	<0.01
Mercury	0.51	0.17	0.30	0.45	0.15	0.26	0.01	<0.01	<0.01
Nickel	0.15	0.06	0.09	0.02	<0.01	0.01	0.02	<0.01	0.01
Selenium	0.72	0.36	0.51	0.59	0.30	0.42	0.24	0.12	0.17
Tin	0.57	0.23	0.36	0.05	0.02	0.03	0.05	0.02	0.03
Vanadium	8.03	4.02	5.68	3.90	1.95	2.76	0.42	0.21	0.29
Zinc	0.54	0.21	0.34	0.09	0.04	0.06	0.04	0.01	0.02

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-44
HAZARD QUOTIENT VALUES FOR MAMMALIAN DIETARY EXPOSURES
TO CHEMICALS IN SUBSURFACE SOIL: STEP 3A RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Brown flower bat		
	NOAEL	LOAEL	MATC
Metals:			
Selenium	0.18	0.12	0.15

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-45
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES
TO CHEMICALS IN SUBSURFACE SOIL: STEP 3A RISK CALCULATION (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Metals:									
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, total	0.30	0.05	0.12	0.08	0.01	0.03	0.06	<0.01	0.02
Copper	0.83	0.28	0.48	0.60	0.20	0.35	0.30	0.10	0.17
Mercury	0.51	0.17	0.30	0.45	0.15	0.26	0.01	<0.01	<0.01
Nickel	0.11	0.04	0.06	0.01	<0.01	<0.01	0.02	<0.01	0.01
Selenium	0.40	0.20	0.28	0.26	0.13	0.18	0.18	0.09	0.13
Silver	0.11	0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tin	0.57	0.23	0.36	0.05	0.02	0.03	0.05	0.02	0.03
Vanadium	11.08	5.54	7.84	5.38	2.69	3.81	0.57	0.29	0.41
Zinc	0.45	0.18	0.28	0.07	0.03	0.04	0.02	<0.01	0.01

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-46
HAZARD QUOTIENT VALUES FOR AVIAN OMNIVORE DIETARY EXPOSURES TO CHEMICALS IN DRAINAGE DITCH SEDIMENT: STEP 3A RISK CALCULATION (2010)
SWMU 69- AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin		
	NOAEL	LOAEL	MATC
Metals:			
Beryllium	NA	NA	NA
Cadmium	4.98	1.15	2.39
Chromium, total	0.83	0.14	0.34
Copper	0.86	0.29	0.50
Lead	3.38	1.69	2.39
Mercury	0.66	0.22	0.38
Nickel	0.41	0.15	0.25
Selenium	0.50	0.25	0.35
Silver	0.08	<0.01	0.03
Tin	1.10	0.44	0.70
Vanadium	11.56	5.78	8.17
Zinc	1.00	0.39	0.62

Notes:

Shaded cells indicate a hazard quotient value greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NA = Toxicity Reference Value not available (hazard quotient value could not be calculated)

TABLE 7-47
SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN AND ECOLOGICAL CHEMICALS OF CONCERN (2010)
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Lower Trophic Level Receptor Groups			Upper Trophic Level Receptor Groups				
				Mammalian		Avian		Avian Omnivore
Chemicals	**Surface Soil**	**Subsurface Soil**	**Sediment**	**Surface Soil**	**Subsurface Soil**	**Surface Soil**	**Subsurface Soil**	**Sediment**
Ecological Chemicals of Concern Recommended for Corrective Action Measures [1]	Vanadium	Vanadium	Cadmium Lead Vanadium Zinc	None	None	Mercury Vanadium	Mercury Vanadium	Cadmium Lead Vanadium
Ecological Chemicals of Potential Concern Not Recommended for Further Evaluation Based on Step 3a of the Baseline Ecological Risk Assessment	Barium Chromium Cobalt Copper Mercury Selenium Zinc	Cobalt Copper Mercury Selenium	Antimony Barium Beryllium Chromium Copper Nickel Thallium Tin (not detected)	Selenium	Selenium	Barium Beryllium Cadmium Chromium Copper Lead Nickel Selenium Tin (not detected) Zinc	Beryllium Chromium Copper Nickel Selenium Silver Tin (not detected) Zinc	Beryllium Chromium Copper Mercury Nickel Selenium Silver Tin (not detected) Zinc

Notes:

[1] Ecological chemicals of concern were identified based on the evaluations presented in Sections 7.10.8.1 through 7.10.8.4. The specific lines of evidence used to exclude ecological chemicals of potential concern from the list of ecological chemicals of concern is provided within these sections.

TABLE 7-48
SUMMARY OF FINAL ECOLOGICAL CHEMICALS OF CONCERN
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Lower Trophic Level Receptor Groups				Upper Trophic Level Receptor Groups				
					Mammalian		Avian		Avian Omnivore
Chemicals	**Surface Soil**	**Subsurface Soil**	**Groundwater**	**Sediment**	**Surface Soil**	**Subsurface Soil**	**Surface Soil**	**Subsurface Soil**	**Sediment**
Ecological Chemicals of Concern Recommended for Corrective Action Measures [(1)]	Vanadium	Vanadium	None	Cadmium Lead Vanadium Zinc	None	None	Mercury Vanadium	Mercury Vanadium	Cadmium Lead Vanadium

Notes:

[(1)] Ecological chemicals of concern were identified in Sections 7.9.3 (Step 3a Decision Point and Recommendations: 2008 Data) and Section 7.10.11 (Step 3a Decision Point and Recommendations: 2010 Data).

TABLE 7-49
ECOLOGICAL-BASED CORRECTIVE ACTION OBJECTIVES FOR SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemcial	Surface Soil Corrective Action Objective (mg/kg)					Final Corrective Action Objective (mg/kg)
	Terrestrial Invertebrates and Plants	Brown Flower Bat (Flying Mammal)	Terrestrial Avian Receptors		ULM Background [2]	
			Value [1]	Most sensitive receptor		
Vanadium	20 [3]	NA	21.4	American robin - omnivore	367.18	367

Notes:

All concentrations are in milligrams per kilogram (mg/kg).

NA = Not applicable (chemical does not present an unacceptable risk to receptor group/species).
ULM = Upper Limit of the Mean concentration

[1] The value shown is the surface soil concentration that results in a NOAEL-based hazard quotient value of 1.00 for the most sensitive receptor (American robin).
[2] Background airfield soil upper limit of the mean concentration presented in Addendum B of Baker (2010).
[3] The value shown is a growth-based Lowests Observed Adverse Effects Concentration for broccoli with a safety factor of 5. (USEPA, 2005).

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity, Puerto Rico, Ceiba, Puerto Rico. July 30, 2010.

USEPA. 2005. Ecological Soil Screening Levels for Vanadium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-75.

TABLE 7-50
ECOLOGICAL-BASED CORRECTIVE ACTION OBJECTIVES FOR SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemcial	Surface Soil Corrective Action Objective (mg/kg)					Final Corrective Action Objective (mg/kg)
	Terrestrial Invertebrates and Plants	Brown Flower Bat (Flying Mammal)	Terrestrial Avian Receptors		ULM Background [2]	
			Value [1]	Most sensitive receptor		
Vanadium	20 [3]	NA	21.4	American robin - omnivore	367.18	367

Notes:

All concentrations are in milligrams per kilogram (mg/kg).

NA = Not applicable (chemical does not present an unacceptable risk to receptor group/species).
ULM = Upper Limit of the Mean concentration

[1] The value shown is the surface soil concentration that results in a NOAEL-based hazard quotient value of 1.00 for the most sensitive receptor (American robin).

[2] Background airfield soil upper limit of the mean concentration presented in Addendum B of Baker (2010).

[3] The value shown is a growth-based Lowests Observed Adverse Effects Concentration for broccoli with a safety factor of 5. (USEPA, 2005).

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity, Puerto Rico, Ceiba, Puerto Rico. July 30, 2010.

USEPA. 2005. Ecological Soil Screening Levels for Vanadium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-75.

TABLE 7-51
ECOLOGICAL-BASED CORRECTIVE ACTION OBJECTIVES FOR SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemcial	Sediment Corrective Action Objective (mg/kg)			Final Corrective Action Objective (mg/kg)
	Invertebrates and Plants	American Robin (Avian Omnivore)	ULM Background [1]	
Cadmium	0.99 [2]	1.8	0.22	1.0
Lead	35.8 [2]	96	19.38	35.8
Vanadium	57 [3]	21.4	241.1	241
Zinc	121 [2]	NA	148.46	148

Notes:

All concentrations are in mg/kg
NA = Not applicable (chemical does not present an unacceptable risk to receptor group/species).
ULM = Upper Limit of the Mean concentration

[1] The value shown is the sediment concentration that results in a NOAEL-based hazard quotient value of 1.00 for the most sensitive receptor (American robin).
[2] Airfield background freshwater drainage ditch sediment upper limit of the mean concentration presented in Addendum C of Baker (2010
[3] The value shown is a consensus-based threshold effect concentration (MacDonald et al. 2000).

Table references:

Baker Environmental, Inc. (Baker). 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity, Puerto Rico, Ceiba, Puerto Rico. July 30, 2010.

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables. NOAA OR&R Report 08-1. National Oceanic and Atmospheric Administration, Office of Response and Restoration Division, Seattle, WA.

MacDonald, D.D., C.G. Ingersoll, T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

TABLE 8-1

SURFACE SOIL (2008) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Criteria [1]	Chemical Frequency / Range / Location			Background [2]	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL [3] (ProUCL)	Exposure Concentration	Rationale for Concentration Selection [4]
Volatile Organic Compounds (ug/kg)										
1,4-Dichloro-2-butene (trans)	6.90	1/25	59 J	69SB14	NA	YES	ASL	NC	59	Max (Less than 4 detections)
2-Hexanone (MBK)	21,000	1/25	2 J	69SB11	NA	NO	BSL	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	530,000	1/25	7.7 J	69SB22	NA	NO	BSL	NA	NA	NA
Acetone	6,100,000	15/22	9.1 J - 260	69SB05	NA	NO	BSL	NA	NA	NA
Benzene	1,100	1/25	0.99 J	69SB22	NA	NO	BSL	NA	NA	NA
Ethylbenzene	5,400	2/25	2.2 J - 6.2 J	69SB09	NA	NO	BSL	NA	NA	NA
Toluene	500,000	3/25	0.53 J - 3.3 J	69SB02	NA	NO	BSL	NA	NA	NA
Xylenes, total	63,000	5/25	4.9 J - 28 J	69SB09	NA	NO	BSL	NA	NA	NA
Semivolatile Organic Compounds (ug/kg)										
1,2,4,5-Tetrachlorobenzene	1,800	2/25	26 J - 29 J	69SB11	NA	NO	BSL	NA	NA	NA
2-Methylnaphthalene	31,000	2/25	2.3 J - 9.2 J	69SB05	NA	NO	BSL	NA	NA	NA
Acenaphthene	340,000	5/25	0.79 J - 10 J	69SB05	NA	NO	BSL	NA	NA	NA
Acenaphthylene	340,000 [5]	2/25	9.8 J - 11 J	69SB05	NA	NO	BSL	NA	NA	NA
Anthracene	1,700,000	6/25	3.8 J - 34 J	69SB05	NA	NO	BSL	NA	NA	NA
Benzo(a)anthracene	150	14/25	4.8 J - 460 J	69SB05	NA	YES	ASL	254 (NP)	254	99% KM (Chebyshev) UCL
Benzo(a)pyrene (BaP)	15.0	17/25	2.8 J - 530 J	69SB05	NA	YES	ASL	116 (NP)	116	95% KM (BCA) UCL
Benzo(b)fluoranthene	150	18/25	5.6 J - 1,300 J	69SB05	NA	YES	ASL	799 (NP)	799	99% KM (Chebyshev) UCL
Benzo(g,h,i)perylene	170,000 [6]	17/25	7.8 J - 1,400 J	69SB05	NA	NO	BSL	NA	NA	NA
Benzo(k)fluoranthene *	1,500	3/25	2.9 J - 140	69SB11	NA	YES	CHEM	NC	140	Max (Less than 4 detections)
Bis(2-ethylhexyl) Phthalate (BEHP)	35,000	9/25	9.4 J - 1,000 J	69SB05	NA	NO	BSL	NA	NA	NA
Butyl Benzyl Phthalate	260,000	11/25	16 J - 300 J	69SB05	NA	NO	BSL	NA	NA	NA
Chrysene *	15,000	19/25	3.9 J - 1,000 J	69SB05	NA	YES	CHEM	303 (NP)	303	95% KM (Chebyshev) UCL
Dibenz(a,h)anthracene	15.0	14/25	3 J - 220 J	69SB05	NA	YES	ASL	40.1 (NP)	40.1	95% KM (BCA) UCL
Di-n-octyl Phthalate	NE	1/25	26 J	69SB11	NA	YES	NSC	NC	26	Max (Less than 4 detections)
Fluoranthene	230,000	19/25	2.1 J - 1,100 J	69SB05	NA	NO	BSL	NA	NA	NA
Fluorene	230,000	4/25	1.3 J - 14 J	69SB05	NA	NO	BSL	NA	NA	NA
Indeno(1,2,3-cd)pyrene	150	16/25	8.6 J - 1,400 J	69SB05	NA	YES	ASL	441 (NP)	441	97.5% KM (Chebyshev) UCL
Naphthalene	3,600	3/25	0.75 J - 3.4 J	69SB05	NA	NO	BSL	NA	NA	NA
Pentachlorobenzene	4,900	1/25	13 J	69SB05	NA	NO	BSL	NA	NA	NA
Phenanthrene	170,000 [6]	15/25	2.4 J - 270 J	69SB05	NA	NO	BSL	NA	NA	NA
Pyrene	170,000	20/25	2.4 J - 1,200 J	69SB05	NA	NO	BSL	NA	NA	NA

TABLE 8-1

SURFACE SOIL (2008) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Criteria (1)	Chemical Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL (3) (ProUCL)	Exposure Concentration	Rationale for Concentration Selection (4)
Metals (mg/kg)										
Antimony	3.10	1/25	2 J	69SB05	2.43	NO	BSL	NA	NA	NA
Arsenic	0.390	25/25	1.4 - 5.4	69SB05	2.37	YES	ASL	3.78 (N)	3.78	95% Student's-t UCL
Barium	1,500	25/25	14 - 800	69SB05	233	NO	BSL	NA	NA	NA
Beryllium	16.0	25/25	0.037 J - 0.35	69SB05	0.717	NO	BSL	NA	NA	NA
Cadmium	7.0	24/25	0.051 J - 36 J	69SB05	0.655	YES	ASL	18.6 (NP)	18.6	99% KM (Chebyshev) UCL
Chromium	12,000 (7)	25/25	15 J - 89 J	69SB05	87.6	NO	BSL	NA	NA	NA
Cobalt	2.30	25/25	5.7 - 18	69SB27	51.9	YES	ASL	11.6 (N)	12.0	See Total Soil Exposure
Copper	310	25/25	16 - 130 J	69SB05, 69SB09	225	NO	BSL	NA	NA	NA
Lead	400 (8)	24/25	0.93 J - 520	69SB05	28.2	YES	ASL	158 (NP)	157.7	95% KM (Chebyshev) UCL
Mercury	0.560	25/25	0.0066 J - 0.16	69SB04	0.112	NO	BSL	NA	NA	NA
Nickel	150	25/25	4 - 34	69SB05	27.0	NO	BSL	NA	NA	NA
Selenium	39.0	21/25	0.13 J - 1.8	69SB04	1.85	NO	BSL	NA	NA	NA
Silver	39.0	20/25	0.021 J - 0.54	69SB05	ND	NO	BSL	NA	NA	NA
Tin	4,700	1/25	9 J	69SB05	3.68	NO	BSL	NA	NA	NA
Vanadium	0.550	25/25	46 J - 280	69SB08	367	YES	ASL	137 (G)	201	See Total Soil Exposure
Zinc	2,300	25/25	9 - 650	69SB05	113	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated
ND - Not Detected
NE - Not Established

SSL - Soil Screening Level
COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit
ULM - Upper Limit of Means

mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram
ft bgs = feet below ground surface

Rationale Codes:

(ASL) Above Screening Level
(CHEM) Same Chemical Class
(NSC) No Screening Criteria
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated

Shaded constituents were identified as COPCs for quantitative risk evaluation.

* These compounds were retained because one or more of its related carcinogenic PAHs were retained, and these compounds are known to exist together in mixtures

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Residential Soil (Nov 2010)

(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)

(3) ProUCL was used to calculate the 95% UCL and distribution (>8 samples and >4 detections):
(N) - Normal distribution
(NP) - Nonparametric distribution
(G) - Gamma distribution

(4) Exposure concentrations were calculaed for surface soil (0-1 ft bgs) and total soil (0-10 ft bgs).
The higher of the two exposure concentrations for each COPC was used in the risk calculations to produce a conservative risk estimate.
"See Total Soil Exposure" indicates that the greatest expsoure concentration is in total soil. The basis of that concentration (i.e., maximum or UCL concentration) is indicated in Table 8-2.

(5) Value for acenaphthene used as a surrogate.
(6) Value for pyrene used as a surrogate.
(7) Value for chromium III used as a surrogate.
(8) USEPA Residential Soil Action Level

TABLE 8-2

TOTAL SOIL (2008) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Criteria [1]	Chemical Frequency / Range / Location			Background [2]	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL [3] (ProUCL)	Exposure Concentration	Rationale for Concentration Selection [4]
Volatile Organic Compounds (ug/kg)										
1,4-Dichloro-2-butene (trans)	6.90	1/35	59 J	69SB14	NA	YES	ASL	NC	59	See Surface Soil Exposure
2-Chloro-1,3-butadiene (Chloropre	9.40	1/35	7.6 J	69SB07	NA	NO	BSL	NA	NA	NA
2-Hexanone (MBK)	21,000	2/35	2 J - 6.3 J	69SB08	NA	NO	BSL	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	530,000	2/35	3.7 J - 7.7 J	69SB22	NA	NO	BSL	NA	NA	NA
Acetone	6,100,000	22/31	7 J - 260	69SB05	NA	NO	BSL	NA	NA	NA
Benzene	1,100	1/35	0.99 J	69SB22	NA	NO	BSL	NA	NA	NA
Carbon Disulfide	82,000	1/35	0.59 J	69SB27	NA	NO	BSL	NA	NA	NA
Ethylbenzene	5,400	2/35	2.2 J - 6.2 J	69SB09	NA	NO	BSL	NA	NA	NA
Toluene	500,000	3/35	0.53 J - 3.3 J	69SB02	NA	NO	BSL	NA	NA	NA
Xylenes, total	63,000	5/35	4.9 J - 28 J	69SB09	NA	NO	BSL	NA	NA	NA
Semivolatile Organic Compounds (ug/kg)										
1,2,4,5-Tetrachlorobenzene	1,800	2/35	26 J - 29 J	69SB11	NA	NO	BSL	NA	NA	NA
2-Methylnaphthalene	31,000	2/35	2.3 J - 9.2 J	69SB05	NA	NO	BSL	NA	NA	NA
Acenaphthene	340,000	5/35	0.79 J - 10 J	69SB05	NA	NO	BSL	NA	NA	NA
Acenaphthylene	340,000 [5]	2/35	9.8 J - 11 J	69SB05	NA	NO	BSL	NA	NA	NA
Anthracene	1,700,000	6/35	3.8 J - 34 J	69SB05	NA	NO	BSL	NA	NA	NA
Benzo(a)anthracene	150	14/35	4.8 J - 460 J	69SB05	NA	YES	ASL	131 (NP)	254	See Surface Soil Exposure
Benzo(a)pyrene (BaP)	15.0	17/35	2.8 J - 530 J	69SB05	NA	YES	ASL	82.8 (NP)	116	See Surface Soil Exposure
Benzo(b)fluoranthene	150	18/35	5.6 J - 1,300 J	69SB05	NA	YES	ASL	588 (NP)	799	See Surface Soil Exposure
Benzo(g,h,i)perylene	170,000 [6]	17/35	7.8 J - 1,400 J	69SB05	NA	NO	BSL	NA	NA	NA
Benzo(k)fluoranthene *	1,500	3/35	2.9 J - 140	69SB11	NA	YES	CHEM	NC	140	See Surface Soil Exposure
Bis(2-ethylhexyl) Phthalate (BEHP)	35,000	10/35	9.4 J - 1,000 J	69SB05	NA	NO	BSL	NA	NA	NA
Butyl Benzyl Phthalate	260,000	11/35	16 J - 300 J	69SB05	NA	NO	BSL	NA	NA	NA
Chrysene *	15,000	19/35	3.9 J - 1,000 J	69SB05	NA	YES	CHEM	150 (NP)	303	See Surface Soil Exposure
Dibenz(a,h)anthracene	15.0	14/35	3 J - 220 J	69SB05	NA	YES	ASL	28.4 (NP)	40.1	See Surface Soil Exposure
Di-n-octyl Phthalate	NE	1/35	26 J	69SB11	NA	YES	NSC	NC	26	See Surface Soil Exposure
Fluoranthene	230,000	19/35	2.1 J - 1,100 J	69SB05	NA	NO	BSL	NA	NA	NA
Fluorene	230,000	4/35	1.3 J - 14 J	69SB05	NA	NO	BSL	NA	NA	NA
Indeno(1,2,3-cd)pyrene	150	16/35	8.6 J - 1,400 J	69SB05	NA	YES	ASL	156 (NP)	441	See Surface Soil Exposure
Naphthalene	3,600	3/35	0.75 J - 3.4 J	69SB05	NA	NO	BSL	NA	NA	NA
Pentachlorobenzene	4,900	1/35	13 J	69SB05	NA	NO	BSL	NA	NA	NA
Phenanthrene	170,000 [6]	15/35	2.4 J - 270 J	69SB05	NA	NO	BSL	NA	NA	NA
Pyrene	170,000	20/35	2.4 J - 1,200 J	69SB05	NA	NO	BSL	NA	NA	NA

TABLE 8-2

TOTAL SOIL (2008) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Criteria [1]	Chemical Frequency / Range / Location			Background [2]	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL [3] (ProUCL)	Exposure Concentration	Rationale for Concentration Selection [4]
Metals (mg/kg)										
Antimony	3.10	1/35	2 J	69SB05	2.43	NO	BSL	NA	NA	NA
Arsenic	0.390	35/35	0.83 - 5.4	69SB05	2.37	YES	ASL	3.27 (G)	3.78	See Surface Soil Exposure
Barium	1,500	31/31	14 - 800	69SB05	233	NO	BSL	NA	NA	NA
Beryllium	16.0	35/35	0.037 J - 0.35	69SB05, 69SB27	0.717	NO	BSL	NA	NA	NA
Cadmium	7.0	27/35	0.046 J - 36 J	69SB05	0.655	YES	ASL	13.5 (NP)	18.6	See Surface Soil Exposure
Chromium	12,000 [7]	35/35	9 - 89 J	69SB05	87.6	NO	BSL	NA	NA	NA
Cobalt	2.30	35/35	2.4 J - 27	69SB12	51.9	YES	ASL	12.0 (N)	12.0	95% Student's-t UCL
Copper	310	35/35	16 - 270	69SB27	225	NO	BSL	NA	NA	NA
Lead	400 [8]	24/25	0.93 J - 520	69SB05	28.2	YES	ASL	158 (NP)	157.7	See Surface Soil Exposure
Mercury	0.560	34/35	0.0066 J - 0.16	69SB04	0.112	NO	BSL	NA	NA	NA
Nickel	150	35/35	2.7 - 34	69SB05	27.0	NO	BSL	NA	NA	NA
Selenium	39.0	31/35	0.13 J - 1.8	69SB04	1.85	NO	BSL	NA	NA	NA
Silver	39.0	26/35	0.021 J - 0.54	69SB05	ND	NO	BSL	NA	NA	NA
Tin	4,700	1/35	9 J	69SB05	3.68	NO	BSL	NA	NA	NA
Vanadium	0.550	35/35	46 J - 460 J	69SB08	367	YES	ASL	201 (G)	201	95% Approximate Gamma UCL
Zinc	2,300	25/25	9 - 650	69SB05	113	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated
ND - Not Detected
NE - Not Established

SSL - Soil Screening Level
COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit
ULM - Upper Limit of Means

mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram
ft bgs = feet below ground surface

Rationale Codes:

(ASL) Above Screening Level
(CHEM) Same Chemical Class
(NSC) No Screening Criteria
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated

Shaded constituents were identified as COPCs for quantitative risk evaluation.

* These compounds were retained because one or more of its related carcinogenic PAHs were retained, and these compounds are known to exist together in mixtures

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Residential Soil (Nov 2010)
(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was used to calculate the 95% UCL and distribution (>8 samples and >4 detections):
(N) - Normal distribution
(NP) - Nonparametric distribution
(G) - Gamma distribution
(4) Exposure concentrations were calculaed for surface soil (0-1 ft bgs) and total soil (0-10 ft bgs).
The higher of the two exposure concentrations for each COPC was used in the risk calculations to produce a conservative risk estimate.
"See Surface Soil Exposure" indicates that the greatest expsoure concentration is in surface soil. The basis of that concentration
(i.e., maximum or UCL concentration) is indicated in Table 8-1.

(5) Value for acenaphthene used as a surrogate.
(6) Value for pyrene used as a surrogate.
(7) Value for chromium III used as a surrogate.
(8) USEPA Residential Soil Action Level

TABLE 8-3

GROUNDWATER (2008) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Criteria (1)	Chemical Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Tapwater	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL (3) (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Volatile Organic Compounds (ug/L)										
2-Hexanone (MBK)	4.70	1/7	1.1 J	69GW26	NA	NO	BSL	NA	NA	NA
Acetone	2,200	1/7	15 J	69GW27	NA	NO	BSL	NA	NA	NA
Chloromethane	19.0	1/7	1.5 J	69GW25	NA	NO	BSL	NA	NA	NA
Semivolatile Organic Compou										
Acenaphthene	220	1/7	0.11 J	69GW27	NA	NO	BSL	NA	NA	NA
Bis(2-ethylhexyl) Phthalate (BE	4.80	1/7	0.6 J	69GW25	NA	NO	BSL	NA	NA	NA
Cresol (Mixed Isomers)	93.0	1/7	2.1	69GW27	NA	NO	BSL	NA	NA	NA
Dibenzofuran	3.70	1/7	0.36 J	69GW27	NA	NO	BSL	NA	NA	NA
Fluorene	150	1/7	0.083 J	69GW26	NA	NO	BSL	NA	NA	NA
Phenanthrene	110 (4)	1/7	0.28	69GW26	NA	NO	BSL	NA	NA	NA
Dissolved Metals (ug/L)										
Arsenic	0.0450	3/7	0.32 J - 0.38 J	69GW27	14.2	YES	ASL	NC	NA	NA
Barium	730	7/7	12 - 570	69GW12	267	NO	BSL	NA	NA	NA
Cadmium	1.80	2/7	0.14 J - 0.16 J	69GW12	13.6	NO	BSL	NA	NA	NA
Cobalt	1.10	5/7	0.71 J - 12 J	69GW12	35.2	YES	ASL	NC	NA	NA
Nickel	73.0	7/7	0.42 J - 0.89 J	69GW25	20.2	NO	BSL	NA	NA	NA
Vanadium	0.260	7/7	2.4 J - 6.6	69GW11	21.4	YES	ASL	NC	NA	NA
Zinc	1,100	4/7	7.2 J - 16 J	69GW26	22.7	NO	BSL	NA	NA	NA
Total Metals (ug/L)										
Arsenic	0.0450	4/7	0.34 J - 0.56 J	69GW27	8.01	YES	ASL	NC	0.56	Max (Less than 8 samples)
Barium	730	7/7	12 - 580	69GW12	694	NO	BSL	NA	NA	NA
Cadmium	1.80	2/7	0.12 J - 0.16 J	69GW12	13.6	NO	BSL	NA	NA	NA
Cobalt	1.10	4/7	0.81 J - 11	69GW11	35.2	YES	ASL	NC	11	Max (Less than 8 samples)
Nickel	73.0	7/7	0.44 J - 0.9 J	69GW25	96.9	NO	BSL	NA	NA	NA
Vanadium	0.260	7/7	2.7 J - 6.9	69GW07	21.4	YES	ASL	NC	6.9	Max (Less than 8 samples)
Zinc	1,100	4/7	7.2 J - 10 J	69GW26	22.7	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated

COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit
ULM - Upper Limit of Means

ug/L - microgram per liter

Rationale Codes:

(ASL) Above Screening Level
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated

Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Tapwater (Nov 2010)
(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was not calculated (NC) because there were less than 8 samples.
(4) Value for pyrene used as a surrogate.

TABLE 8-4

SUMMARY OF EXPOSURE PARAMETERS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Parameter	Units	Current and Future Adult Trespassers RME	Current and Future Youth Trespassers RME	Current and Future Adult On-Site Workers RME	Future Adult Industrial / Commercial Workers RME	Future Adult Residents RME	Future Young Child Residents RME	Future Adult Construction Workers RME
Soil								
Ingestion Rate of Soil (IR-S)	mg/day	100 USEPA, 1991	100 USEPA, 1991	100 USEPA, 2002	100 USEPA, 2002	100 USEPA, 1991	200 USEPA, 1991	330 USEPA, 2002
Fraction Ingested from Source (FI)	NA	1 Prof Judge (1)	1 Prof Judge (1)	1 Prof Judge (1)	1 Prof Judge (1)	1 Prof Judge (1)	1 Prof Judge (1)	1 Prof Judge (1)
Exposure Frequency (EF)	days/year	52 Prof Judge (2)	52 Prof Judge (2)	250 USEPA, 2004	250 USEPA, 2004	350 USEPA, 2004	350 USEPA, 2004	250 USEPA, 2004
Exposure Duration (ED)	years	24 USEPA, 1991	11 Prof Judge (3)	25 USEPA, 2004	25 USEPA, 2004	24 USEPA, 1991	6 USEPA, 1991	1 Prof Judge (4)
Exposure Time (ET)	hours/day	2 USEPA, 1997 (4)	2 USEPA, 1997 (5)	8 Prof Judge (6)	8 Prof Judge (6)	24 Prof Judge (7)	24 Prof Judge (7)	8 Prof Judge (6)
Surface Area Available for Contact (SA)	cm2/day	5,700 USEPA, 2004	3,200 USEPA, 1997	3,300 USEPA, 2004	3,300 USEPA, 2004	5,700 USEPA, 2004	2,800 USEPA, 2004	3,300 USEPA, 2004
Conversion Factor (CF)	kg/mg	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989
Averaging Time (Non-Cancer) (AT-N)	days	8,760 USEPA, 1989	4,015 USEPA, 1989	9,125 USEPA, 1989	9,125 USEPA, 1989	8,760 USEPA, 1989	2,190 USEPA, 1989	365 USEPA, 1989
Groundwater								
Ingestion Rate of Groundwater (IR-W)	L/day	--	--	--	1 USEPA, 1991	2 USEPA, 1991	1 USEPA, 1989	0.02 VDEQ, 2009
Exposure Frequency (EF)	days/year	--	--	--	250 USEPA, 2004	350 USEPA, 2004	350 USEPA, 2004	50 Prof Judge (8)
Exposure Duration (ED)	years	--	--	--	25 USEPA, 2004	24 USEPA, 1991	6 USEPA, 1991	1 Prof Judge (4)
Exposure Time (ET)	hours/day	--	--	--	--	0.58 USEPA, 2004	1 USEPA, 2004	2 Prof Judge (9)
Surface Area Available for Contact (SA)	cm2	--	--	--	--	18,000 USEPA, 2004	6,600 USEPA, 2004	3,300 USEPA, 2004
Conversion Factor (CF)	L/cm3	--	--	--	--	1.00E-03 USEPA, 1989	1.00E-03 USEPA, 1989	1.00E-03 USEPA, 1989
Averaging Time (Non-Cancer) (AT-N)	days	--	--	--	9,125 USEPA, 1989	8,760 USEPA, 1989	2,190 USEPA, 1989	365 USEPA, 1989
Sediment								
Ingestion Rate of Sediment (IR-S)	mg/day	100 USEPA, 1991	100 USEPA, 1991	100 USEPA, 2002	--	100 USEPA, 1991	200 USEPA, 1991	--
Fraction Ingested from Source (Fi)	NA	1 Prof Judge (1)	1 Prof Judge (1)	1 Prof Judge (1)	--	1 Prof Judge (1)	1 Prof Judge (1)	--
Exposure Frequency (EF)	days/year	52 Prof Judge (2)	52 Prof Judge (2)	250 USEPA, 2004	--	52 Prof Judge (2)	52 Prof Judge (2)	--
Exposure Duration (ED)	years	24 USEPA, 1991	11 USEPA, 1991	25 USEPA, 2004	--	24 USEPA, 1991	6 USEPA, 1991	--
Surface Area Available for Contact (SA)	cm2/day	5,700 USEPA, 2004	3,200 USEPA, 1997	3,300 USEPA, 2004	--	5,700 USEPA, 2004	2,800 USEPA, 2004	--
Conversion Factor (CF)	kg/mg	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	--	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989	--
Averaging Time (Non-Cancer) (AT-N)	days	8,760 USEPA, 1989	4,015 USEPA, 1989	9,125 USEPA, 1989	--	8,760 USEPA, 1989	2,190 USEPA, 1989	--

TABLE 8-4

SUMMARY OF EXPOSURE PARAMETERS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Parameter	Units	Current and Future Adult Trespassers RME	Current and Future Youth Trespassers RME	Current and Future Adult On-Site Workers RME	Future Adult Industrial / Commercial Workers RME	Future Adult Residents RME	Future Young Child Residents RME	Future Adult Construction Workers RME
Other Parameters								
Body Weight (BW)	kg	70 USEPA, 1997	45 USEPA, 1997	70 USEPA, 1997	70 USEPA, 1997	70 USEPA, 1997	15 USEPA, 1997	70 USEPA, 1997
Soil to Skin Adherence Factor (AF)	mg/cm2	0.07 USEPA, 2004	0.2 USEPA, 2004	0.2 USEPA, 2004	0.2 USEPA, 2004	0.07 USEPA, 2004	0.2 USEPA, 2004	0.3 USEPA, 2002
Sediment to Skin Adherence Factor (AF)	mg/cm2	0.3 VDEQ, 2010	0.3 VDEQ, 2010	0.3 VDEQ, 2010	0.3 VDEQ, 2010	0.3 VDEQ, 2010	0.3 VDEQ, 2010	0.3 VDEQ, 2010
Particulate Emission Factor (PEF)	m3/kg	1.36E+09 USEPA, 2002	1.36E+09 USEPA, 2002	1.36E+09 USEPA, 2002	1.36E+09 USEPA, 2002	1.36E+09 USEPA, 2002	1.36E+09 USEPA, 2002	2.99E+06 USEPA, 2002 (10)
Averaging Time (Cancer) (AT-C)	days	25,550 USEPA, 1989	25,550 USEPA, 1989	25,550 USEPA, 1989	25,550 USEPA, 1989	25,550 USEPA, 1989	25,550 USEPA, 1989	25,550 USEPA, 1989

Notes:

RME - Reasonalble Maximum Exposure
Prof Judge - Professional Judgment
Gastrointestinal absorption efficiencies (GIABS), dermal absorption factors (ABS), and permeability constants (Kp) obtained from RAGS Part E (USEPA, 2004).

(1) Conservative assumption of 100% ingested from source.
(2) Assumes individuals trespass on site 1 day/week.
(3) Represents youths from 6 to 16 years of age.
(4) Assumes a construction period of 1 year.
(5) Recommended outdoor activity factor for adults.
(6) Assumes an 8 hour work day.
(7) Conservatively assumes receptor remains at residence 24 hours/day.
(8) Assumes 20% of time spent in trench.
(9) Assumes 2 hours/event in trench.
(10) PEF calculated based on emissions from truck traffic on unpaved roads (refer to Appendix J).

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.
USEPA, 2002. Draft Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.
Virginia Department of Environmental Quality (VDEQ), 2010. Virginia Voluntary Remediation Program Risk Assessment Guidance, Section 3.2.2 (http://www.deq.state.va.us/vrprisk/raguide.html). Accessed February 2010.

TABLE 8-5

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Constituents	Oral CSF (mg/kg/day)$^{-1}$	Inhalation UR 1/(µg/m^3)	Oral RfD (mg/kg/day)$^{-1}$	Inhalation RfC (mg/m^3)	Oral Absorption Factors (1)	Oral to (2) Dermal Adjustment	WOE	Target Organ (Systemic Toxicity)	Critical Effect (Systemic Toxicity)
Volatiles									
1,4-Dichloro-2-butene (trans)	NA	4.20E-03	NA	NA	0.1	100%	D	NA	NA
Semivolatiles									
Benzo(a)anthracene	7.30E-01	1.10E-04	NA	NA	0.13	100%	(o) B2, (i) D	NA	NA
Benzo(a)pyrene (BaP)	7.30E+00	1.10E-03	NA	NA	0.13	100%	B2	NA	NA
Benzo(b)fluoranthene	7.30E-01	1.10E-04	NA	NA	0.13	100%	B2	NA	NA
Benzo(k)fluoranthene	7.30E-02	1.10E-04	NA	NA	0.13	100%	B2	NA	NA
Chrysene	7.30E-03	1.10E-05	NA	NA	0.13	100%	B2	NA	NA
Dibenz(a,h)anthracene	7.30E+00	1.20E-03	NA	NA	0.13	100%	(o) B2, (i) D	NA	NA
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	100%	D	Kidney / Liver	Kidney / Liver: Increased weight; Liver: Increased SGOT activity
Indeno(1,2,3-cd)pyrene	7.30E-01	1.10E-04	NA	NA	0.13	100%	B2	NA	NA
Inorganics									
Arsenic	1.50E+00	4.30E-03	3.00E-04	1.50E-05	0.03	100%	A	Skin / CVS	Skin / CVS: Hyperpigmentation, keratosis, possible vascular complications
Cadmium	NA	1.80E-03	1.00E-03	1.00E-05	0.001	3%	(o) D, (i) B1	Kidney	Kidney: 10% Probability of abnormally high urinary NAG excretion
Cobalt	NA	9.00E-03	3.00E-04	6.00E-06	0.01	100%	D	(o) CVS, (i) RsS	(o) - CVS: Blood; (i) - RsS: Lesions on the respiratory tract
Lead	NA	NA	NA	NA	0.01	100%	B2	NA	NA
Thallium	NA	NA	NA	NA	0.01	100%	D	Liver / CVS / Skin	Liver / CVS / Skin: Increased levels of SGOT and LDH in blood
Vanadium	NA	NA	7.00E-05	1.00E-04	0.01	3%	D	GIS / Kidney	GIS / Kidney: Gastrointestinal disturbances, Discoloration of mouth and tongue

Notes:

CSF = Cancer Slope Factor
UR = Unit Risk
RfD = Reference Dose
RfC = Reference Concentration
WOE = Weight of Evidence

NA = Not Available
(o) = Toxicty due to oral exposure
(i) = Toxicity due to inhalation exposure

WOE / EPA Group:

A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen — Known/Likely (EPA classes A, B1, B2, C)
D - Not classifiable as a human carcinogen — Cannot be Determined (EPA class D)
E - Evidence of noncarcinogenicity — Not Likely (EPA class E)

Target Organ Abbreviations:

CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

(1) - ABS - Absorption Factors - In the absence of reference values from USEPA 2004, ABS of 0.01 (VDEQ 2010) is assumed for inorganics.
(2) - Oral to dermal adjustment taken from RAGS Part E (USEPA, 2004)

TABLE 8-6

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	1.3E-08	--	6.7E-09	--	2.0E-08	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	5.9E-08	--	3.1E-08	--	9.0E-08	NA	--	--	--	--
			Benzo(b)fluoranthene	4.1E-08	--	2.1E-08	--	6.2E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	7.1E-10	--	3.7E-10	--	1.1E-09	NA	--	--	--	--
			Chrysene	1.5E-10	--	8.0E-11	--	2.3E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	2.0E-08	--	1.1E-08	--	3.1E-08	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	2.2E-08	--	1.2E-08	--	3.4E-08	NA	--	--	--	--
			Arsenic	4.0E-07	--	4.7E-08	--	4.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.58	--	0.90	**1.48**
			Chemical Total	5.5E-07	--	1.3E-07	--	6.8E-07		0.60	--	0.90	**1.50**
		Exposure Point Total						6.8E-07					**1.50**
	Exposure Medium Total							6.8E-07					**1.50**

TABLE 8-6

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust											
			1,4-Dichloro-2-butene (trans)	--	7.3E-13	--	--	7.3E-13	NA	--	--	--	--
			Benzo(a)anthracene	--	6.4E-12	--	--	6.4E-12	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(b)fluoranthene	--	1.7E-11	--	--	1.7E-11	NA	--	--	--	--
			Benzo(k)fluoranthene	--	1.4E-12	--	--	1.4E-12	NA	--	--	--	--
			Chrysene	--	5.0E-12	--	--	5.0E-12	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	2.4E-12	--	--	2.4E-12	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	2.6E-12	--	--	2.6E-12	NA	--	--	--	--
			Arsenic	--	4.8E-11	--	--	4.8E-11	NA	--	<0.01	--	<0.01
			Cadmium	--	9.8E-11	--	--	9.8E-11	Kidney	--	<0.01	--	<0.01
			Cobalt	--	3.2E-10	--	--	3.2E-10	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	5.1E-10	--	--	5.1E-10		--	<0.01	--	<0.01
		Exposure Point Total						5.1E-10					<0.01
	Exposure Medium Total							5.1E-10					<0.01
Soil (2008) Total								**6.81E-07**					**1.50**
Adult Trespassers Total								**6.81E-07**					**1.50**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	6.8E-07	Total Hazard Index Across Soil (2008)	**1.5**
Total Risk Across All Media and All Exposure Routes	6.8E-07	azard Index Across All Media and All Exposure Routes	**1.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**1.5**	**1.5**
Cardiovascular System HI =		0.01	0.01
Skin HI =		<0.01	<0.01
Kidney HI =	<0.01	**1.5**	**1.5**
Respiratory System HI =	<0.01		<0.01

TABLE 8-7

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers (2008)
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	9.2E-09	--	7.7E-09	--	1.7E-08	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	4.2E-08	--	3.5E-08	--	7.7E-08	NA	--	--	--	--
			Benzo(b)fluoranthene	2.9E-08	--	2.4E-08	--	5.3E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	5.1E-10	--	4.2E-10	--	9.3E-10	NA	--	--	--	--
			Chrysene	1.1E-10	--	9.2E-11	--	2.0E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.5E-08	--	1.2E-08	--	2.7E-08	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.6E-08	--	1.3E-08	--	2.9E-08	NA	--	--	--	--
			Arsenic	2.8E-07	--	5.4E-08	--	3.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.91	--	2.24	**3.15**
			Chemical Total	3.9E-07	--	1.5E-07	--	5.4E-07		0.93	--	2.24	**3.17**
		Exposure Point Total						5.4E-07					**3.17**
	Exposure Medium Total							5.4E-07					**3.17**

TABLE 8-7

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers (2008)
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	3.3E-13	--	--	3.3E-13	NA	--	--	--	--
			Benzo(a)anthracene	--	2.9E-12	--	--	2.9E-12	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	6.9E-12	--	--	6.9E-12	NA	--	--	--	--
			Benzo(b)fluoranthene	--	7.9E-12	--	--	7.9E-12	NA	--	--	--	--
			Benzo(k)fluoranthene	--	6.6E-13	--	--	6.6E-13	NA	--	--	--	--
			Chrysene	--	2.3E-12	--	--	2.3E-12	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	1.1E-12	--	--	1.1E-12	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	1.2E-12	--	--	1.2E-12	NA	--	--	--	--
			Arsenic	--	2.2E-11	--	--	2.2E-11	NA	--	<0.01	--	<0.01
			Cadmium	--	4.5E-11	--	--	4.5E-11	Kidney	--	<0.01	--	<0.01
			Cobalt	--	1.4E-10	--	--	1.4E-10	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	2.3E-10	--	--	2.3E-10		--	<0.01	--	<0.01
		Exposure Point Total						2.3E-10					<0.01
	Exposure Medium Total							2.3E-10					<0.01
Soil (2008) Total								**5.41E-07**					**3.17**
Youth Trespassers Total								**5.41E-07**					**3.17**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	5.4E-07	Total Hazard Index Across Soil (2008)	**3.2**
Total Risk Across All Media and All Exposure Routes	5.4E-07	azard Index Across All Media and All Exposure Routes	**3.2**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**3.1**	**3.1**
Cardiovascular System HI =		0.02	0.02
Skin HI =		<0.01	<0.01
Kidney HI =	<0.01	**3.2**	**3.2**
Respiratory System HI =	<0.01		<0.01

TABLE 8-8

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	6.5E-08	--	5.6E-08	--	1.2E-07	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	3.0E-07	--	2.5E-07	--	5.5E-07	NA	--	--	--	--
			Benzo(b)fluoranthene	2.0E-07	--	1.7E-07	--	3.8E-07	NA	--	--	--	--
			Benzo(k)fluoranthene	3.6E-09	--	3.1E-09	--	6.6E-09	NA	--	--	--	--
			Chrysene	7.7E-10	--	6.6E-10	--	1.4E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.0E-07	--	8.8E-08	--	1.9E-07	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.1E-07	--	9.7E-08	--	2.1E-07	NA	--	--	--	--
			Arsenic	2.0E-06	--	3.9E-07	--	2.4E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cadmium	--	--	--	--	--	Kidney	0.02	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.81	--	7.13	**9.94**
			Chemical Total	2.8E-06	--	1.1E-06	--	3.8E-06		2.88	--	7.14	**10.02**
		Exposure Point Total						3.8E-06					**10.02**
	Exposure Medium Total							3.8E-06					**10.02**

TABLE 8-8

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust											
			1,4-Dichloro-2-butene (trans)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	1.3E-10	--	--	1.3E-10	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	3.0E-10	--	--	3.0E-10	NA	--	--	--	--
			Benzo(b)fluoranthene	--	3.4E-10	--	--	3.4E-10	NA	--	--	--	--
			Benzo(k)fluoranthene	--	2.9E-11	--	--	2.9E-11	NA	--	--	--	--
			Chrysene	--	1.0E-10	--	--	1.0E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	4.8E-11	--	--	4.8E-11	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	5.1E-11	--	--	5.1E-11	NA	--	--	--	--
			Arsenic	--	9.5E-10	--	--	9.5E-10	NA	--	<0.01	--	<0.01
			Cadmium	--	2.0E-09	--	--	2.0E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	6.3E-09	--	--	6.3E-09	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.0E-08	--	--	1.0E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.0E-08					<0.01
	Exposure Medium Total							1.0E-08					<0.01
Soil (2008) Total								**3.84E-06**					**10.02**
On-Site Workers Total								**3.84E-06**					**10.02**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	3.8E-06	Total Hazard Index Across Soil (2008)	**10.0**
Total Risk Across All Media and All Exposure Routes	3.8E-06	azard Index Across All Media and All Exposure Routes	**10.0**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**9.9**	**9.9**
Cardiovascular System HI =		0.06	0.06
Skin HI =		0.01	0.01
Kidney HI =	<0.01	**10.0**	**10.0**
Respiratory System HI =	<0.01		<0.01

TABLE 8-9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	3.0E-06	--	1.1E-06	--	4.1E-06	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	1.4E-05	--	5.2E-06	--	1.9E-05	NA	--	--	--	--
			Benzo(b)fluoranthene	9.4E-06	--	3.6E-06	--	1.3E-05	NA	--	--	--	--
			Benzo(k)fluoranthene	1.6E-07	--	6.3E-08	--	2.3E-07	NA	--	--	--	--
			Chrysene	3.6E-08	--	1.4E-08	--	4.9E-08	NA	--	--	--	--
			Dibenz(a,h)anthracene	4.7E-06	--	1.8E-06	--	6.5E-06	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.2E-06	--	2.0E-06	--	7.2E-06	NA	--	--	--	--
			Arsenic	2.7E-06	--	3.2E-07	--	3.0E-06	Skin / CVS	0.02	--	<0.01	0.02
			Cadmium	--	--	--	--	--	Kidney	0.03	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.05	--	<0.01	0.06
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.93	--	6.04	**9.97**
			Chemical Total	3.9E-05	--	1.4E-05	--	5.3E-05		4.03	--	6.04	**10.07**
		Exposure Point Total						5.3E-05					**10.07**
	Exposure Medium Total							5.3E-05					**10.07**

TABLE 8-9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust											
			1,4-Dichloro-2-butene (trans)	--	5.9E-11	--	--	5.9E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	3.7E-09	--	--	3.7E-09	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	8.9E-09	--	--	8.9E-09	NA	--	--	--	--
			Benzo(b)fluoranthene	--	1.0E-08	--	--	1.0E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	--	8.4E-10	--	--	8.4E-10	NA	--	--	--	--
			Chrysene	--	2.9E-09	--	--	2.9E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	1.4E-09	--	--	1.4E-09	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	1.5E-09	--	--	1.5E-09	NA	--	--	--	--
			Arsenic	--	3.8E-09	--	--	3.8E-09	NA	--	<0.01	--	<0.01
			Cadmium	--	7.9E-09	--	--	7.9E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	2.6E-08	--	--	2.6E-08	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	6.7E-08	--	--	6.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						6.7E-08					<0.01
	Exposure Medium Total							6.7E-08					<0.01
Soil (2008) Total								**5.30E-05**					**10.08**

TABLE 8-9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater (2008)	Groundwater (2008)	Tap	Arsenic	7.9E-06	--	4.1E-08	--	7.9E-06	Skin / CVS	0.05	--	<0.01	0.05
			Cobalt	--	--	--	--	--	CVS	1.00	--	<0.01	**1.01**
			Vanadium	--	--	--	--	--	GIS / Kidney	2.70	--	0.54	**3.24**
			Chemical Total	7.9E-06	--	4.1E-08	--	7.9E-06		3.76	--	0.54	**4.30**
		Exposure Point Total						7.9E-06					**4.30**
	Exposure Medium Total							7.9E-06					**4.30**
Groundwater (2008) Total								**7.93E-06**					**4.30**
Adult Residents Total								**6.10E-05**					**14.38**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	5.3E-05	Total Hazard Index Across Soil (2008)	**10.1**
Total Risk Across Groundwater (2008)	7.9E-06	Total Hazard Index Across Groundwater (2008)	**4.3**
Total Risk Across All Media and All Exposure Routes	6.1E-05	azard Index Across All Media and All Exposure Routes	**14.4**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**13.2**	**13.2**
Cardiovascular System HI =		**1.1**	**1.1**
Skin HI =		0.07	0.07
Kidney HI =	<0.01	**13.2**	**13.2**
Respiratory System HI =	<0.01		<0.01

TABLE 8-10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents (2008)
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	2.6E-06	--	9.6E-07	--	3.6E-06	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	1.2E-05	--	4.4E-06	--	1.6E-05	NA	--	--	--	--
			Benzo(b)fluoranthene	8.3E-06	--	3.0E-06	--	1.1E-05	NA	--	--	--	--
			Benzo(k)fluoranthene	1.5E-07	--	5.3E-08	--	2.0E-07	NA	--	--	--	--
			Chrysene	3.2E-08	--	1.1E-08	--	4.3E-08	NA	--	--	--	--
			Dibenz(a,h)anthracene	4.2E-06	--	1.5E-06	--	5.7E-06	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	4.6E-06	--	1.7E-06	--	6.3E-06	NA	--	--	--	--
			Arsenic	6.2E-06	--	5.2E-07	--	6.7E-06	Skin / CVS	0.16	--	0.01	0.17
			Cadmium	--	--	--	--	--	Kidney	0.24	--	0.02	0.26
			Cobalt	--	--	--	--	--	CVS	0.51	--	0.01	0.53
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	36.71	--	39.54	**76.25**
			Chemical Total	3.8E-05	--	1.2E-05	--	5.0E-05		37.62	--	39.59	**77.21**
		Exposure Point Total						5.0E-05					**77.21**
	Exposure Medium Total							5.0E-05					**77.21**

TABLE 8-10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents (2008)
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust											
			1,4-Dichloro-2-butene (trans)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	1.7E-09	--	--	1.7E-09	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	4.0E-09	--	--	4.0E-09	NA	--	--	--	--
			Benzo(b)fluoranthene	--	4.5E-09	--	--	4.5E-09	NA	--	--	--	--
			Benzo(k)fluoranthene	--	3.8E-10	--	--	3.8E-10	NA	--	--	--	--
			Chrysene	--	1.3E-09	--	--	1.3E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	6.3E-10	--	--	6.3E-10	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	6.7E-10	--	--	6.7E-10	NA	--	--	--	--
			Arsenic	--	9.6E-10	--	--	9.6E-10	NA	--	<0.01	--	<0.01
			Cadmium	--	2.0E-09	--	--	2.0E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	6.4E-09	--	--	6.4E-09	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	2.2E-08	--	--	2.2E-08		--	<0.01	--	<0.01
		Exposure Point Total						2.2E-08					<0.01
	Exposure Medium Total							2.2E-08					<0.01
Soil (2008) Total								**5.03E-05**					**77.21**

TABLE 8-10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents (2008)
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater (2008)	Groundwater (2008)	Tap	Arsenic	4.6E-06	--	3.0E-08	--	4.6E-06	Skin / CVS	0.12	--	<0.01	0.12
			Cobalt	--	--	--	--	--	CVS	2.34	--	<0.01	**2.35**
			Vanadium	--	--	--	--	--	GIS / Kidney	6.30	--	1.60	**7.90**
			Chemical Total	4.6E-06	--	3.0E-08	--	4.6E-06		8.76	--	1.61	**10.37**
		Exposure Point Total						4.6E-06					**10.37**
	Exposure Medium Total							4.6E-06					**10.37**
Groundwater (2008) Total								**4.63E-06**					**10.37**
Young Child Residents Total								**5.50E-05**					**87.58**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	5.0E-05	Total Hazard Index Across Soil (2008)	**77.2**
Total Risk Across Groundwater (2008)	4.6E-06	Total Hazard Index Across Groundwater (2008)	**10.4**
Total Risk Across All Media and All Exposure Routes	5.5E-05	azard Index Across All Media and All Exposure Routes	**87.6**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**84.1**	**84.1**
Cardiovascular System HI =		**3.2**	**3.2**
Skin HI =		0.29	0.29
Kidney HI =	<0.01	**84.4**	**84.4**
Respiratory System HI =	<0.01		<0.01

TABLE 8-11

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	6.5E-08	--	5.6E-08	--	1.2E-07	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	3.0E-07	--	2.5E-07	--	5.5E-07	NA	--	--	--	--
			Benzo(b)fluoranthene	2.0E-07	--	1.7E-07	--	3.8E-07	NA	--	--	--	--
			Benzo(k)fluoranthene	3.6E-09	--	3.1E-09	--	6.6E-09	NA	--	--	--	--
			Chrysene	7.7E-10	--	6.6E-10	--	1.4E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.0E-07	--	8.8E-08	--	1.9E-07	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.1E-07	--	9.7E-08	--	2.1E-07	NA	--	--	--	--
			Arsenic	2.0E-06	--	3.9E-07	--	2.4E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cadmium	--	--	--	--	--	Kidney	0.02	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.81	--	7.13	**9.94**
			Chemical Total	2.8E-06	--	1.1E-06	--	3.8E-06		2.88	--	7.14	**10.02**
		Exposure Point Total						3.8E-06					**10.02**
	Exposure Medium Total							3.8E-06					**10.02**

TABLE 8-11

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	1.3E-10	--	--	1.3E-10	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	3.0E-10	--	--	3.0E-10	NA	--	--	--	--
			Benzo(b)fluoranthene	--	3.4E-10	--	--	3.4E-10	NA	--	--	--	--
			Benzo(k)fluoranthene	--	2.9E-11	--	--	2.9E-11	NA	--	--	--	--
			Chrysene	--	1.0E-10	--	--	1.0E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	4.8E-11	--	--	4.8E-11	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	5.1E-11	--	--	5.1E-11	NA	--	--	--	--
			Arsenic	--	9.5E-10	--	--	9.5E-10	NA	--	<0.01	--	<0.01
			Cadmium	--	2.0E-09	--	--	2.0E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	6.3E-09	--	--	6.3E-09	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.0E-08	--	--	1.0E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.0E-08					<0.01
	Exposure Medium Total							1.0E-08					<0.01
Soil (2008) Total								**3.84E-06**					**10.02**
Industrial / Commercial Workers Total								**3.84E-06**					**10.02**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	3.8E-06	Total Hazard Index Across Soil (2008)	**10.0**
Total Risk Across All Media and All Exposure Routes	3.8E-06	azard Index Across All Media and All Exposure Routes	**10.0**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**9.9**	**9.9**
Cardiovascular System HI =		0.06	0.06
Skin HI =		0.01	0.01
Kidney HI =	<0.01	**10.0**	**10.0**
Respiratory System HI =	<0.01		<0.01

TABLE 8-12

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	8.6E-09	--	3.3E-09	--	1.2E-08	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	3.9E-08	--	1.5E-08	--	5.4E-08	NA	--	--	--	--
			Benzo(b)fluoranthene	2.7E-08	--	1.0E-08	--	3.7E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	4.7E-10	--	1.8E-10	--	6.6E-10	NA	--	--	--	--
			Chrysene	1.0E-10	--	4.0E-11	--	1.4E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.4E-08	--	5.3E-09	--	1.9E-08	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.5E-08	--	5.8E-09	--	2.1E-08	NA	--	--	--	--
			Arsenic	2.6E-07	--	2.4E-08	--	2.9E-07	Skin / CVS	0.04	--	<0.01	0.04
			Cadmium	--	--	--	--	--	Kidney	0.06	--	<0.01	0.07
			Cobalt	--	--	--	--	--	CVS	0.13	--	<0.01	0.13
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	9.27	--	10.70	**19.97**
			Chemical Total	3.6E-07	--	6.4E-08	--	4.3E-07		9.50	--	10.71	**20.21**
		Exposure Point Total						4.3E-07					**20.21**
	Exposure Medium Total							4.3E-07					**20.21**

TABLE 8-12

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust											
			1,4-Dichloro-2-butene (trans)	--	2.7E-10	--	--	2.7E-10	NA	--	--	--	--
			Benzo(a)anthracene	--	3.5E-11	--	--	3.5E-11	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	1.5E-10	--	--	1.5E-10	NA	--	--	--	--
			Benzo(b)fluoranthene	--	1.1E-10	--	--	1.1E-10	NA	--	--	--	--
			Benzo(k)fluoranthene	--	1.8E-11	--	--	1.8E-11	NA	--	--	--	--
			Chrysene	--	7.6E-12	--	--	7.6E-12	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	5.4E-11	--	--	5.4E-11	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	5.5E-11	--	--	5.5E-11	NA	--	--	--	--
			Arsenic	--	1.8E-08	--	--	1.8E-08	NA	--	0.02	--	0.02
			Cadmium	--	3.6E-08	--	--	3.6E-08	Kidney	--	0.14	--	0.14
			Cobalt	--	1.2E-07	--	--	1.2E-07	RsS	--	0.15	--	0.15
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	0.15	--	0.15
			Chemical Total	--	1.7E-07	--	--	1.7E-07		--	0.47	--	0.47
		Exposure Point Total						1.7E-07					0.47
	Exposure Medium Total							1.7E-07					0.47
Soil (2008) Total								**6.01E-07**					**20.68**

TABLE 8-12

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers (2008)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater (2008)	Groundwater (2008)	Tap	Arsenic	4.7E-10	--	1.5E-10	--	6.2E-10	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	<0.01	--	0.05	0.05
			Chemical Total	4.7E-10	--	1.5E-10	--	6.2E-10		<0.01	--	0.05	0.05
		Exposure Point Total						6.2E-10					0.05
	Exposure Medium Total							6.2E-10					0.05
Groundwater (2008) Total								**6.25E-10**					**0.05**
Construction Workers Total								**6.02E-07**					**20.73**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	6.0E-07	Total Hazard Index Across Soil (2008)	**20.7**
Total Risk Across Groundwater (2008)	6.2E-10	Total Hazard Index Across Groundwater (2008)	0.05
Total Risk Across All Media and All Exposure Routes	6.0E-07	azard Index Across All Media and All Exposure Routes	**20.7**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**20.0**	**20.0**
Cardiovascular System HI =		0.18	0.18
Skin HI =		0.04	0.04
Kidney HI =	0.14	**20.1**	**20.2**
Respiratory System HI =	0.15		0.15

TABLE 8-13

COMPARISON OF SITE-SPECIFIC AND BACKGROUND VANADIUM HIs (2008)
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Receptor	Total Soil (Airfield) (1)		Groundwater	
	SWMU 69 Vanadium HI	Background Vanadium HI	SWMU 69 Vanadium HI	Background Vanadium HI
Adult Trespassers	1.48	1.47	NA	
Youth Trespassers	3.15	3.13	NA	
On-Site Workers	9.94	9.89	NA	
Adult Residents	9.97	9.92	3.24	117.02
Young Child Residents	76.25	75.87	7.90	285.12
Industrial / Commercial Workers	9.94	9.89	NA	
Construction Workers	19.97	19.87	0.05	1.91

Notes:

NA - Not applicable.

(1) 95% UCL for vanadium in total soil was selected as the soil EPC as the most conservative estimate. Therefore, site-specific HIs for vanadium were compared to total soil background HIs.

TABLE 8-14

SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT SWMU 69 (AIRCRAFT PARKING AREA) CORRECTIVE MEASURES STUDY REPORT NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Potential Magnitude for Over-Estimation of Risks	Potential Magnitude for Under-Estimation of Risks	Potential Magnitude for Over or Under-Estimation of Risks
Environmental Sampling and Analysis			
Sufficient samples may not have been taken to characterize the media being evaluated.			Moderate
Systematic or random errors in the chemical analysis may yield erroneous data.			Low
Selection of COPCs			
The use of site-specific background and USEPA Regional Screening Levels in selecting COPCs in all media of concern.		Low	
Maximum detection limits in excess of screening levels.		Low	
Exposure Assessment			
The standard assumptions regarding body weight, exposure period, life expectancy, population characteristics, and lifestyle may not be representative of the actual exposure situations.			Moderate
The use of the 95th percentile upper confidence level data for the normal or lognormal distribution in the estimation of the RME.			Low
The amount of media intake is assumed to be constant and representative of any actual exposure.			Low
The use of an ABS of 0.01 for metals in the absence of reference values from USEPA RAGS Part E.	Moderate		
Toxicological Assessment			
Toxicological indices derived from high dose animal studies, extrapolated to low dose human exposure.	Moderate		
Use of PPRTV RfD for vanadium.	Moderate		
Chemicals lacking screening criteria.		Low	
Risk Characterization			
Assumption of additivity in the quantitation of cancer risks without consideration of synergism, antagonism, promotion and initiation.			Moderate
Assumption of additivity in the estimation of systemic health effects without consideration of synergism, antagonism, etc.			Moderate
Additivity of risks by individual exposure pathways (dermal and ingestion and inhalation).			Low

TABLE 8-14

SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT SWMU 69 (AIRCRAFT PARKING AREA) CORRECTIVE MEASURES STUDY REPORT NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Potential Magnitude for Over-Estimation of Risks	Potential Magnitude for Under-Estimation of Risks	Potential Magnitude for Over or Under-Estimation of Risks
Comparison to Background Levels			
Contribution of background levels of vanadium to risks calculated for SWMU 69	Moderate		

Notes:

Low - Assumptions categorized as "low" may effect risk estimates by less than one order of magnitude.
Moderate - Assumptions categorized as "moderate" may effect estimates of risk by between one and two orders of magnitude.
High - Assumptions categorized as "high" may effect estimates of risk by more than two orders of magnitude.

Source: Risk Assessment Guidance for Superfund, Volume 1, Part A: Human Health Evaluation Manual. USEPA, 1989.

TABLE 8-15

SURFACE SOIL (2010) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Contaminant	Criteria (1)		Contaminant Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil		No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL (3) (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Inorganics (mg/kg)											
Arsenic	0.390		52/52	0.65 - 6.2	69SB101	2.37	YES	ASL	3.04 (N)	3.04	95% Student's-t UCL
Barium	1,500		52/52	9 J - 470 J	69SB126	233	NO	BSL	NA	NA	NA
Beryllium	16.0		36/52	0.056 J - 0.29	69SB136	0.717	NO	BSL	NA	NA	NA
Cadmium	7.0		46/52	0.044 J - 5.3	69SB115	0.655	NO	BSL	NA	NA	NA
Chromium	12,000	(4)	52/52	4.2 - 68	69SB123, 69SB145	87.6	NO	BSL	NA	NA	NA
Cobalt	2.30		52/52	0.61 - 64	69SB125	51.9	YES	ASL	12.2 (G)	12.3	See Total Soil Exposure
Copper	310		52/52	3 - 120	69SB128	225	NO	BSL	NA	NA	NA
Lead	400	(5)	51/51	0.25 J - 71 J	69SB122	28.2	NO	BSL	NA	NA	NA
Mercury	1.0		36/46	0.0086 J - 0.18	69SB125, 69SB130	0.112	NO	BSL	NA	NA	NA
Nickel	150		52/52	1.2 J - 19	69SB123, 69SB145	27.0	NO	BSL	NA	NA	NA
Selenium	39.0		12/52	0.58 J - 2.1	69SB126	1.85	NO	BSL	NA	NA	NA
Silver	39.0		4/52	0.15 J - 0.27	69SB125	ND	NO	BSL	NA	NA	NA
Thallium	0.0780		22/52	0.054 J - 0.32 J	69SB126	0.775	YES	ASL	0.446 (NP)	0.446	95% Chebyshev (Mean, Sd) UCL
Vanadium	39.0		52/52	9 - 550	69SB132	367	YES	ASL	172 (G)	216	See Total Soil Exposure
Zinc	2,300		51/52	4.9 - 200	69SB115	113	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
ND - Not Detected
COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit
ULM - Upper Limit of Means
mg/kg = milligrams per kilogram

Rationale Codes:

(ASL) Above Screening Level
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated

Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Residential Soil (November 2011)
(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was used to calculate the 95% UCL and distribution (>8 samples and >4 detections):
(N) - Normal distribution
(NP) - Nonparametric distribution
(G) - Gamma distribution
(4) Value for **chromium III** used as a surrogate.
(5) USEPA action level for lead.

TABLE 8-16

TOTAL SOIL (2010) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Contaminant	Criteria (1)		Contaminant Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil		No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL (3) (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Inorganics (mg/kg)											
Arsenic	0.390		161/161	0.27 J - 6.2	69SB101	2.37	YES	ASL	2.35 (NP)	3.04	See Surface Soil Exposure
Barium	1,500		158/158	7.1 - 470 J	69SB126	233	NO	BSL	NA	NA	NA
Beryllium	16.0		132/161	0.055 J - 0.45	69SB150	0.717	NO	BSL	NA	NA	NA
Cadmium	7.0		108/161	0.031 J - 5.3	69SB115	0.655	NO	BSL	NA	NA	NA
Chromium	12,000	(4)	160/160	3 J - 68	69SB123	87.6	NO	BSL	NA	NA	NA
Cobalt	2.30		160/160	0.38 - 64	69SB125	51.9	YES	ASL	12.3 (NP)	12.3	95% KM (Chebyshev) UCL
Copper	310		161/161	3 - 280	69SB150	225	NO	BSL	NA	NA	NA
Lead	400	(5)	154/154	0.25 J - 71 J	69SB122	28.2	NO	BSL	NA	NA	NA
Mercury	1.0		122/143	0.0081 J - 0.18	B110, 69SB125, 69SE	0.112	NO	BSL	NA	NA	NA
Nickel	150		159/161	0.76 J - 19	69SB123	27.0	NO	BSL	NA	NA	NA
Selenium	39.0		50/161	0.23 J - 2.2	69SB129	1.85	NO	BSL	NA	NA	NA
Silver	39.0		12/161	0.047 J - 0.96	69SB118	ND	NO	BSL	NA	NA	NA
Thallium	0.0780		83/161	0.054 J - 0.32 J	69SB126	0.775	YES	ASL	0.114 (NP)	0.446	See Surface Soil Exposure
Vanadium	39.0		159/159	9 - 580	69SB127, 69SB130	367	YES	ASL	216 (NP)	216	95% KM (BCA) UCL
Zinc	2,300		149/156	4.9 - 200	69SB115	113	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
ND - Not Detected
mg/kg = milligrams per kilogram

COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit

Rationale Codes:

(ASL) Above Screening Level
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated
Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Residential Soil (November 2011)
(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was used to calculate the 95% UCL and distribution (>8 samples and >4 detections):
(NP) - Nonparametric distribution
(4) Value for **chromium III** used as a surrogate.
(5) USEPA action level for lead.

TABLE 8-17

GROUNDWATER DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Contaminant	Criteria (1)	Contaminant Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Tapwater	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL (3) (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Dissolved Metals (ug/L)										
Arsenic	0.0450	3/7	0.32 J - 0.38 J	69GW27	14.0	YES	ASL	NC	NA	NA
Barium	290	7/7	12 - 570	69GW12	260	YES	ASL	NC	NA	NA
Cadmium	0.690	2/7	0.14 J - 0.16 J	69GW12	36.4	NO	BSL	NA	NA	NA
Cobalt	0.470	5/7	0.71 J - 12 J	69GW12	581	YES	ASL	NC	NA	NA
Nickel	30.0	7/7	0.42 J - 0.89 J	69GW25	84.1	NO	BSL	NA	NA	NA
Vanadium	7.80	7/7	2.4 J - 6.6	69GW11	21.0	NO	BSL	NA	NA	NA
Zinc	470	4/7	7.2 J - 16 J	69GW26	361	NO	BSL	NA	NA	NA
Total Metals (ug/L)										
Arsenic	0.0450	4/7	0.34 J - 0.56 J	69GW27	18.9	YES	ASL	NC	0.56	Max (Less than 8 samples)
Barium	290	7/7	12 - 580	69GW12	686	YES	ASL	NC	580	Max (Less than 8 samples)
Cadmium	0.690	2/7	0.12 J - 0.16 J	69GW12	16.6	NO	BSL	NA	NA	NA
Cobalt	0.470	4/7	0.81 J - 11	69GW11	633	YES	ASL	NC	11	Max (Less than 8 samples)
Nickel	30.0	7/7	0.44 J - 0.9 J	69GW25	95.7	NO	BSL	NA	NA	NA
Vanadium	7.80	7/7	2.7 J - 6.9	69GW07	485	NO	BSL	NA	NA	NA
Zinc	470	4/7	7.2 J - 10 J	69GW26	548	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated

COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit

ug/L - microgram per liter

Rationale Codes:

(ASL) Above Screening Level
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated

Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Tapwater (November 2011)
(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was not calculated (NC) because there were less than 8 samples.

TABLE 8-18

SEDIMENT (2010) DATA AND COPC SELECTION SUMMARY
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Contaminant	Criteria (1)		Contaminant Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
	Regional Screening Level Residential Soil		No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Upper Limit of Means (ULM)	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL (3) (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Inorganics (mg/kg)											
Arsenic	0.390		14/14	1 - 4.8 J	69SD09	2.88	YES	ASL	3.36 (N)	3.36	95% Student's-t UCL
Barium	1,500		14/14	24 J - 140 J	69SD08	214	NO	BSL	NA	NA	NA
Beryllium	16.0		14/14	0.098 J - 0.33 J	69SD07	0.355	NO	BSL	NA	NA	NA
Cadmium	7.0		14/14	0.38 - 24 J	69SD07	0.226	YES	ASL	13.4 (NP)	13.4	95% Chebyshev (Mean, Sd) UCL
Chromium	12,000	(4)	14/14	10 - 99 J	69SD06	65.0	NO	BSL	NA	NA	NA
Cobalt	2.30		14/14	5.6 J - 20 J	69SD09	46.5	YES	ASL	14.6 (N)	14.6	95% Student's-t UCL
Copper	310		14/14	38 J - 160 J	69SD07	164	NO	BSL	NA	NA	NA
Lead	400	(5)	14/14	6.4 - 680 J	69SD07	20.0	YES	ASL	353 (NP)	353	95% Chebyshev (Mean, Sd) UCL
Mercury	1.0		14/14	0.045 - 0.14 J	69SD10	0.167	NO	BSL	NA	NA	NA
Nickel	150		14/14	5.2 - 34 J	69SD06	18.4	NO	BSL	NA	NA	NA
Selenium	39.0		6/14	0.85 J - 1.3 J	69SD05, 69SD09	3.72	NO	BSL	NA	NA	NA
Silver	39.0		3/14	0.25 J - 0.7 J	69SD06	ND	NO	BSL	NA	NA	NA
Thallium	0.0780		1/14	0.11 J	69SD02	4.36	YES	ASL	NC	0.11	Max (Less than 4 detections)
Vanadium	39.0		14/14	67 J - 370 J	69SD09	244	YES	ASL	247 (N)	247	95% Student's-t UCL
Zinc	2,300		14/14	40 - 490 J	69SD07	152	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated
ND - Not Detected

COPC - Chemical of Potential Concern
UCL - Upper Confidence Limit

mg/kg = milligrams per kilogram

Rationale Codes:

(ASL) Above Screening Level
(BSL) Below Screening Level

J - Analyte present - Reported value is estimated

Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Regional Screening Levels, Residential Soil (November 2011)
(2) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was used to calculate the 95% UCL and distribution (>8 samples and >4 detections):
(N) - Normal distribution
(NP) - Nonparametric distribution
(4) Value for **chromium III** used as a surrogate.
(5) USEPA action level for lead.

TABLE 8-19

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS (2010)
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Constituents	Oral CSF $(mg/kg/day)^{-1}$	Inhalation UR $1/(\mu g/m^3)$	Oral RfD $(mg/kg/day)^{-1}$	Inhalation RfC (mg/m^3)	Oral Absorption Factors (1)	Oral to (2) Dermal Adjustment	WOE	Target Organ (Systemic Toxicity)	Critical Effect (Systemic Toxicity)
Inorganics									
Arsenic	1.50E+00	4.30E-03	3.00E-04	1.50E-05	0.03	100%	A	Skin / CVS	Skin / CVS: Hyperpigmentation, keratosis, possible vascular complications
Barium	NA	NA	2.00E-01	5.00E-04	0.01	7%	D	(o) Kidney, (i) Fetus	(o) - Kidney: Nephropathy; (i) - Fetus: Fetotoxicity
Cadmium	NA	1.80E-03	1.00E-03	2.00E-05	0.001	3%	(o) D, (i) B1	Kidney	Kidney: 10% Probability of abnormally high urinary NAG excretion
Cobalt	NA	9.00E-03	3.00E-04	6.00E-06	0.01	100%	D	(o) CVS, (i) RsS	(o) - CVS: Blood; (i) - RsS: Lesions on the respiratory tract
Lead	NA	NA	NA	NA	0.01	100%	B2	NA	NA
Thallium	NA	NA	1.00E-05	NA	0.01	100%	D	Liver / CVS / Skin	Liver / CVS / Skin: Increased levels of SGOT and LDH in blood
Vanadium	NA	NA	5.00E-03	NA	0.01	100%	D	GIS / Kidney	GIS / Kidney: Gastrointestinal disturbances, Discoloration of mouth and tongue

Notes:

CSF = Cancer Slope Factor
UR = Unit Risk
RfD = Reference Dose
RfC = Reference Concentration
WOE = Weight of Evidence

NA = Not Available
(o) = Toxicty due to oral exposure
(i) = Toxicity due to inhalation exposure

WOE / EPA Group:

A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen — Known/Likely (EPA classes A, B1, B2, C)
D - Not classifiable as a human carcinogen — Cannot be Determined (EPA class D)
E - Evidence of noncarcinogenicity — Not Likely (EPA class E)

Target Organ Abbreviations:

CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

(1) - ABS - Absorption Factors
The following default absorbance factors will be applied in the absence of reference values from USEPA, 2004 to estimate dermal intake of COPCs in soil and sediment
0.1% - Inorganics
(2) - Oral to dermal adjustment taken from RAGS Part E (USEPA, 2004)

TABLE 8-20

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	3.2E-07	--	3.8E-08	--	3.6E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	<0.01	--	<0.01	<0.01
			Chemical Total	3.2E-07	--	3.8E-08	--	3.6E-07		0.03	--	<0.01	0.03
		Exposure Point Total						3.6E-07					0.03
	Exposure Medium Total							3.6E-07					0.03
	Air	Fugative Dust											
			Arsenic	--	3.8E-11	--	--	3.8E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	3.2E-10	--	--	3.2E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	3.6E-10	--	--	3.6E-10		--	<0.01	--	<0.01
		Exposure Point Total						3.6E-10					<0.01
	Exposure Medium Total							3.6E-10					<0.01
Soil (2010) Total								**3.57E-07**					**0.03**

TABLE 8-20

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Sediment (2010)	Sediment	Sediment	Arsenic	3.5E-07	--	1.8E-07	--	5.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.01	--	<0.01	0.01
			Chemical Total	3.5E-07	--	1.8E-07	--	5.3E-07		0.03	--	<0.01	0.03
		Exposure Point Total						5.3E-07					0.03
	Exposure Medium Total							5.3E-07					0.03
Sediment (2010) Total								**5.32E-07**					**0.03**
Adult Trespassers Total								**8.89E-07**					**0.06**

Total Risk Across Soil (2010)	3.6E-07	Total Hazard Index Across Soil (2010)	0.03
Total Risk Across Sediment (2010)	5.3E-07	Total Hazard Index Across Sediment (2010)	0.03
Total Risk Across All Media and All Exposure Routes	8.9E-07	Total Hazard Index Across All Media and All Exposure Routes	0.06

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.02	0.02
Cardiovascular System HI =		0.04	0.04
Skin HI =		0.02	0.02
Kidney HI =		0.03	0.03
Liver HI =		<0.01	<0.01
Respiratory System HI =	<0.01		<0.01

TABLE 8-21

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	2.3E-07	--	4.4E-08	--	2.7E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.01	--	<0.01	0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.01	--	<0.01	0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.01	--	<0.01	0.01
			Chemical Total	2.3E-07	--	4.4E-08	--	2.7E-07		0.04	--	<0.01	0.04
		Exposure Point Total						2.7E-07					0.04
	Exposure Medium Total							2.7E-07					0.04
	Air	Fugative Dust											
			Arsenic	--	1.8E-11	--	--	1.8E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	1.5E-10	--	--	1.5E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	1.7E-10	--	--	1.7E-10		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-10					<0.01
	Exposure Medium Total							1.7E-10					<0.01
Soil (2010) Total								**2.71E-07**					**0.04**

TABLE 8-21

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adolescent

Sediment (2010)	Sediment	Sediment	Arsenic	2.5E-07	--	7.2E-08	--	3.2E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.02	--	<0.01	0.02
			Chemical Total	2.5E-07	--	7.2E-08	--	3.2E-07		0.04	--	<0.01	0.05
		Exposure Point Total						3.2E-07					0.05
	Exposure Medium Total							3.2E-07					0.05
Sediment (2010) Total								**3.23E-07**					**0.05**
Youth Trespassers Total								**5.94E-07**					**0.09**

Total Risk Across Soil (2010)	2.7E-07	Total Hazard Index Across Soil (2010)	0.04
Total Risk Across Sediment (2010)	3.2E-07	Total Hazard Index Across Sediment (2010)	0.05
Total Risk Across All Media and All Exposure Routes	5.9E-07	Total Hazard Index Across All Media and All Exposure Routes	0.09

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.03	0.03
Cardiovascular System HI =		0.05	0.05
Skin HI =		0.02	0.02
Kidney HI =		0.04	0.04
Liver HI =		0.01	0.01
Respiratory System HI =	<0.01		<0.01

TABLE 8-22

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	1.6E-06	--	3.2E-07	--	1.9E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.03	--	<0.01	0.03
			Vanadium	--	--	--	--	--	GIS / Kidney	0.04	--	<0.01	0.05
			Chemical Total	1.6E-06	--	3.2E-07	--	1.9E-06		0.12	--	<0.01	0.13
		Exposure Point Total						1.9E-06					0.13
	Exposure Medium Total							1.9E-06					0.13
	Air	Fugative Dust	Arsenic	--	7.7E-10	--	--	7.7E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	6.5E-09	--	--	6.5E-09	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	7.3E-09	--	--	7.3E-09		--	<0.01	--	<0.01
		Exposure Point Total						7.3E-09					<0.01
	Exposure Medium Total							7.3E-09					<0.01
Soil (2010) Total								**1.92E-06**					**0.13**

TABLE 8-22

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Sediment (2010)	Sediment (2010)	Sediment (2010)	Arsenic	1.8E-06	--	5.2E-07	--	2.3E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cadmium	--	--	--	--	--	Kidney	0.01	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.05	--	<0.01	0.05
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.01	--	<0.01	0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.05	--	<0.01	0.05
			Chemical Total	1.8E-06	--	5.2E-07	--	2.3E-06		0.13	--	0.02	0.15
		Exposure Point Total						2.3E-06					0.15
	Exposure Medium Total							2.3E-06					0.15
Sediment (2010) Total								**2.28E-06**					**0.15**
On-Site Workers Total								**4.20E-06**					**0.28**

Total Risk Across Soil (2010)	1.9E-06	Total Hazard Index Across Soil (2010)	0.13
Total Risk Across Sediment (2010)	2.3E-06	Total Hazard Index Across Sediment (2010)	0.15
Total Risk Across All Media and All Exposure Routes	4.2E-06	Total Hazard Index Across All Media and All Exposure Routes	0.28

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.10	0.10
Cardiovascular System HI =		0.17	0.17
Skin HI =		0.07	0.07
Kidney HI =		0.12	0.12
Liver HI =		0.05	0.05
Respiratory System HI =	<0.01		<0.01

TABLE 8-23

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	2.1E-06	--	2.6E-07	--	2.4E-06	Skin / CVS	0.01	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.06	--	<0.01	0.06
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.04	--	<0.01	0.05
			Vanadium	--	--	--	--	--	GIS / Kidney	0.06	--	<0.01	0.06
			Chemical Total	2.1E-06	--	2.6E-07	--	2.4E-06		0.17	--	<0.01	0.18
		Exposure Point Total						2.4E-06					0.18
	Exposure Medium Total							2.4E-06					0.18
	Air	Fugative Dust	Arsenic	--	3.1E-09	--	--	3.1E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	2.6E-08	--	--	2.6E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	2.9E-08	--	--	2.9E-08		--	<0.01	--	<0.01
		Exposure Point Total						2.9E-08					<0.01
	Exposure Medium Total							2.9E-08					<0.01
Soil (2010) Total								**2.43E-06**					**0.18**
Groundwater	Groundwater	Tap	Arsenic	7.9E-06	--	4.1E-08	--	7.9E-06	Skin / CVS	0.05	--	<0.01	0.05
			Barium	--	--	--	--	--	Kidney	0.08	--	<0.01	0.09
			Cobalt	--	--	--	--	--	CVS	1.00	--	<0.01	**1.01**
			Chemical Total	7.9E-06	--	4.1E-08	--	7.9E-06		1.14	--	<0.01	**1.14**
		Exposure Point Total						7.9E-06					**1.14**
	Exposure Medium Total							7.9E-06					**1.14**
Groundwater Total								**7.93E-06**					**1.14**

TABLE 8-23

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment (2010)	Sediment	Sediment	Arsenic	3.5E-07	--	1.8E-07	--	5.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.01	--	<0.01	0.01
			Chemical Total	3.5E-07	--	1.8E-07	--	5.3E-07		0.03	--	<0.01	0.03
		Exposure Point Total						5.3E-07					0.03
	Exposure Medium Total							5.3E-07					0.03
Sediment (2010) Total								**5.32E-07**					**0.03**
Adult Residents Total								**1.09E-05**					**1.36**

Total Risk Across Soil (2010)	2.4E-06	Total Hazard Index Across Soil (2010)	0.18
Total Risk Across Groundwater (2010)	7.9E-06	Total Hazard Index Across Groundwater	**1.1**
Total Risk Across Sediment (2010)	5.3E-07	Total Hazard Index Across Sediment (2010)	0.03
Total Risk Across All Media and All Exposure Routes	1.1E-05	Total Hazard Index Across All Media and All Exposure Routes	**1.4**

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.07	0.07
Cardiovascular System HI =		**1.2**	**1.2**
Skin HI =		0.12	0.12
Kidney HI =		0.16	0.16
Liver HI =		0.05	0.05
Respiratory System HI =	<0.01		<0.01

TABLE 8-24

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	5.0E-06	--	4.2E-07	--	5.4E-06	Skin / CVS	0.13	--	0.01	0.14
			Cobalt	--	--	--	--	--	CVS	0.52	--	0.01	0.54
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.41	--	0.01	0.42
			Vanadium	--	--	--	--	--	GIS / Kidney	0.55	--	0.02	0.57
			Chemical Total	5.0E-06	--	4.2E-07	--	5.4E-06		1.62	--	0.05	**1.67**
		Exposure Point Total						5.4E-06					**1.67**
	Exposure Medium Total							5.4E-06					**1.67**
	Air	Fugative Dust											
			Arsenic	--	7.7E-10	--	--	7.7E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	6.5E-09	--	--	6.5E-09	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	7.3E-09	--	--	7.3E-09		--	<0.01	--	<0.01
		Exposure Point Total						7.3E-09					<0.01
	Exposure Medium Total							7.3E-09					<0.01
Soil (2010) Total								**5.42E-06**					**1.67**
Groundwater	Groundwater	Tap											
			Arsenic	4.6E-06	--	3.0E-08	--	4.6E-06	Skin / CVS	0.12	--	<0.01	0.12
			Barium	--	--	--	--	--	Kidney	0.19	--	0.02	0.20
			Cobalt	--	--	--	--	--	CVS	2.34	--	<0.01	**2.35**
			Chemical Total	4.6E-06	--	3.0E-08	--	4.6E-06		2.65	--	0.02	**2.67**
		Exposure Point Total						4.6E-06					**2.67**
	Exposure Medium Total							4.6E-06					**2.67**
Groundwater Total								**4.63E-06**					**2.67**

TABLE 8-24

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment (2010)	Sediment	Sediment	Arsenic	8.2E-07	--	1.0E-07	--	9.2E-07	Skin / CVS	0.02	--	<0.01	0.02
			Cadmium	--	--	--	--	--	Kidney	0.03	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.09	--	<0.01	0.10
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.02	--	<0.01	0.02
			Vanadium	--	--	--	--	--	GIS / Kidney	0.09	--	<0.01	0.10
			Chemical Total	8.2E-07	--	1.0E-07	--	9.2E-07		0.25	--	0.01	0.27
		Exposure Point Total						9.2E-07					0.27
	Exposure Medium Total							9.2E-07					0.27
Sediment (2010) Total								**9.24E-07**					**0.27**
Young Child Residents Total								**1.10E-05**					**4.61**

Total Risk Across Soil (2010)	5.4E-06	Total Hazard Index Across Soil (2010)	**1.7**
Total Risk Across Groundwater (2010)	4.6E-06	Total Hazard Index Across Groundwater	**2.7**
Total Risk Across Sediment (2010)	9.2E-07	Total Hazard Index Across Sediment (2010)	0.27
Total Risk Across All Media and All Exposure Routes	1.1E-05	Total Hazard Index Across All Media and All Exposure Routes	**4.6**

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.67	0.67
Cardiovascular System HI =		**3.7**	**3.7**
Skin HI =		0.73	0.73
Kidney HI =		0.90	0.90
Liver HI =		0.44	0.44
Respiratory System HI =	<0.01		<0.01

TABLE 8-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	1.6E-06	--	3.2E-07	--	1.9E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.03	--	<0.01	0.03
			Vanadium	--	--	--	--	--	GIS / Kidney	0.04	--	<0.01	0.05
			Chemical Total	1.6E-06	--	3.2E-07	--	1.9E-06		0.12	--	<0.01	0.13
		Exposure Point Total						1.9E-06					0.13
	Exposure Medium Total							1.9E-06					0.13
	Air	Fugative Dust											
			Arsenic	--	7.8E-10	--	--	7.8E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	6.6E-09	--	--	6.6E-09	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	7.4E-09	--	--	7.4E-09		--	<0.01	--	<0.01
		Exposure Point Total						7.4E-09					<0.01
	Exposure Medium Total							7.4E-09					<0.01
Soil (2010) Total								**1.92E-06**					**0.13**

TABLE 8-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Arsenic	2.9E-06	--	--	--	2.9E-06	Skin / CVS	0.02	--	--	0.02
			Barium	--	--	--	--	--	Kidney	0.03	--	--	0.03
			Cobalt	--	--	--	--	--	CVS	0.36	--	--	0.36
			Chemical Total	2.9E-06	--	--	--	2.9E-06		0.41	--	--	0.41
		Exposure Point Total						2.9E-06					0.41
	Exposure Medium Total							2.9E-06					0.41
Groundwater Total								**2.94E-06**					**0.41**
Industrial / Commercial Workers Total								**4.85E-06**					**0.54**

Total Risk Across Soil (2010)	1.9E-06	Total Hazard Index Across Soil (2010)	0.13
Total Risk Across Groundwater (2010)	2.9E-06	Total Hazard Index Across Groundwater	0.41
Total Risk Across All Media and All Exposure Routes	4.9E-06	Total Hazard Index Across All Media and All Exposure Routes	0.54

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.05	0.05
Cardiovascular System HI =		0.47	0.47
Skin HI =		0.06	0.06
Kidney HI =		0.07	0.07
Liver HI =		0.03	0.03
Respiratory System HI =	<0.01		<0.01

TABLE 8-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	2.1E-07	--	1.9E-08	--	2.3E-07	Skin / CVS	0.03	--	<0.01	0.04
			Cobalt	--	--	--	--	--	CVS	0.13	--	<0.01	0.14
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.10	--	<0.01	0.11
			Vanadium	--	--	--	--	--	GIS / Kidney	0.14	--	<0.01	0.14
			Chemical Total	2.1E-07	--	1.9E-08	--	2.3E-07		0.41	--	0.01	0.42
		Exposure Point Total						2.3E-07					0.42
	Exposure Medium Total							2.3E-07					0.42
	Air	Fugative Dust	Arsenic	--	1.4E-08	--	--	1.4E-08	NA	--	0.02	--	0.02
			Cobalt	--	1.2E-07	--	--	1.2E-07	RsS	--	0.16	--	0.16
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	1.3E-07	--	--	1.3E-07		--	0.17	--	0.17
		Exposure Point Total						1.3E-07					0.17
	Exposure Medium Total							1.3E-07					0.17
Soil (2010) Total								**3.64E-07**					**0.59**

TABLE 8-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Arsenic	4.7E-10	--	1.5E-10	--	6.2E-10	Skin / CVS	<0.01	--	<0.01	<0.01
			Barium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Chemical Total	4.7E-10	--	1.5E-10	--	6.2E-10		<0.01	--	<0.01	<0.01
		Exposure Point Total						6.2E-10					<0.01
	Exposure Medium Total							6.2E-10					<0.01
Groundwater (2010) Total								**6.25E-10**					**<0.01**
Construction Workers Total								**3.65E-07**					**0.60**

Total Risk Across Soil (2010)	3.6E-07	Total Hazard Index Across Soil (2010)	0.59
Total Risk Across Groundwater (2010)	6.2E-10	Total Hazard Index Across Groundwater	0.0
Total Risk Across All Media and All Exposure Routes	3.6E-07	Total Hazard Index Across All Media and All Exposure Routes	0.60

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.14	0.14
Cardiovascular System HI =		0.28	0.28
Skin HI =		0.14	0.14
Kidney HI =		0.14	0.14
Liver HI =		0.11	0.11
Respiratory System HI =	0.16		0.16

TABLE 9-1

CORRECTIVE ACTION OBJECTIVES FOR SURFACE SOIL, SUBSURFACE SOIL, AND SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Media	Chemical	Final CAO (mg/kg) [1]	Sample Locations with Concentrations Exceeding the CAO
Surface Soil	Vanadium	367	69SB128, 69SB132, 69SB133
Subsurface Soil (1.0-2.0 ft bgs)	Vanadium	367	69SB122, 69SB127, 69SB128, 69SB132, 69SB133, 69SB140, 69SB144
Subsurface Soil (2.0-3.0 ft bgs)	Vanadium	367	69SB122, 69SB129, 69SB130, 69SB140
Sediment	Cadmium	1.0	69SD01, 69SD03, 69SD06, 69SD07, 69SD08, 69SD09, 69SD10, 69SD11, 69SD12
	Lead	35.8	69SD01, 69SD03, 69SD06, 69SD07, 69SD08
	Vanadium	241	69SD05, 69SD09, 69SD14
	Zinc	148	69SD06, 69SD07, 69SD08

[1] Refer to Tables 7-49, 7-50, and 7-51 for the source and derivation of the CAOs

TABLE 11-1

DESIGN CONSIDERATIONS
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Design Consideration	Applicability
Site Ownership	Ownership of the Air Field parcel (Ofstie Airfield) was transferred from the United States Navy to the Puerto Rico Ports Authority on February 7, 2008. However, in accordance with the Administrative Order, the Covenant Deferral Request and the Quitclaim Deed of transfer, the US Navy maintains responsibility for the investigation and cleanup of SWMU 69. The Ports Authority plans to develop the airfield into a regional airport. The quitclaim deed requires the Ports Authority to allow access to the Navy and its contractors for the remedial action or corrective action found to be necessary after the date of the conveyance of the property. This access is guaranteed through 42 U.S.C. §9620(h)(3)(A)(iii), which also prohibits the Ports Authority from taking action to interfere with future necessary remedial and investigative actions. The deed also says that remedial and investigative actions shall take priority in all cases where a conflict may exist with Port's and any lessee's or sub lessee's activities.
Site Access	Site is located adjacent to an aircraft parking apron. Site access is through the airfield and from the taxiways. Coordinate site access with the Puerto Rico Ports Authority.
Existing Structures	Other than the concrete apron, there are no existing structures in the immediate vicinity of the SWMU.
Disruption of Adjacent Facilities	Ofstie Field is currently operational; however, the new owner of the facility is upgrading the infrastructure and plans to reopen the airfield as a regional airport. Other contractors may be working at the Airfield. There will be no disruption of adjacent facilities or operations.
Available Utilities	Utilities are not available in the immediate vicinity of the site; utilities are available at other areas of the airfield and day tank storage area.
Utility Clearance	The remedial contractor will be responsible for clearing all sampling and excavation areas of utilities.
Extent of Contamination	The estimated maximum extent of vanadium contamination in the soil has been defined by the CMS Investigation. The estimated maximum extent of cadmium, lead, vanadium, and zinc in the sediment has been partially defined by the CMS Investigation. Additional delineation sampling is suggested to refine the extent of sediment contamination.
Staging and Decontamination Areas	Staging and decontamination areas may be placed on the expanded concrete apron area, as indicated on Figures 11-1 and 11-2 or alternate location requested by excavation contractor and approved by Navy representative.
Off-Site Disposal	Off-site disposal at a permitted on-island facility is anticipated for both soil and sediment; however, if the waste characterization sampling so indicates, disposal at a permitted facility in the continental United States may be required.

TABLE 11-2
EXCAVATION AND DISPOSAL COST ESTIMATE
SWMU 69 - AIRCRAFT PARKING APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

ITEM	QTY.	UNIT	UNIT PRICE	ITEM PRICE	NOTES
Direct Capital Costs					
Mobilization/Demobilization	1	LS	$10,000.00	$10,000	Professional Judgement
Excavation of Contaminated Soil	2,221	CY	$105.00	$233,205	Professional Judgement
Confirmatory Sampling Analysis	50	EA	$100.00	$5,000	Vendor Quote
Backfilling with clean fill, including delivery, spreading and compaction in 6" lifts (excavation volume plus 20%)	2,665	CY	$150.00	$399,780	Professional Judgement
Vegetative Cover	18,500	SF	$0.50	$9,250	Professional Judgement
Transportation (Off-Site)	3,323	ton	$40.00	$132,905	Professional Judgement
Disposal (Off-Site Facility)	3,323	ton	$100.00	$332,262	Professional Judgement
E&S Controls and Dewatering	1	LS	$10,000.00	$10,000	Professional Judgement
Delineation Sampling Analysis	4	EA	$100.00	$400	Vendor Quote
Excavation and Dewatering of Contaminated Sediment	192	CY	$125.00	$24,000	Professional Judgement
Confirmatory Sampling Analysis	8	EA	$100.00	$800	Vendor Quote
Management/Treatment/Disposal of Liquid from Dewatered Sediment	3,878	Gal	$2.50	$9,694	Professional Judgement
Backfilling with clean clay backfill and riprap, including delivery, spreading and compaction in 6" lifts (excavation volume plus 20%)	230	CY	$75.00	$17,280	Professional Judgement
Vegetative Cover	1,900	SF	$1.00	$1,900	Professional Judgement
Sediment Transportation (Off-Site)	287	ton	$67.00	$19,245	Professional Judgement
Sediment Disposal (Off-Site Facility)	287	ton	$42.00	$12,064	Professional Judgement
Subtotal - Direct Capital Costs				*$1,217,784*	
Scope and bid Contingency				*$243,557*	20% total contingency (10% scope and 10% bid contingencies)
Total Direct Capital Costs				**$1,461,340**	
Professional Services					
Project Management				$60,889	Assume 5% of total direct capital cost
Remedial Design/EngineeringSupport				$121,778	Assume 10% of total direct capital cost
Construction Oversight and Startup				$60,889	Assume 5% of total direct capital cost
Total Professional Services				**$243,557**	
TOTAL				**$1,704,897**	

FIGURES

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4 0 2 4 8

1 inch = 4 miles

Baker

FIGURE 2-1
REGIONAL LOCATION MAP
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

SOURCE: METRODATA, INC., 1999.

NAVAL ACTIVITY PUERTO RICO

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LEGEND

– SWMUs

– AREA TO WHICH THIS INVESTIGATION PERTAINS

AOC D – AOCs

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

3000 0 1500 3000

1 inch = 3000 ft.

FIGURE 2-2
SWMU/AOC LOCATION MAP
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

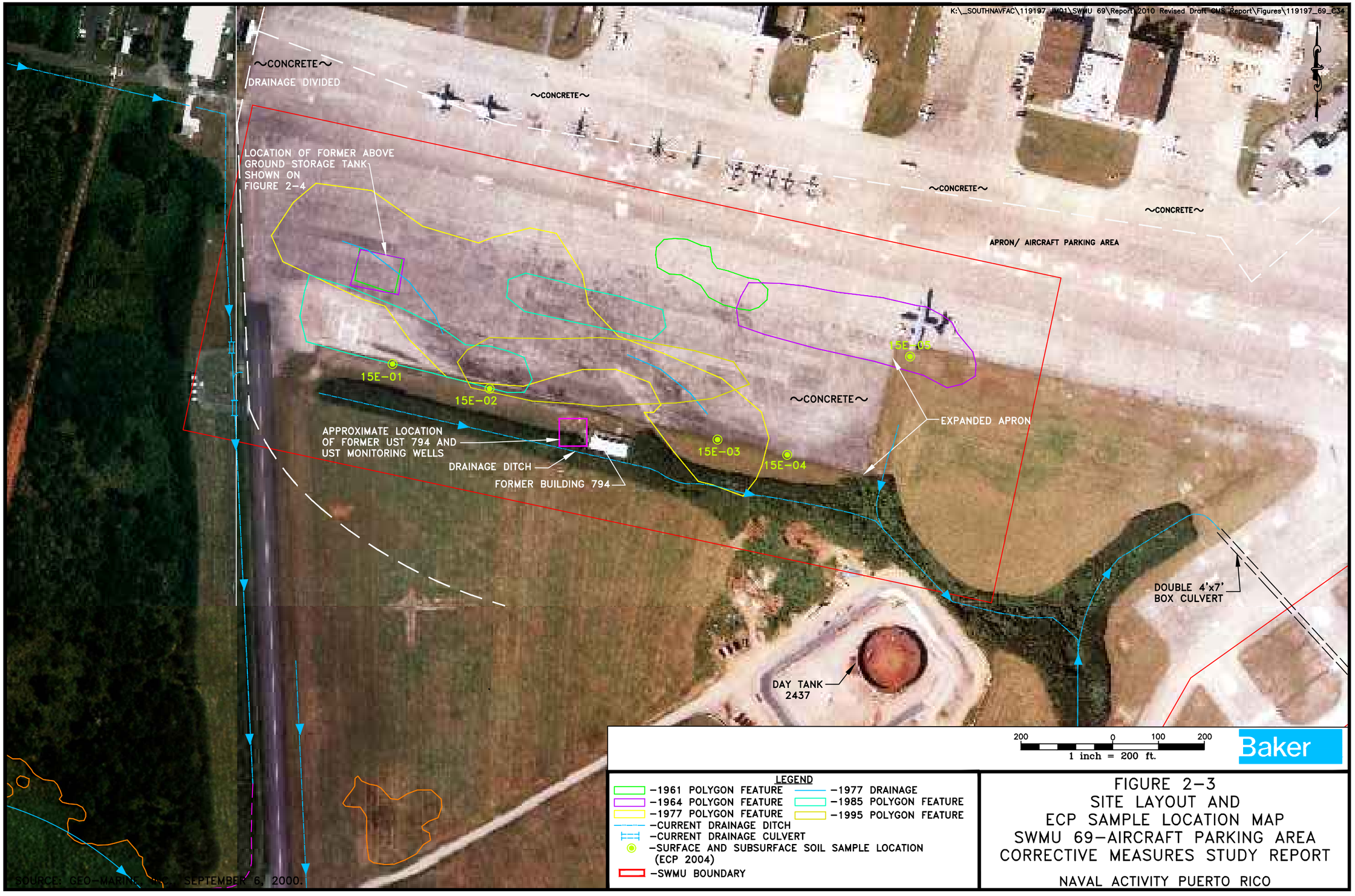

FIGURE 2-3
SITE LAYOUT AND
ECP SAMPLE LOCATION MAP
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

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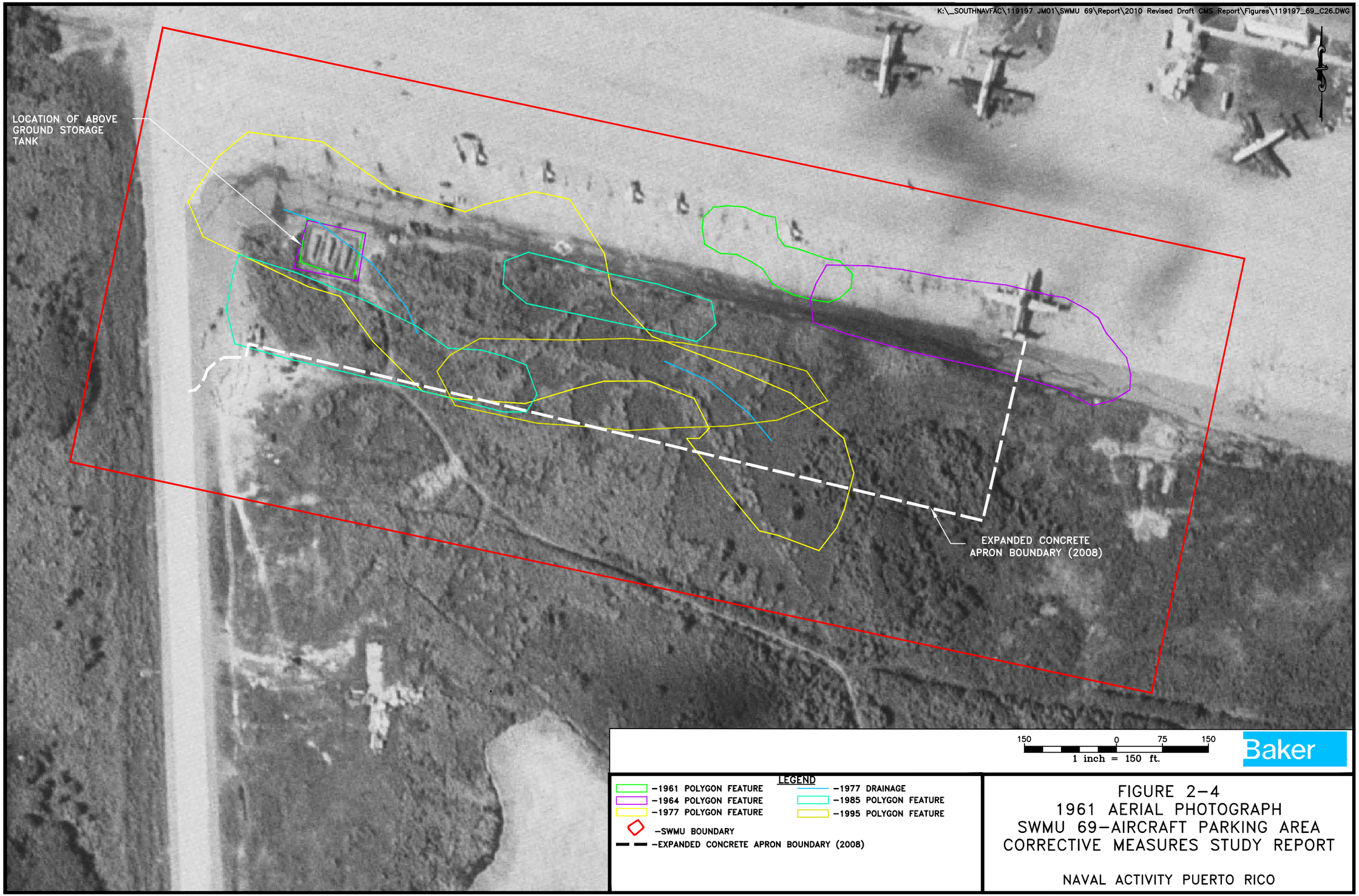
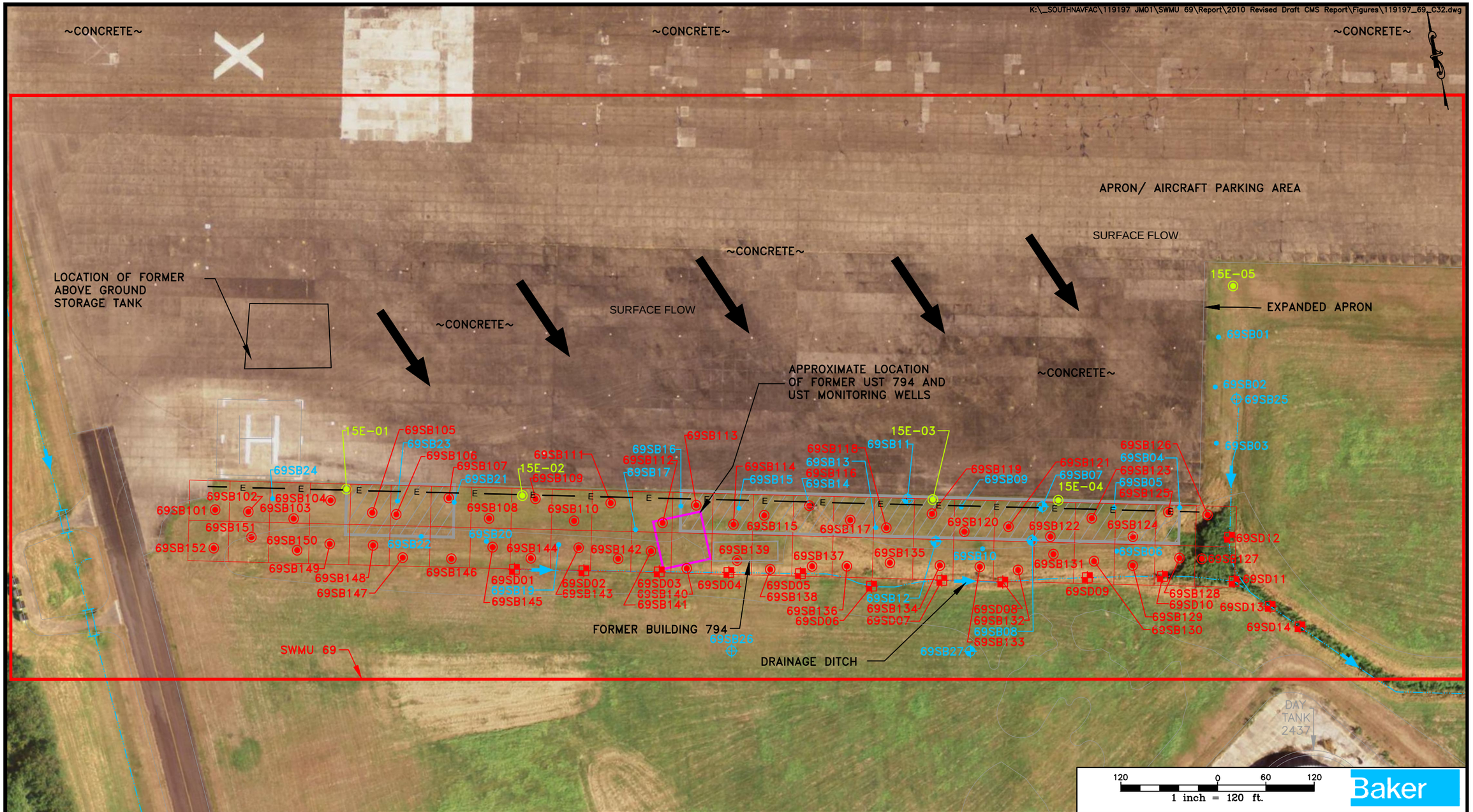


FIGURE 2-4
1961 AERIAL PHOTOGRAPH
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

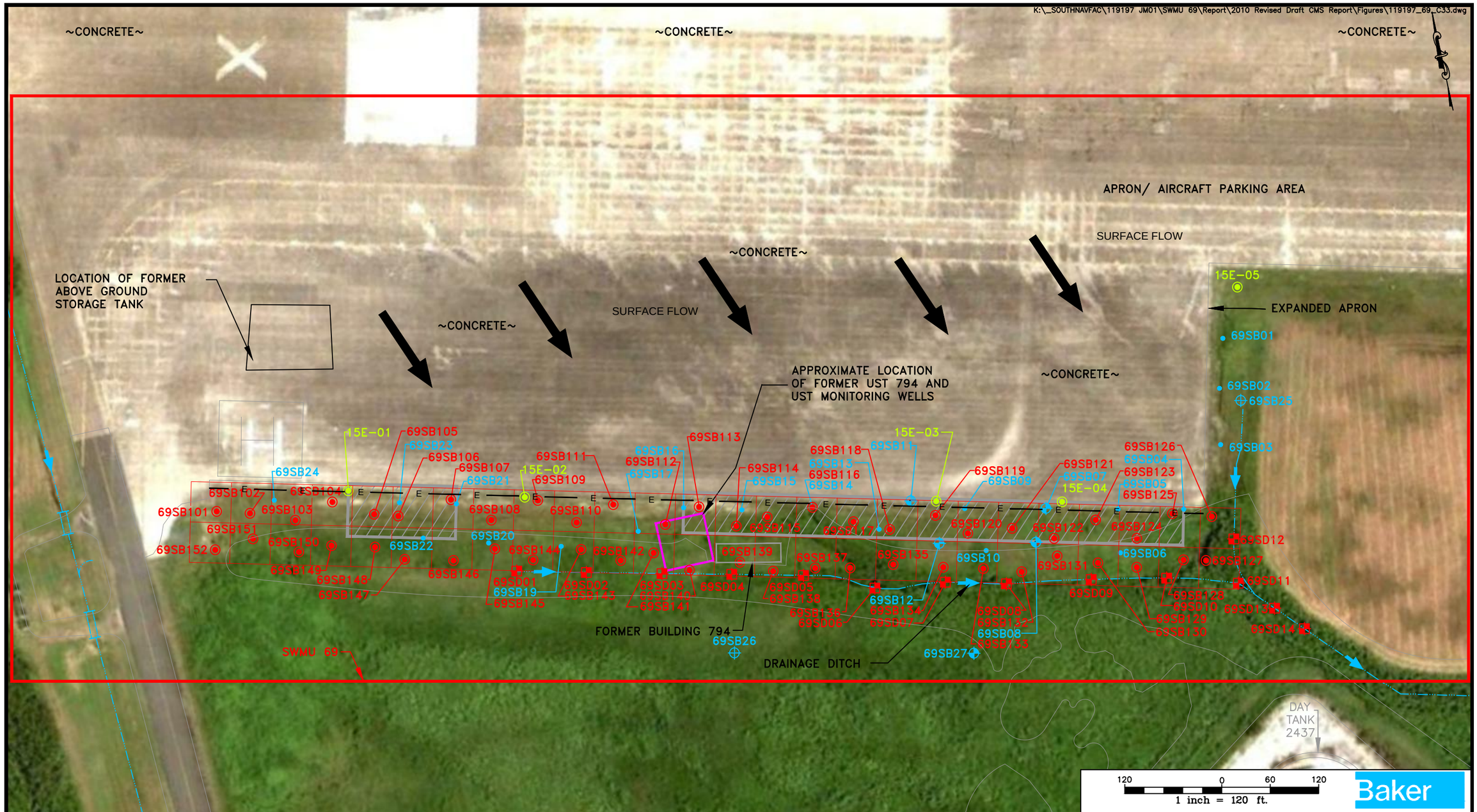


LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –CURRENT DRAINAGE CULVERT
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- –E– –ELECTRIC BURIED LINE INSTALLED BY PRPA 10 FEET FROM EDGE OF APRON
- –PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- –SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- –MONITORING WELL LOCATION (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 4–1
SAMPLE LOCATION MAP
WITH 2006 AERIAL PHOTO
SWMU 69–AIRCRAFT PARKING AREA

CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO



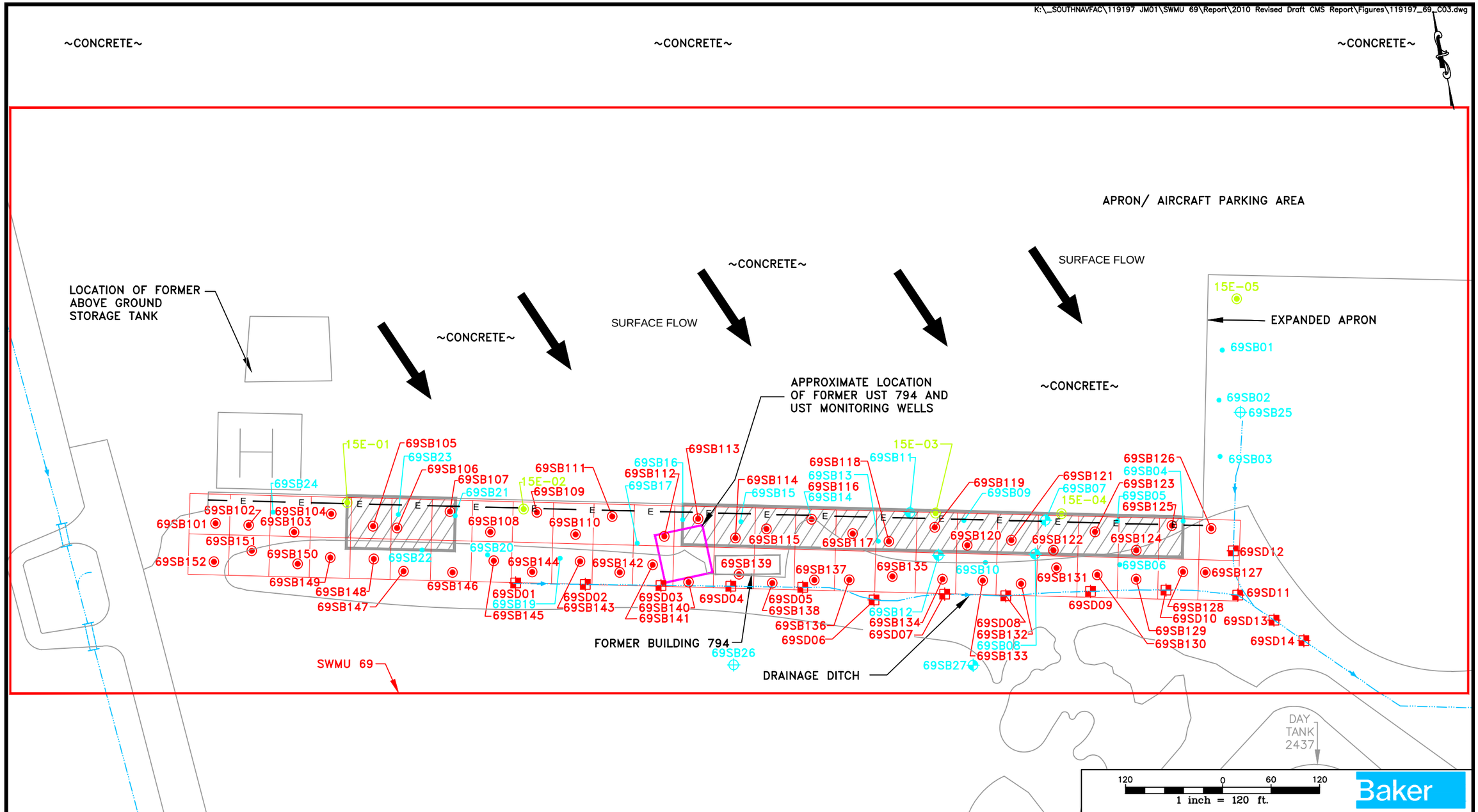
LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –CURRENT DRAINAGE CULVERT
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- –E– –ELECTRIC BURIED LINE INSTALLED BY PRPA 10 FEET FROM EDGE OF APRON
- –PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- –SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- –MONITORING WELL LOCATION (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 4–2
SAMPLE LOCATION MAP
WITH 2009 AERIAL PHOTO
SWMU 69–AIRCRAFT PARKING AREA

CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 69\Report\2010 Revised Draft CMS Report\Figures\119197_69_C03.dwg



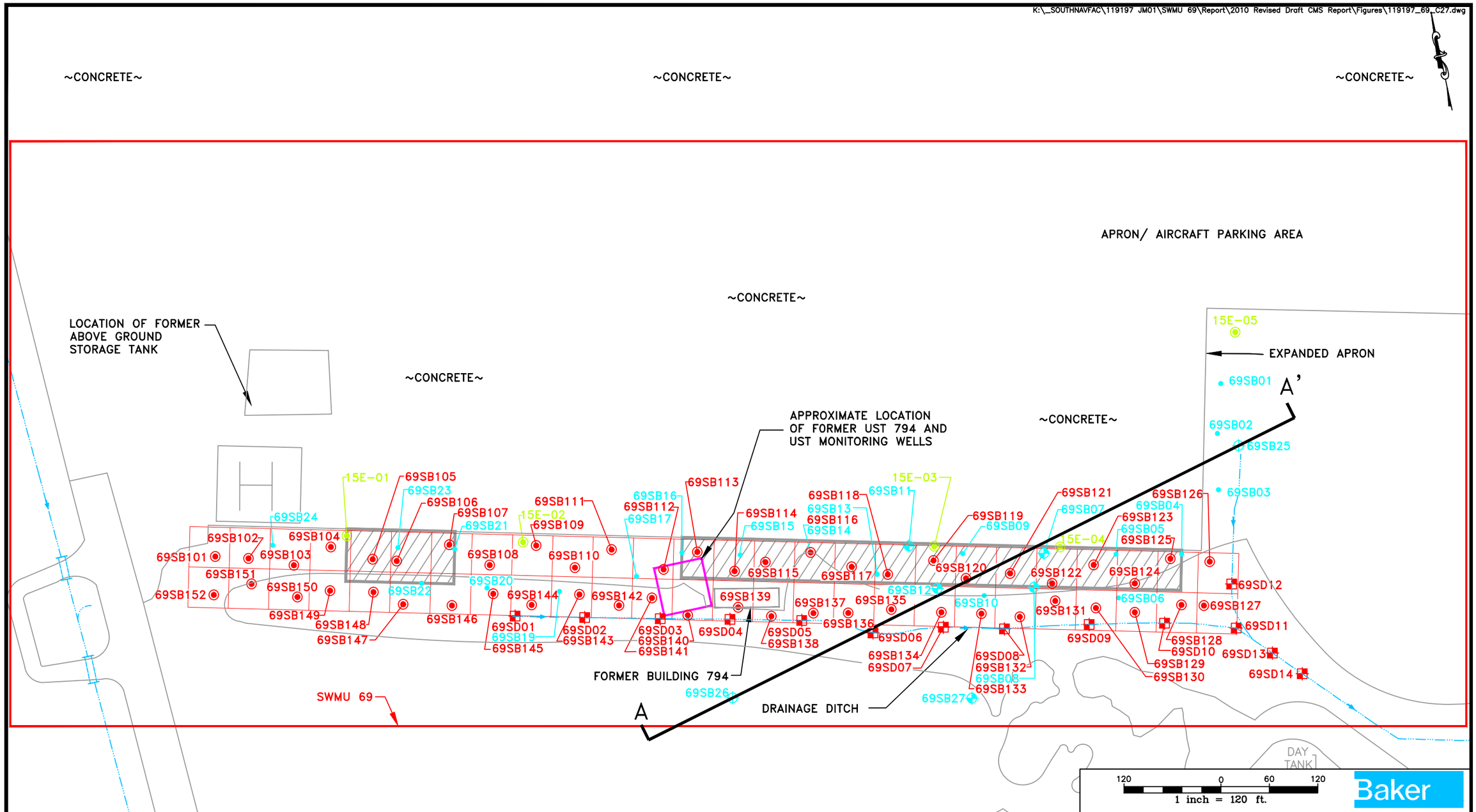
LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –CURRENT DRAINAGE CULVERT
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- –E– –ELECTRIC BURIED LINE INSTALLED BY PRPA 10 FEET FROM EDGE OF APRON
- –PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- –SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- –MONITORING WELL LOCATION (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 4–3
SAMPLE LOCATION MAP
SWMU 69–AIRCRAFT PARKING AREA

CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 69\Report\2010 Revised Draft CMS Report\Figures\119197_69_C27.dwg



LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –CURRENT DRAINAGE CULVERT
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- A A' –GEOLOGICAL CROSS SECTION LOCATION
- –PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- –SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- –MONITORING WELL LOCATION (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 5–1
GEOLOGICAL CROSS SECTION LOCATION
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

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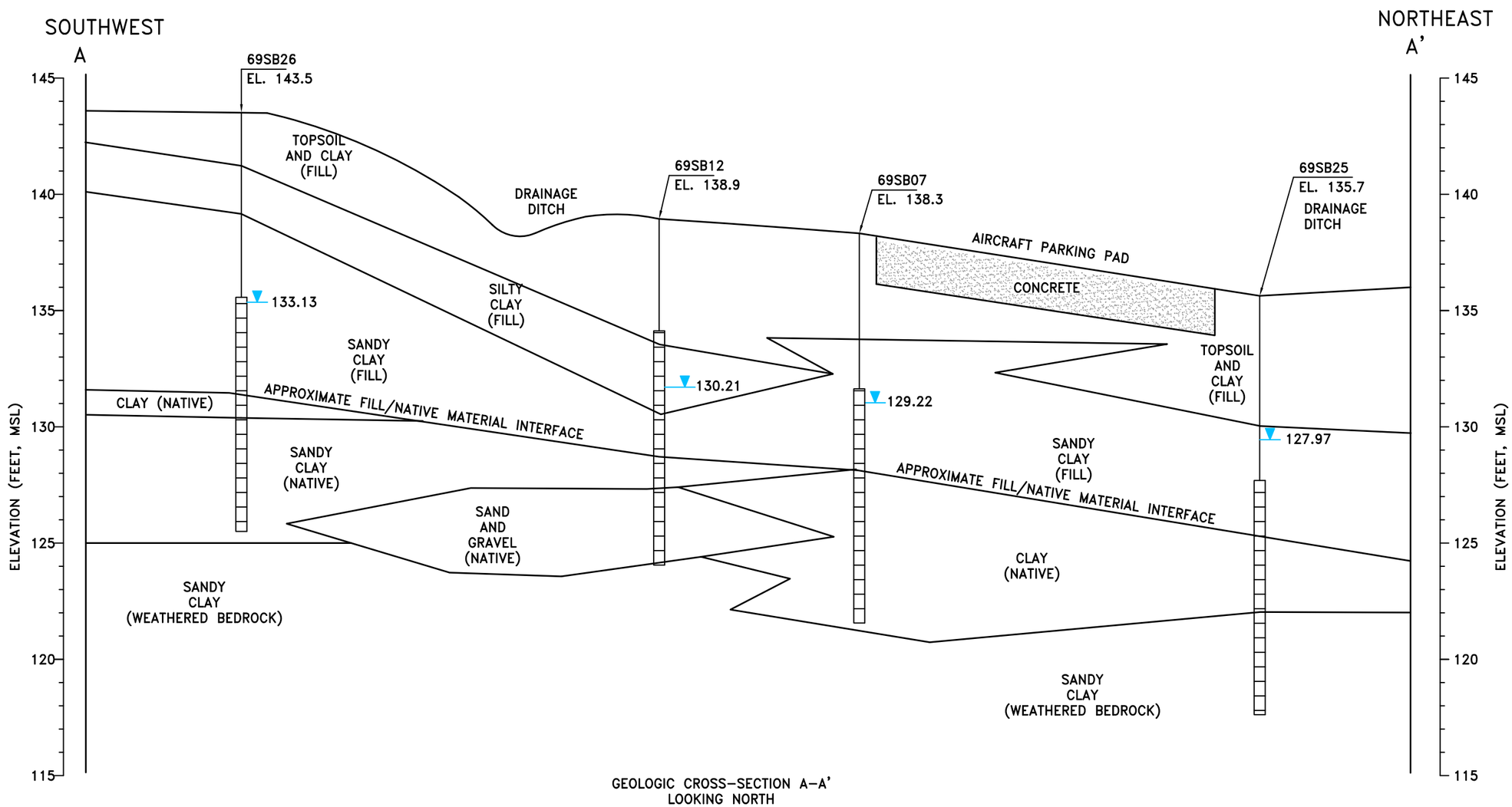

GEOLOGIC CROSS-SECTION A–A'
LOOKING NORTH

5 0 2.5 5
1 inch = 5 ft.
VERTICAL SCALE
EXAGGERATION 15x

80 0 40 80
1 inch = 80 ft.
HORIZONTAL SCALE

Baker

LEGEND

ft.	FEET	I	WELL RISER
msl	MEAN SEA LEVEL		WELL SCREEN INTERVAL
———	ESTIMATED	———	PROJECTED
G.S.	GROUND SURFACE, ft. msl		
▼	GROUNDWATER ELEVATION (COLLECTED ON 7/22/08)		

ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL PLUS 100 FEET

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

FIGURE 5–2
GEOLOGIC CROSS–SECTION A–A'
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

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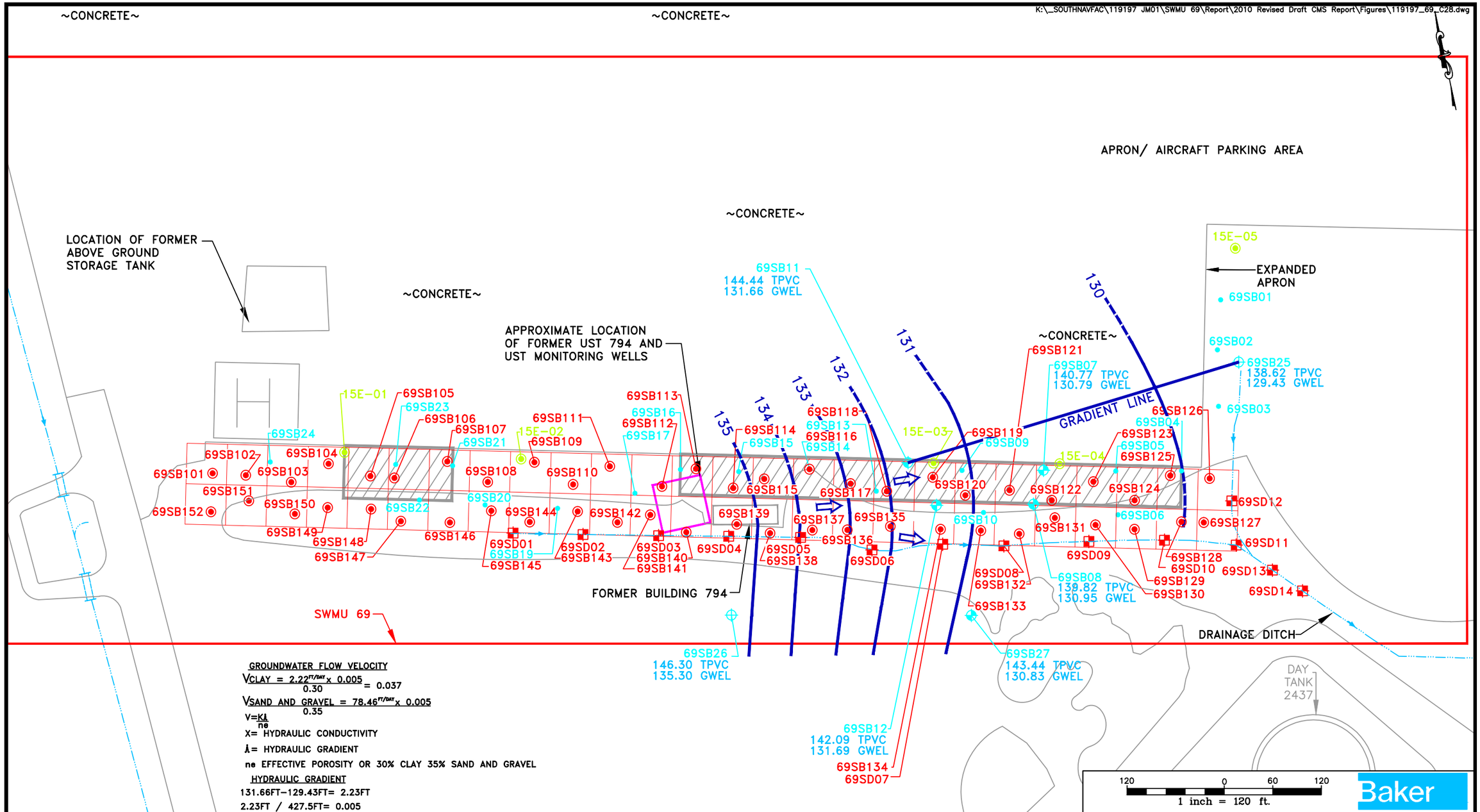


GROUNDWATER FLOW VELOCITY

$V_{CLAY} = \frac{2.22^{FT/DAY} \times 0.005}{0.30} = 0.037$

$V_{SAND\ AND\ GRAVEL} = \frac{78.46^{FT/DAY} \times 0.005}{0.35}$

$V = \frac{Ki}{ne}$

X= HYDRAULIC CONDUCTIVITY

i= HYDRAULIC GRADIENT

ne EFFECTIVE POROSITY OR 30% CLAY 35% SAND AND GRAVEL

HYDRAULIC GRADIENT

131.66FT–129.43FT= 2.23FT

2.23FT / 427.5FT= 0.005

GROUNDWATER LEGEND

–PROJECTED GROUNDWATER CONTOUR, FEET

–ESTIMATED GROUNDWATER CONTOUR, FEET

114.69 TPVC –ELEVATION AT TOP OF PVC WELL CASING, FEET

109.22 GWEL –GROUNDWATER ELEVATION, FEET

–GROUNDWATER FLOW DIRECTION

ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL PLUS 100 FEET

GROUNDWATER ELEVATIONS 5/7/08.

–SWMU BOUNDARY

–CURRENT DRAINAGE DITCH

–CURRENT DRAINAGE CULVERT

–STORMWATER FLOW DIRECTION (TYPICAL)

–PROPOSED SOIL SAMPLING GRID CELL (50' X 50')

–SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE

LEGEND

–PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)

–SURFACE SOIL SAMPLING LOCATION (CMS 2008)

–MONITORING WELL LOCATION (CMS 2008)

–SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)

–SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)

–SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 5–3

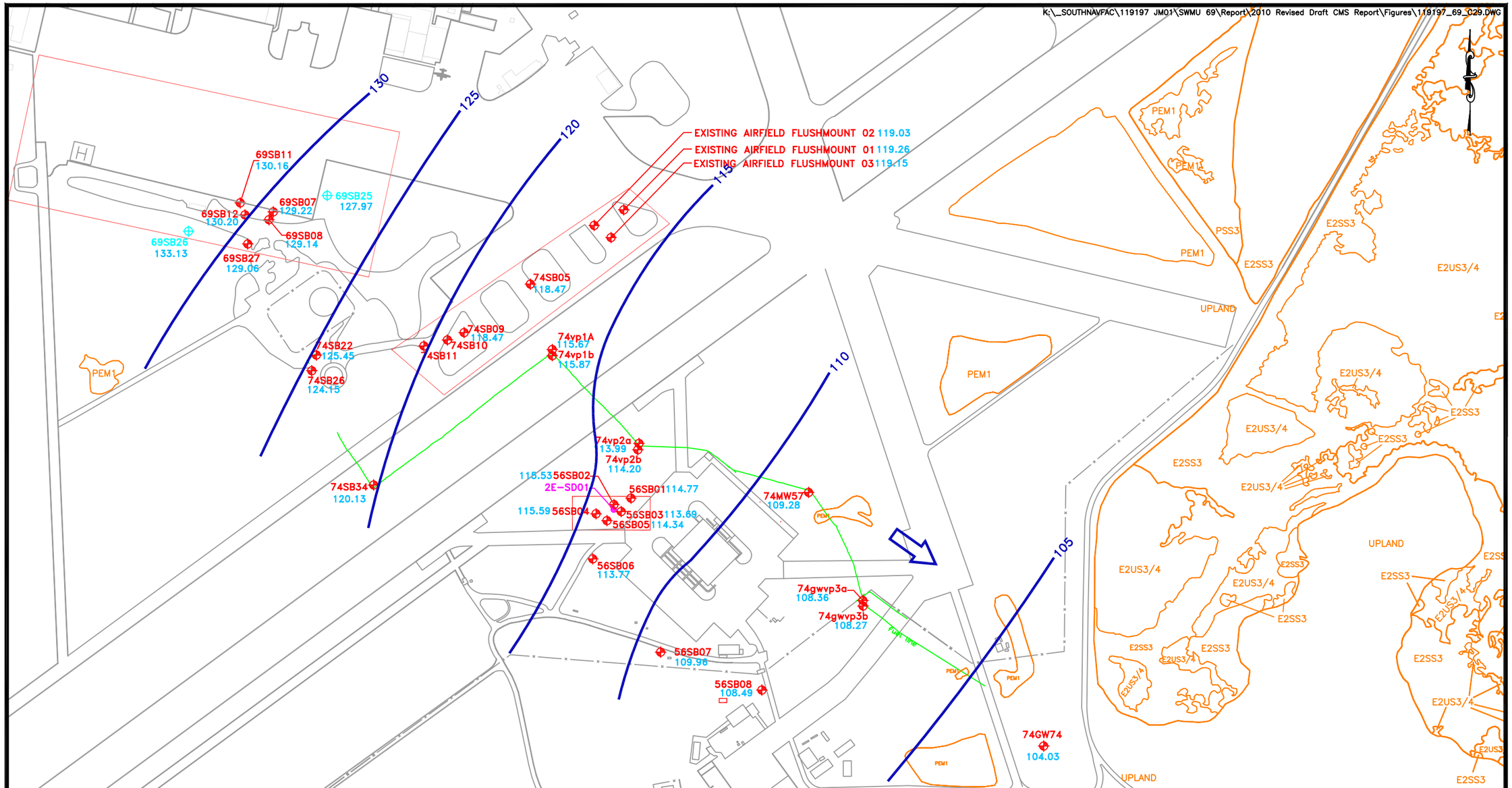
GROUNDWATER ELEVATION CONTOUR MAP

SWMU 69–AIRCRAFT PARKING AREA

CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 69\Report\2010 Revised Draft CMS Report\Figures\119197_69_C29.DWG



NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

500 0 250 500
1 inch = 500 ft.

Baker

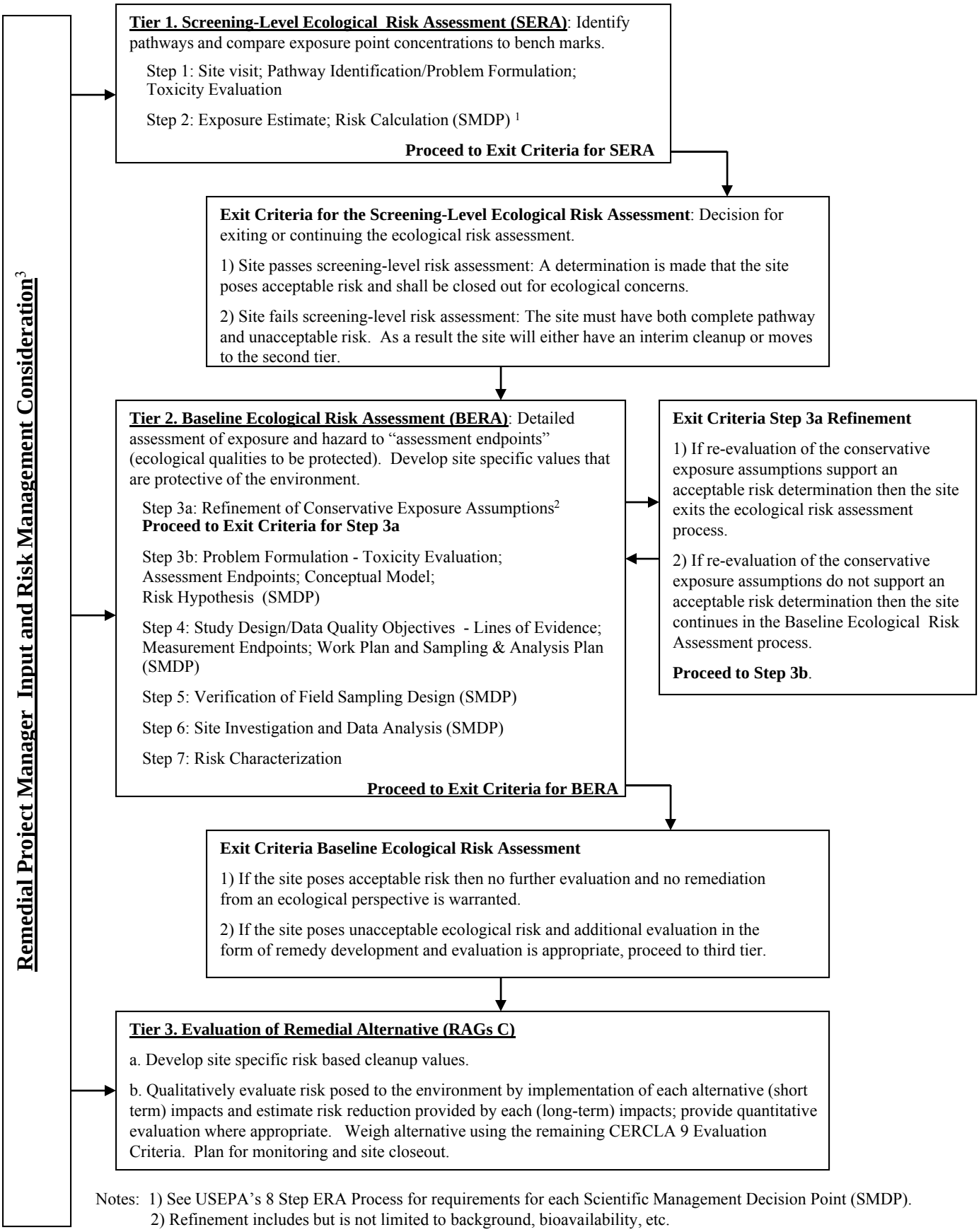
GROUNDWATER LEGEND
—ESTIMATED GROUNDWATER CONTOUR, FEET
—GROUNDWATER FLOW DIRECTION
ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL PLUS 100 FEET
DEPTH TO WATER MEASURED ON JULY 22, 2008

LEGEND
—SWMU BOUNDARY
108.49 —GROUNDWATER ELEVATION
—MONITORING WELL LOCATION (CMS 2008)
—CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

FIGURE 5-4
REGIONAL GROUNDWATER CONTOUR MAP
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

Figure 7-1
Navy Ecological Risk Assessment Tiered Approach



Notes: 1) See USEPA's 8 Step ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2) Refinement includes but is not limited to background, bioavailability, etc.
3) Risk management is incorporated throughout the tiered approach.

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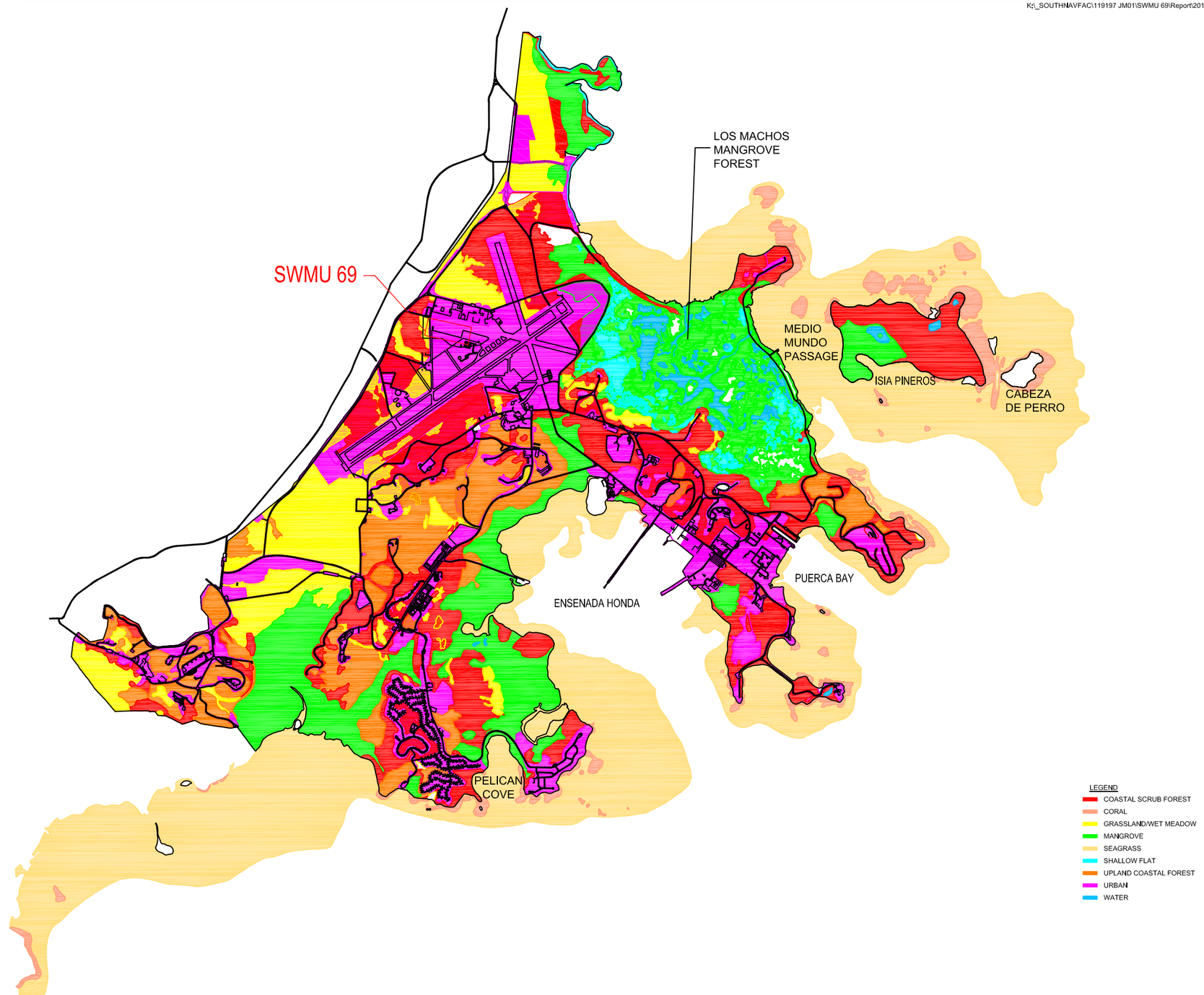


SOURCE: GEO-MARINE, INC. 1998

REVISIONS		NORTH				
	DRAWN RRR REVIEWED MEK S.O.# 119197 CADD# 119197_69_C30.dwg			SWMU 69-AIRCRAFT PARKING AREA NAVAL ACTIVITY PUERTO RICO BAKER ENVIRONMENTAL, Inc. Coraopolis, Pennsylvania	Baker	"TERRESTRIAL AND AQUATIC HABITAT OCCURRING AT NAVAL ACTIVITY PUERTO RICO" CORRECTIVE MEASURES STUDY REPORT SCALE FULLSIZE 1" = 600' DATE JUNE 2008

FIGURE

7-2

NOTE
1. INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM
2. DOES NOT DEPICT ENTIRE STORMWATER DRAINAGE SYSTEM

LEGEND
- —WETLAND DELINEATION
- —SWMU BOUNDARY
- —DRAINAGE DITCH
- —APPROXIMATE DRAINAGE DITCH
- —DRAINAGE DIVIDE
- —CULVERTS

FIGURE 7-3
WETLAND LOCATION MAP
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

M - MARINE

SYSTEM	M - MARINE								
SUBSYSTEM	1 - SUBTIDAL					2 - INTERTIDAL			
CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	RF - Reef	OW - Open Water (unknown bottom)	AB - Aquatic Bed	RF - Reef	RS - Rocky Shore	US - Unconsolidated Shore
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vasc 5 Unknown	1 Coral 3 Worm		1 Algal 3 Rooted Vasc 5 Unknown	1 Coral 3 Worm	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic

E - ESTUARINE

SYSTEM	E - ESTUARINE										
SUBSYSTEM	1 - SUBTIDAL				2 - INTERTIDAL						
CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	RF - Reef	OW - Open Water (unknown bottom)	AB - Aquatic Bed	RF - Reef	SB - Streambed	RS - Rocky Shore	US - Unconsolidated Shore	EM - Emergent	SS - Scrub-Shrub	FO - Forested
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	2 Mollusk 3 Worm		1 Algal 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	2 Mollusk 3 Worm	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Dead	1 Persistent 2 Nonpersistent	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*

R - RIVERINE

SYSTEM	R - RIVERINE							
SUBSYSTEM	1 - TIDAL	2 - LOWER PERENNIAL		3 - UPPER PERENNIAL		4 INTERMITTENT		5 - UNKNOWN PERENNIAL
CLASS	RB - Rock	UB - Unconsolidated Bottom	SB - Streambed	AB - Aquatic Bed	RS - Rocky Shore	US - Unconsolidated Shore	OW - Open Water (unknown bottom)	**EM - Emergent
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble 3 Cobble - Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic		2 Nonpersistent

L - LACUSTRINE

SYSTEM	L - LACUSTRINE										
SUBSYSTEM	1 - LIMNETIC					2 - LITTORAL					
CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	OW - Open Water (unknown bottom)	RB - Rock Bottom	RS - Rocky Shore	UB - Unconsolidated Bottom	AB - Aquatic Bed	US - Unconsolidated Shore	EM - Emergent	OW - Open Water (unknown bottom)
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*		1 Bedrock 2 Rubble	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent	

P - PALUSTRINE

SYSTEM	P - PALUSTRINE								
CLASS	RB - Rock Bottom	UB - Unconsolidated Bottom	AB - Aquatic Bed	US - Unconsolidated Shore	ML - Moss-Lichen	EM - Emergent	SS - Scrub-Shrub	FO - Forested	OW - Open Water (unknown bottom)
Subclass	1 Bedrock 2 Rubble	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vasc 4 Floating Vasc 5 *Unknown Submerg.* 6 *Unknown Surface*	1 Cobble - Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-leaved Decid. 2 Needle-leaved Decid. 3 Broad-leaved Everg. 4 Needle-leaved Everg. 5 Dead 6 *Deciduous* 7 *Evergreen*	

MODIFIERS

WATER REGIME

Non-Tidal

A Temp. Flooded
B Saturated
C Seasonally Flooded
D Seasonally Flooded/ Well Drained
E Seasonally Flooded/ Saturated
F Semipermanently Flooded
G Intermittently Exposed
H Permanently Flooded
J Intermittently Flooded
K Artificially Flooded
W Intermittently Flooded/ Temporary
Y Saturated/Semipermanent/ Seasonal
Z Intermittently Exposed Permanent
U Unknown

Tidal

K Artificially Flooded
L Subtidal
M Irregularly Flooded
N Regularly Flooded
P Irregularly Flooded
*S Temporary-Tidal
*R Seasonal-Tidal
*T Semipermanent- Tidal
*V Permanent-Tidal
U Unknown

* These water regimes are only used in tidally influenced, freshwater systems.

WATER CHEMISTRY

Coastal Halinity

1 Hyperhaline
2 Euhaline
3 Mixohaline
4 Polyhaline
5 Mesohaline
6 Oligohaline
0 Fresh

Inland Salinity

7 Hypersaline
8 Eusaline
9 Mixosaline
0 Fresh

pH (fresh water)

a Acid
t circumneutral
i Alkaline

SOIL

g Organic
n Mineral

SPECIAL

b Beaver
d partially drained/ditched
f Farmed
h Diked/Impounded
r Artificial Substrate
s Spoil
x Excavated

SOURCE: UNITED STATES, FISH AND WILDLIFE SERVICE. CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES, 1985

Baker

FIGURE 7-4
THE COWARDIN WETLAND
CLASSIFICATION SYSTEM
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

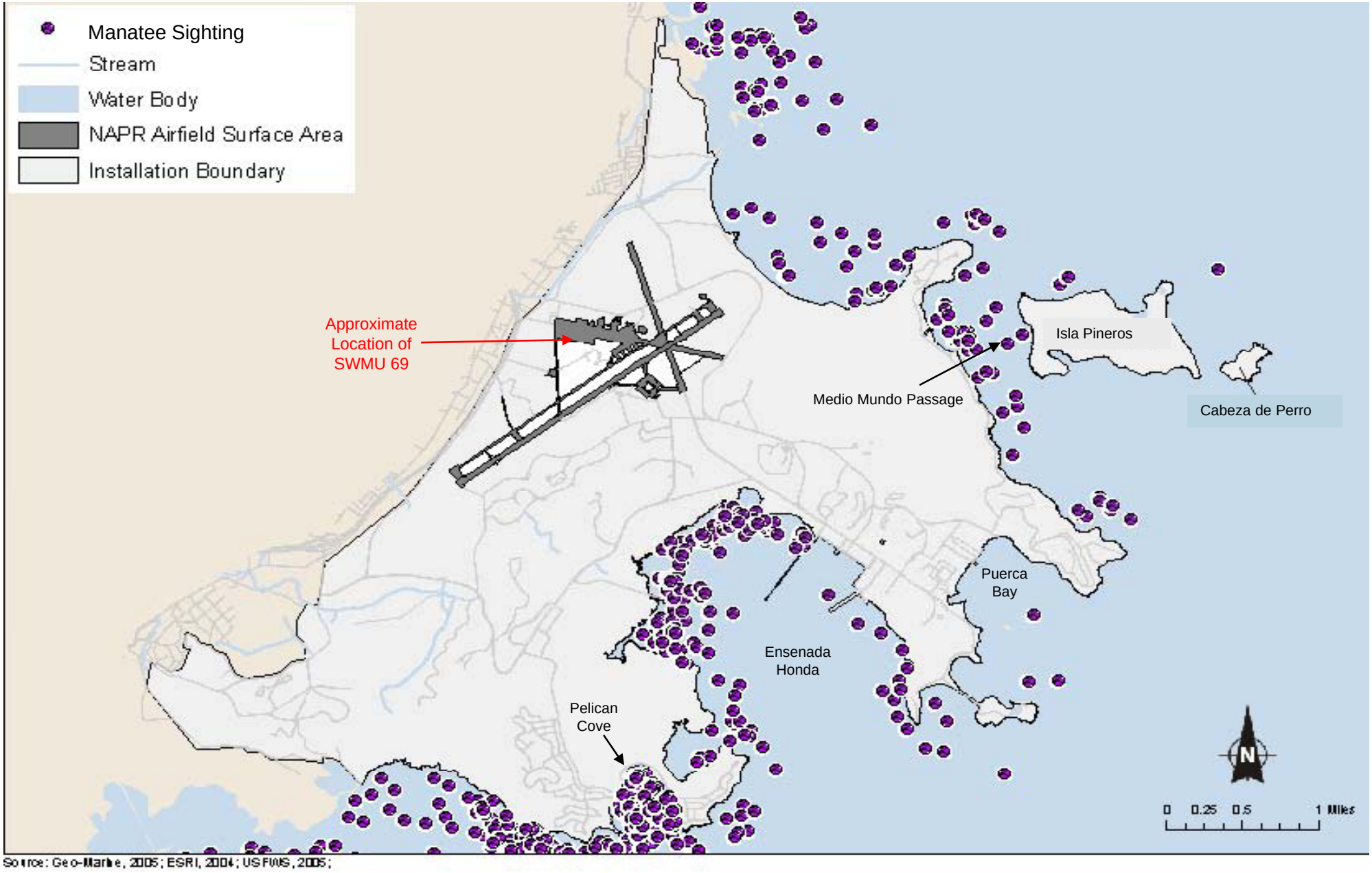
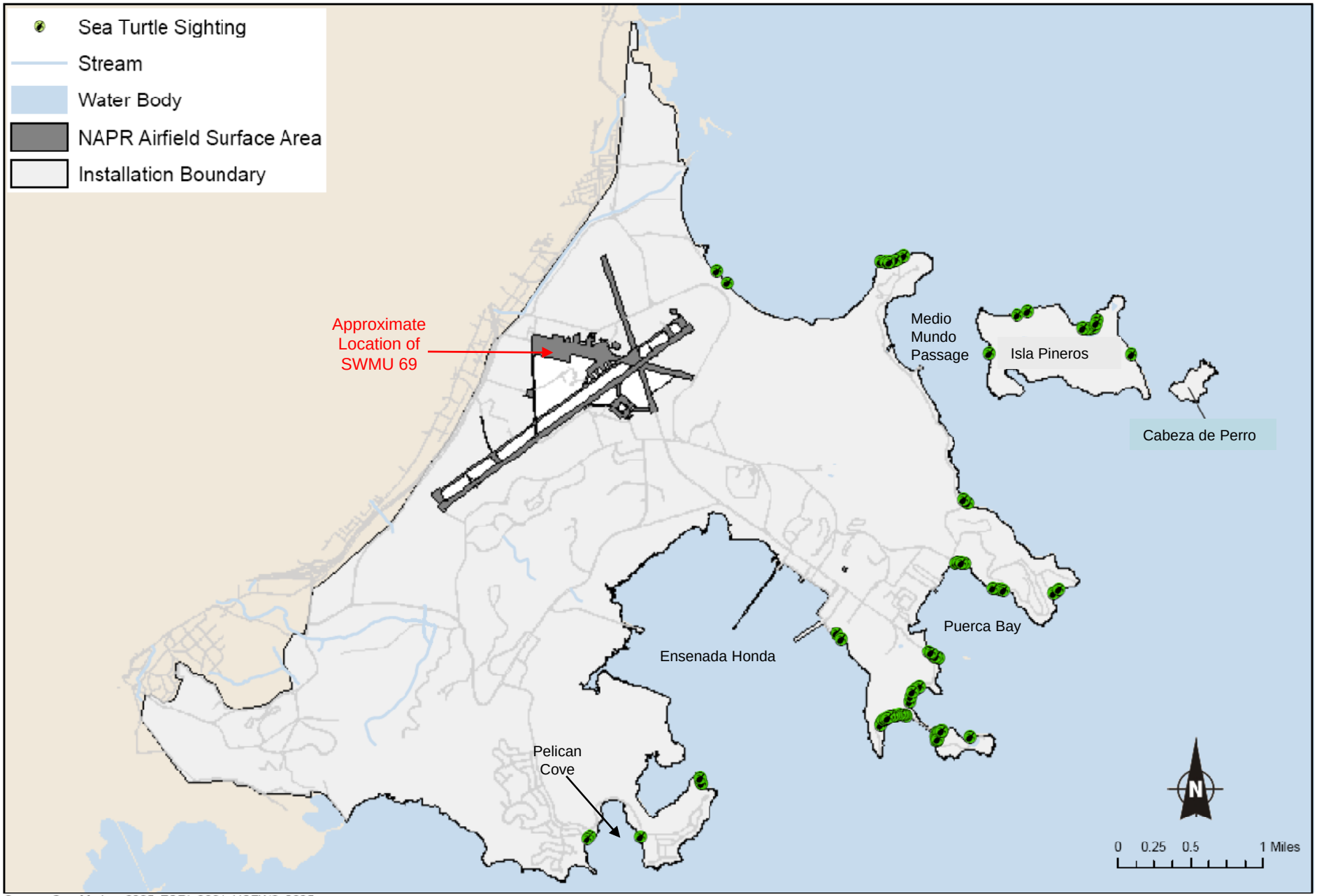


Figure from: Department of the Navy (DoN). 2007. *Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads).* April 2007.

FIGURE 7-5
HISTORICAL MANATEE SIGHTINGS IN EASTERN PUERTO RICO
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

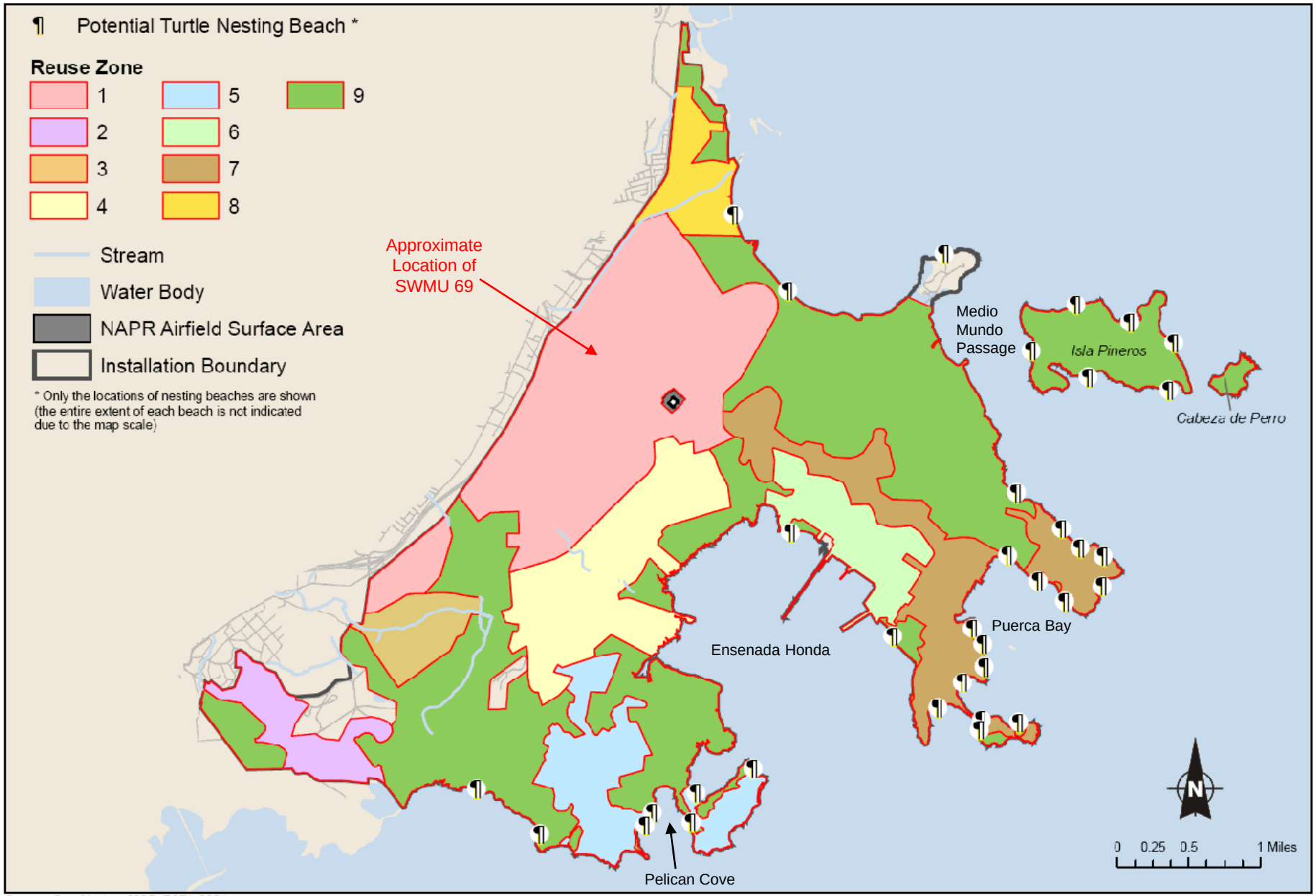


Source: Geo-Marine, 2005; ESRI, 2004; USFWS, 2005;

Cumulative sea turtle sightings from March 1984 through March 1995 obtained from weekly aerial surveys of the Former Naval Station Roosevelt Roads.

Figure from: Department of the Navy (DoN). 2007. *Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads).* April 2007.

FIGURE 7-6
SEA TURTLE SIGHTINGS AT NAVAL ACTIVITY PUERTO RICO
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Source: Geo-Marine, 2005; ESRI, 2004;

Figure from: Department of Navy (DoN). 2007. *Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads).* April 2007

FIGURE 7-7
POTENTIAL TURTLE NESTING SITES
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

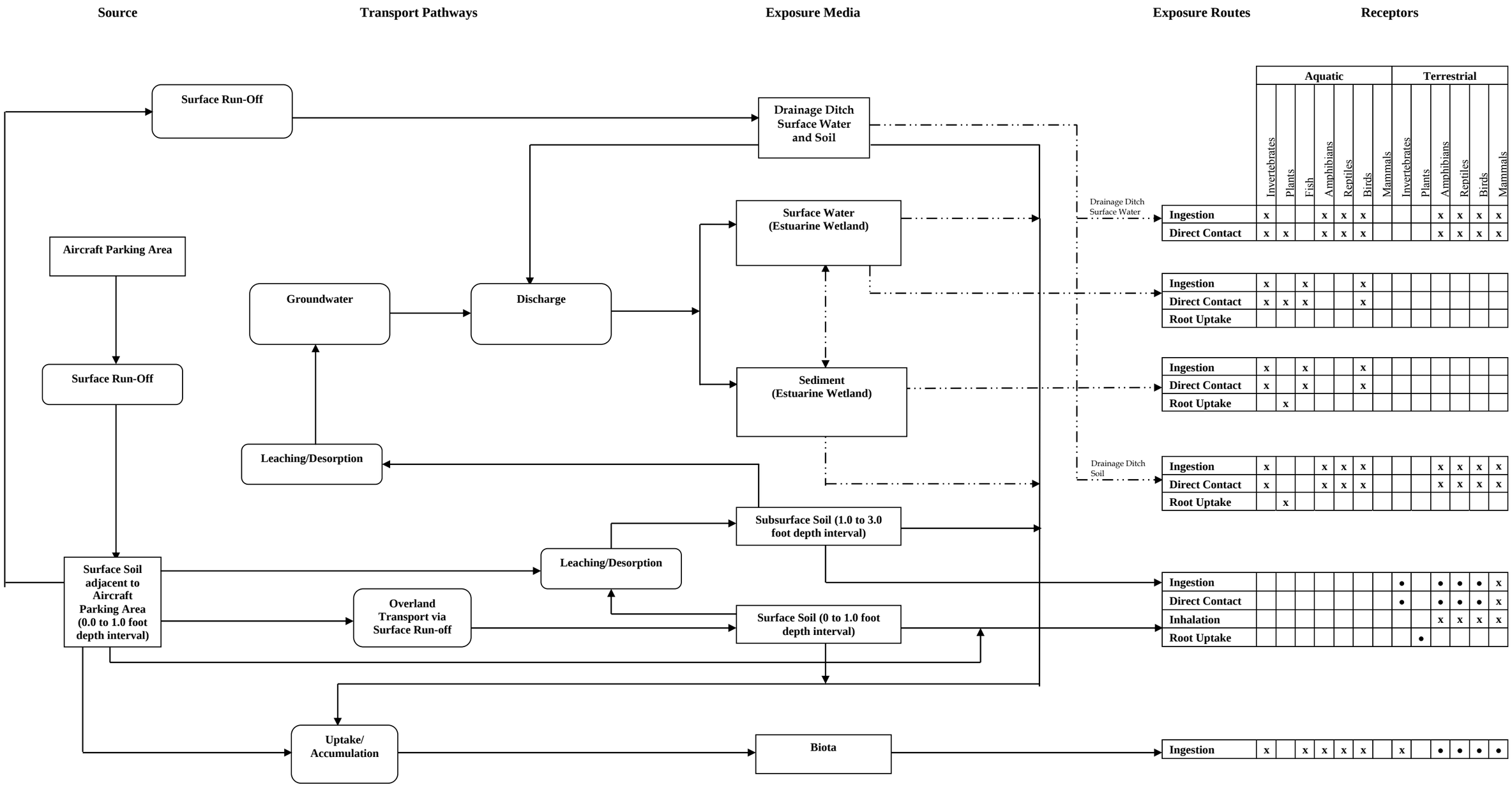


FIGURE 7-8
PRELIMINARY CONCEPTUAL MODEL (2008)
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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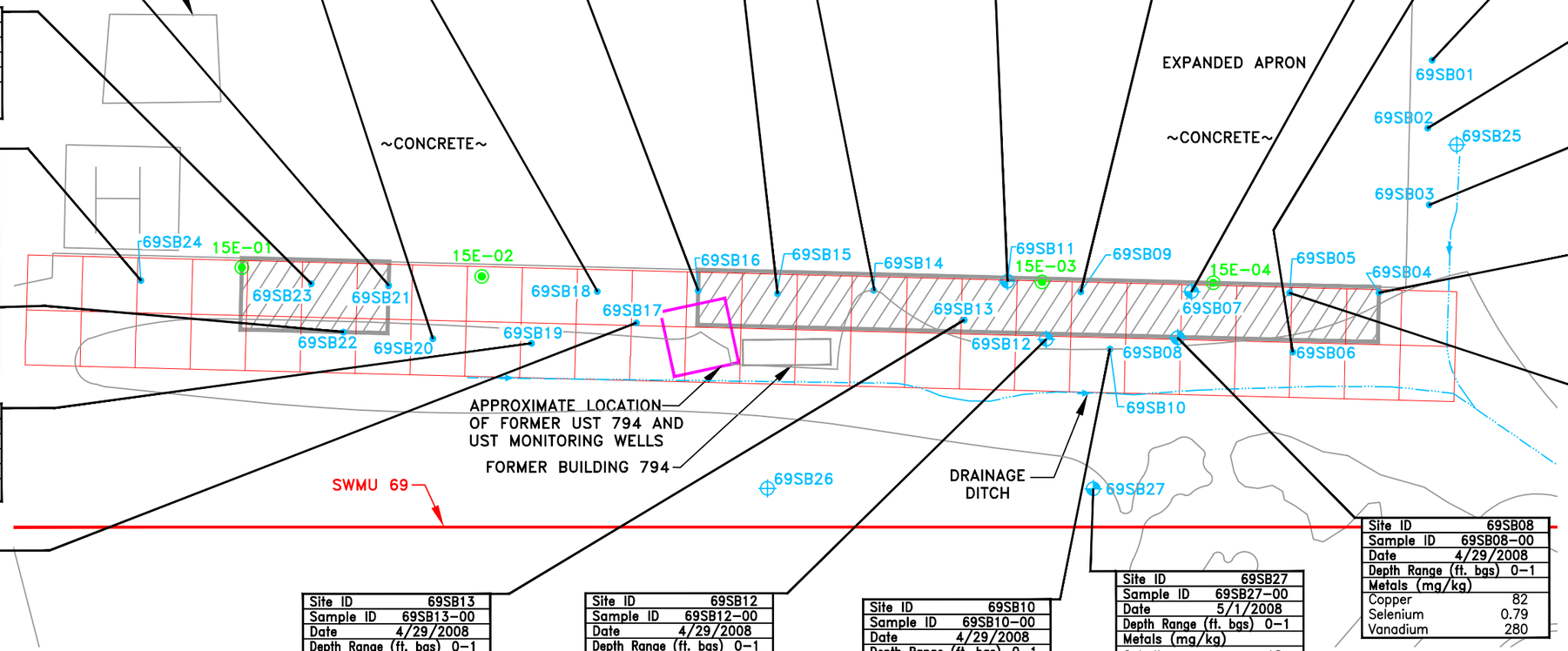

Site ID	69SB20
Sample ID	69SB20-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Chromium	85 J
Cobalt	17
Vanadium	140 J

Site ID	69SB18
Sample ID	69SB18-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	86 J

Site ID	69SB16
Sample ID	69SB16-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	96 J

Site ID	69SB15
Sample ID	69SB15-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	46 J
Zinc	140

Site ID	69SB14
Sample ID	69SB14-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	99 J
Zinc	130

Site ID	69SB11
Sample ID	69SB11-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Lead	220
Vanadium	53

Site ID	69SB09
Sample ID	69SB09-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Copper	130 J
Lead	250 J
Selenium	0.67 J
Vanadium	92 J
Zinc	270 J

Site ID	69SB07
Sample ID	69SB07-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	58

Site ID	69SB06
Sample ID	69SB06-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Copper	73
Mercury	0.13
Selenium	0.81
Vanadium	230 J

Site ID	69SB21
Sample ID	69SB21-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Selenium	0.58
Vanadium	120 J

Site ID	69SB23
Sample ID	69SB23-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Barium	410
Vanadium	62

Site ID	69SB24
Sample ID	69SB24-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	70

Site ID	69SB22
Sample ID	69SB22-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Chromium	60 J
Vanadium	140 J

Site ID	69SB19
Sample ID	69SB19-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	82 J

Site ID	69SB17
Sample ID	69SB17-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	110 J

Site ID	69SB01
Sample ID	69SB01-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Chromium	58 J
Cobalt	14
Vanadium	140 J

Site ID	69SB02
Sample ID	69SB02-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	140 J

Site ID	69SB03
Sample ID	69SB03-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	110 J

Site ID	69SB04
Sample ID	69SB04-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Mercury	0.16
Selenium	1.8
Vanadium	170 J

Site ID	69SB05
Sample ID	69SB05-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Barium	800
Cadmium	36 J
Chromium	89 J
Cobalt	17
Copper	130
Lead	520
Mercury	0.12
Selenium	0.72 J
Vanadium	100 J
Zinc	650

Site ID	69SB08
Sample ID	69SB08-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Copper	82
Selenium	0.79
Vanadium	280

Site ID	69SB13
Sample ID	69SB13-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	78 J

Site ID	69SB12
Sample ID	69SB12-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Cobalt	14
Vanadium	87

Site ID	69SB10
Sample ID	69SB10-00
Date	4/29/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Vanadium	110 J

Site ID	69SB27
Sample ID	69SB27-00
Date	5/1/2008
Depth Range (ft. bgs)	0-1
Metals (mg/kg)	
Cobalt	18
Copper	85
Vanadium	210

ECOLOGICAL SOIL SCREENING CRITERIA	
INORGANICS (mg/kg)	
Barium	330
Cadmium	32
Chromium	57
Cobalt	13
Copper	70
Lead	120
Mercury	0.1
Nickel	38
Selenium	0.52
Vanadium	20
Zinc	120

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

LEGEND

- -SWMU BOUNDARY
- -CURRENT DRAINAGE DITCH
- -CURRENT DRAINAGE CULVERT
- -STORMWATER FLOW DIRECTION (TYPICAL)
- -PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- -SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- -PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- -SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- -MONITORING WELL LOCATION (CMS 2008)
- -SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)

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FIGURE 7-9
DETECTED CONCENTRATIONS IN SURFACE SOIL EXCEEDING SOIL SCREENING VALUES 2008 DATA
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

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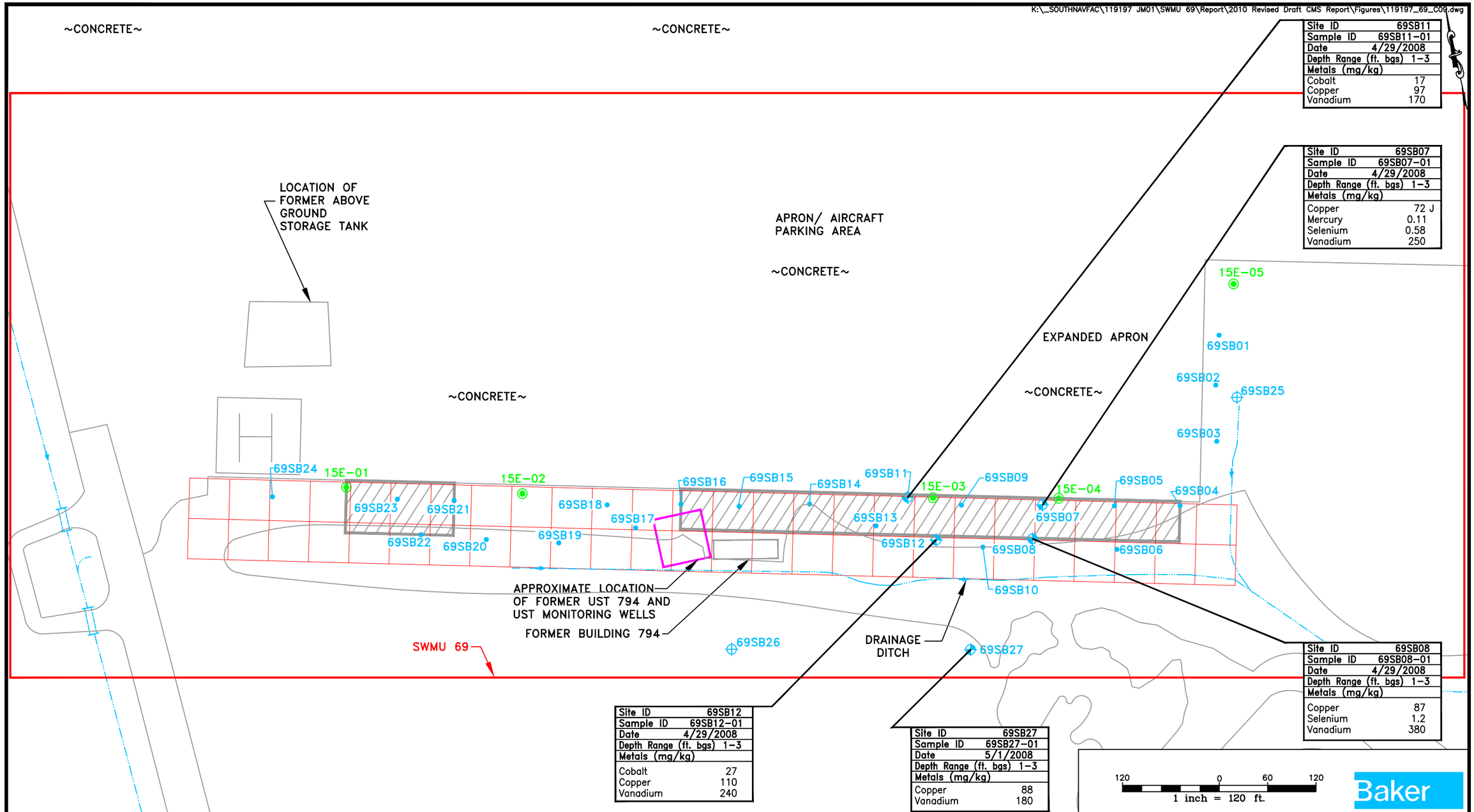


Site ID	69SB11
Sample ID	69SB11-01
Date	4/29/2008
Depth Range (ft. bgs)	1-3
Metals (mg/kg)	
Cobalt	17
Copper	97
Vanadium	170

Site ID	69SB07
Sample ID	69SB07-01
Date	4/29/2008
Depth Range (ft. bgs)	1-3
Metals (mg/kg)	
Copper	72 J
Mercury	0.11
Selenium	0.58
Vanadium	250

Site ID	69SB08
Sample ID	69SB08-01
Date	4/29/2008
Depth Range (ft. bgs)	1-3
Metals (mg/kg)	
Copper	87
Selenium	1.2
Vanadium	380

Site ID	69SB12
Sample ID	69SB12-01
Date	4/29/2008
Depth Range (ft. bgs)	1-3
Metals (mg/kg)	
Cobalt	27
Copper	110
Vanadium	240

Site ID	69SB27
Sample ID	69SB27-01
Date	5/1/2008
Depth Range (ft. bgs)	1-3
Metals (mg/kg)	
Copper	88
Vanadium	180

ECOLOGICAL SOIL SCREENING CRITERIA	
INORGANICS (mg/kg)	
Cobalt	13
Copper	70
Mercury	0.1
Selenium	0.52
Vanadium	20

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

LEGEND

- -SWMU BOUNDARY
- -CURRENT DRAINAGE DITCH
- -CURRENT DRAINAGE CULVERT
- -STORMWATER FLOW DIRECTION (TYPICAL)
- -PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- -SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- -PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- -SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- -MONITORING WELL LOCATION (CMS 2008)
- -SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)

FIGURE 7-10
DETECTED CONCENTRATIONS IN SUBSURFACE SOIL EXCEEDING SOIL SCREENING VALUES 2008 DATA
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

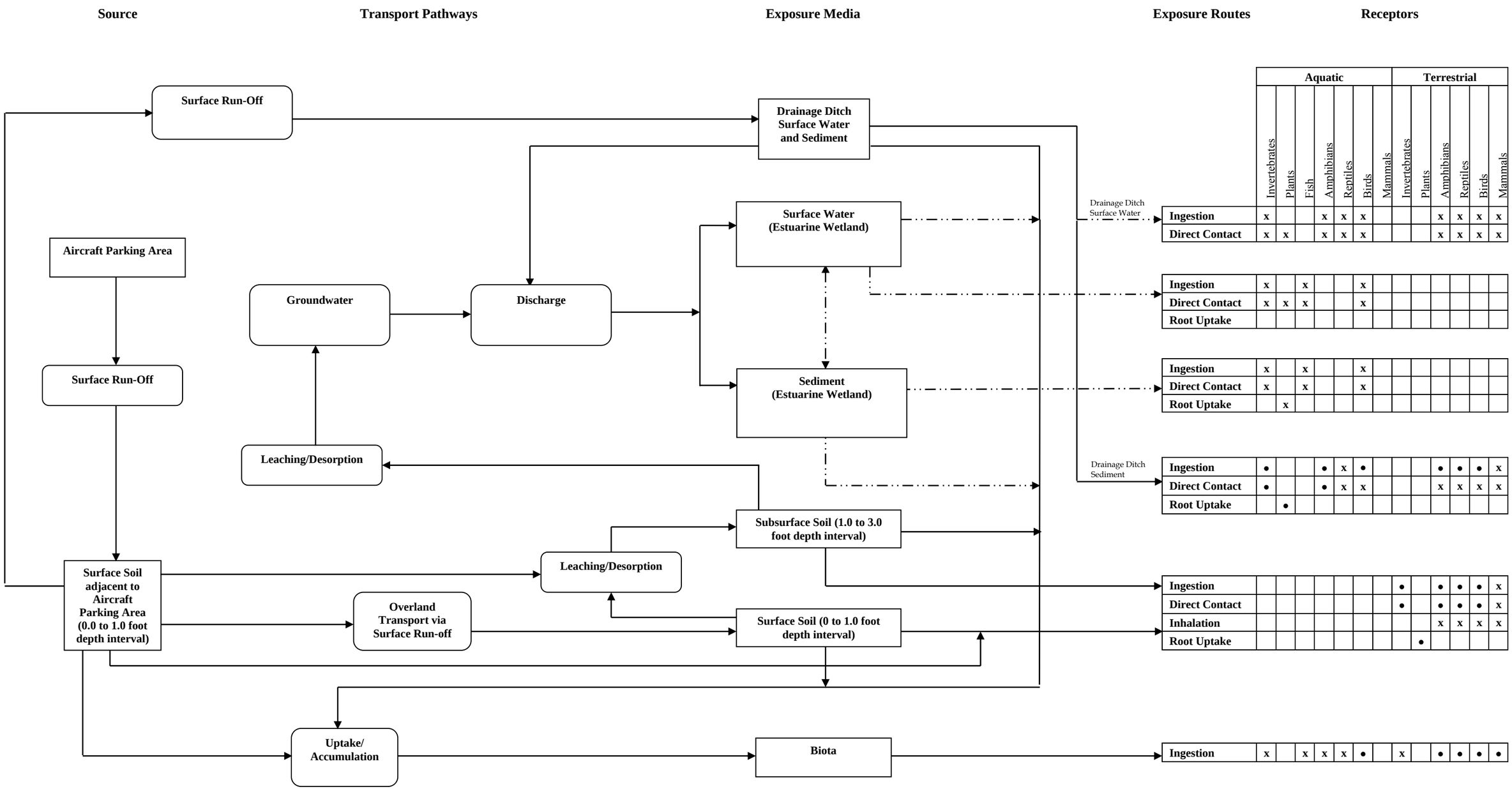
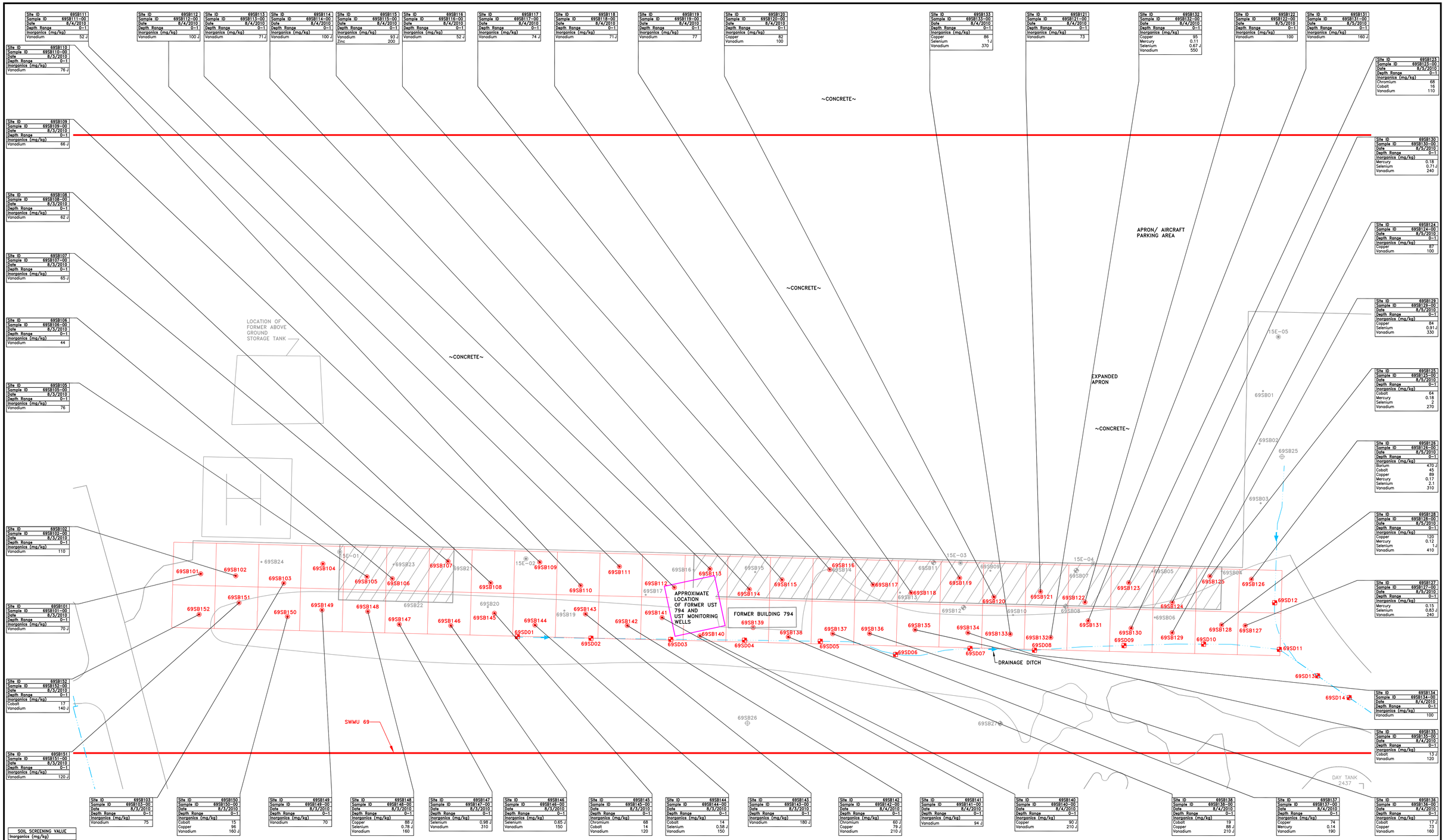


FIGURE 7-11
PRELIMINARY CONCEPTUAL MODEL (2010)
SWMU 69 – AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Site ID	69SB111
Sample ID	69SB111-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	52 J

Site ID	69SB112
Sample ID	69SB112-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	100 J

Site ID	69SB113
Sample ID	69SB113-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	71 J

Site ID	69SB114
Sample ID	69SB114-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	100 J

Site ID	69SB115
Sample ID	69SB115-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	93 J
Zinc	200

Site ID	69SB116
Sample ID	69SB116-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	52 J

Site ID	69SB117
Sample ID	69SB117-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	74 J

Site ID	69SB118
Sample ID	69SB118-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	71 J

Site ID	69SB119
Sample ID	69SB119-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	77

Site ID	69SB120
Sample ID	69SB120-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	82
Vanadium	100

Site ID	69SB133
Sample ID	69SB133-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	86
Selenium	1 J
Vanadium	370

Site ID	69SB121
Sample ID	69SB121-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	73

Site ID	69SB132
Sample ID	69SB132-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	95
Mercury	0.11
Selenium	0.67 J
Vanadium	550

Site ID	69SB122
Sample ID	69SB122-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	100

Site ID	69SB131
Sample ID	69SB131-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	160 J

Site ID	69SB110
Sample ID	69SB110-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	76 J

Site ID	69SB109
Sample ID	69SB109-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	66 J

Site ID	69SB108
Sample ID	69SB108-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	62 J

Site ID	69SB107
Sample ID	69SB107-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	65 J

Site ID	69SB106
Sample ID	69SB106-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	44

Site ID	69SB105
Sample ID	69SB105-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	76

Site ID	69SB102
Sample ID	69SB102-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	110

Site ID	69SB101
Sample ID	69SB101-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	70 J

Site ID	69SB152
Sample ID	69SB152-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	17
Vanadium	140 J

Site ID	69SB151
Sample ID	69SB151-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	120 J

Site ID	69SB123
Sample ID	69SB123-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Chromium	68
Cobalt	16
Vanadium	110

Site ID	69SB130
Sample ID	69SB130-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Mercury	0.18
Selenium	0.71 J
Vanadium	240

Site ID	69SB124
Sample ID	69SB124-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	87
Vanadium	100

Site ID	69SB129
Sample ID	69SB129-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	84
Selenium	0.91 J
Vanadium	330

Site ID	69SB125
Sample ID	69SB125-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	64
Mercury	0.18
Selenium	2
Vanadium	270

Site ID	69SB126
Sample ID	69SB126-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Barium	470 J
Cobalt	45
Copper	89
Mercury	0.17
Selenium	2.1
Vanadium	310

Site ID	69SB128
Sample ID	69SB128-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	120
Mercury	0.12
Selenium	1 J
Vanadium	410

Site ID	69SB127
Sample ID	69SB127-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Mercury	0.15
Selenium	0.83 J
Vanadium	240

Site ID	69SB134
Sample ID	69SB134-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	100

Site ID	69SB135
Sample ID	69SB135-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	13 J
Vanadium	120

Site ID	69SB136
Sample ID	69SB136-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	17 J
Copper	73
Vanadium	160

Site ID	69SB137
Sample ID	69SB137-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	74
Mercury	0.14
Vanadium	190

Site ID	69SB138
Sample ID	69SB138-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	19
Copper	88 J
Vanadium	210 J

Site ID	69SB140
Sample ID	69SB140-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	90 J
Vanadium	210 J

Site ID	69SB141
Sample ID	69SB141-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	94 J

Site ID	69SB142
Sample ID	69SB142-00
Date	8/4/2010
Depth Range	0-1
Inorganics (mg/kg)	
Chromium	60 J
Copper	79 J
Vanadium	210 J

Site ID	69SB143
Sample ID	69SB143-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	180 J

Site ID	69SB144
Sample ID	69SB144-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	14
Selenium	0.58 J
Vanadium	150

Site ID	69SB145
Sample ID	69SB145-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Chromium	68
Cobalt	14
Vanadium	120

Site ID	69SB146
Sample ID	69SB146-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Selenium	0.65 J
Vanadium	150

Site ID	69SB147
Sample ID	69SB147-00
Date	8/5/2010
Depth Range	0-1
Inorganics (mg/kg)	
Selenium	0.98 J
Vanadium	310

Site ID	69SB148
Sample ID	69SB148-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Copper	88 J
Selenium	0.78 J
Vanadium	160

Site ID	69SB149
Sample ID	69SB149-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	70

Site ID	69SB150
Sample ID	69SB150-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Cobalt	15
Copper	96
Vanadium	160 J

Site ID	69SB103
Sample ID	69SB103-00
Date	8/3/2010
Depth Range	0-1
Inorganics (mg/kg)	
Vanadium	75

SOIL SCREENING VALUE	
Inorganics (mg/kg)	
Barium	330
Chromium	57
Cobalt	13
Copper	70
Mercury	0.1
Selenium	0.52
Vanadium	20
Zinc	120

LEGEND

- SWMU BOUNDARY
- CURRENT DRAINAGE DITCH
- STORMWATER FLOW DIRECTION (TYPICAL)
- PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- MONITORING WELL LOCATION (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- SEDIMENT SAMPLE LOCATION (CMS 2010)

DRAWN	RRR
REVIEWED	HG
S.O.#	119197
CADD#	119197_69_C06

NORTH

SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

MICHAEL BAKER Jr., Inc.
Moon Township, Pennsylvania

Baker

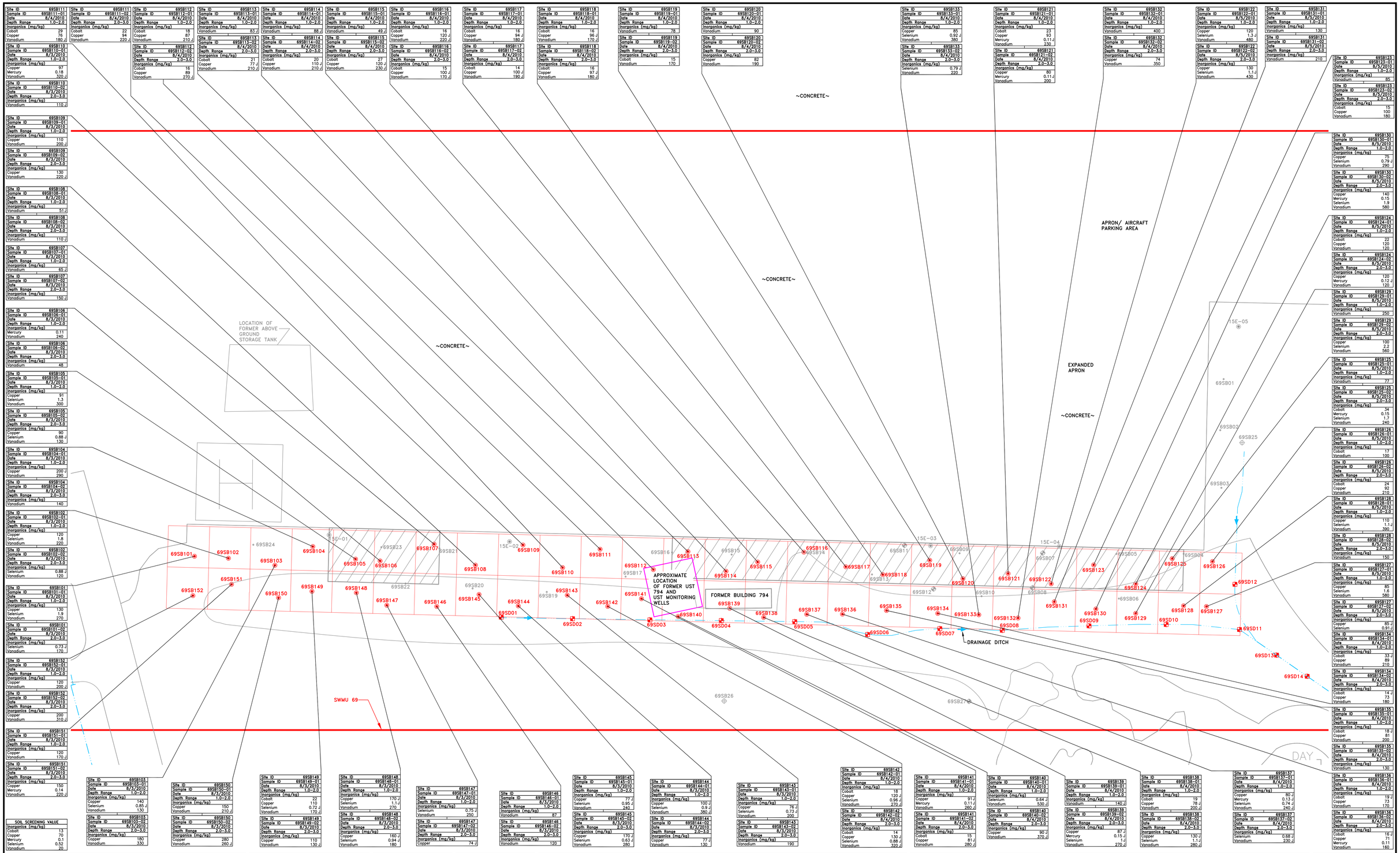
DETECTED CONCENTRATIONS IN SURFACE SOIL EXCEEDING SOIL SCREENING VALUES (2010)

SCALE 1"=50'

DATE APRIL 2011

FIGURE NO.

7-12



Site ID	69SB111
Sample ID	69SB111-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	29
Copper	76
Vanadium	180

Site ID	69SB111
Sample ID	69SB111-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	22
Copper	94
Vanadium	220 J

Site ID	69SB112
Sample ID	69SB112-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	18
Copper	87
Vanadium	210 J

Site ID	69SB112
Sample ID	69SB112-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	16
Copper	89
Vanadium	270 J

Site ID	69SB113
Sample ID	69SB113-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	83 J

Site ID	69SB113
Sample ID	69SB113-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	21
Copper	77 J
Vanadium	210 J

Site ID	69SB114
Sample ID	69SB114-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	88 J

Site ID	69SB114
Sample ID	69SB114-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	20
Copper	110 J
Vanadium	210 J

Site ID	69SB115
Sample ID	69SB115-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	49 J

Site ID	69SB115
Sample ID	69SB115-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	27
Copper	120 J
Vanadium	230 J

Site ID	69SB116
Sample ID	69SB116-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	16
Copper	120 J
Vanadium	220 J

Site ID	69SB116
Sample ID	69SB116-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	15
Copper	100 J
Vanadium	170 J

Site ID	69SB117
Sample ID	69SB117-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	16
Copper	94 J
Vanadium	180 J

Site ID	69SB117
Sample ID	69SB117-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	14
Copper	100 J
Vanadium	190 J

Site ID	69SB118
Sample ID	69SB118-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	16
Copper	96 J
Vanadium	170 J

Site ID	69SB118
Sample ID	69SB118-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	16
Copper	97 J
Vanadium	180 J

Site ID	69SB119
Sample ID	69SB119-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	78

Site ID	69SB119
Sample ID	69SB119-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	15
Vanadium	170

Site ID	69SB120
Sample ID	69SB120-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	90

Site ID	69SB120
Sample ID	69SB120-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	82
Vanadium	190

Site ID	69SB133
Sample ID	69SB133-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	85
Selenium	0.92 J
Vanadium	380

Site ID	69SB133
Sample ID	69SB133-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Selenium	0.79 J
Vanadium	220

Site ID	69SB121
Sample ID	69SB121-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	23
Copper	93
Mercury	0.11 J
Vanadium	230

Site ID	69SB121
Sample ID	69SB121-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	80
Mercury	0.11 J
Vanadium	200

Site ID	69SB132
Sample ID	69SB132-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	400

Site ID	69SB132
Sample ID	69SB132-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	74
Vanadium	350

Site ID	69SB122
Sample ID	69SB122-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	120
Selenium	1.3 J
Vanadium	480

Site ID	69SB122
Sample ID	69SB122-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	130
Selenium	1.1 J
Vanadium	430

Site ID	69SB131
Sample ID	69SB131-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	130

Site ID	69SB131
Sample ID	69SB131-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	210

Site ID	69SB110
Sample ID	69SB110-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	97
Mercury	0.18
Vanadium	320 J

Site ID	69SB110
Sample ID	69SB110-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	110 J

Site ID	69SB109
Sample ID	69SB109-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	110
Vanadium	200 J

Site ID	69SB109
Sample ID	69SB109-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	130
Vanadium	220 J

Site ID	69SB108
Sample ID	69SB108-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	51 J

Site ID	69SB108
Sample ID	69SB108-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	110 J

Site ID	69SB107
Sample ID	69SB107-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	65 J

Site ID	69SB107
Sample ID	69SB107-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	150 J

Site ID	69SB106
Sample ID	69SB106-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Mercury	0.11
Vanadium	240

Site ID	69SB106
Sample ID	69SB106-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	48

Site ID	69SB105
Sample ID	69SB105-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	91
Selenium	1.3
Vanadium	300

Site ID	69SB105
Sample ID	69SB105-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	90
Selenium	0.88 J
Vanadium	130

Site ID	69SB104
Sample ID	69SB104-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	200 J
Vanadium	290

Site ID	69SB104
Sample ID	69SB104-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	140

Site ID	69SB102
Sample ID	69SB102-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	120
Selenium	1.8
Vanadium	220

Site ID	69SB102
Sample ID	69SB102-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Selenium	0.88 J
Vanadium	120

Site ID	69SB101
Sample ID	69SB101-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	130
Selenium	1.9
Vanadium	270

Site ID	69SB101
Sample ID	69SB101-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Selenium	0.73 J
Vanadium	120

Site ID	69SB152
Sample ID	69SB152-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	120
Vanadium	200 J

Site ID	69SB152
Sample ID	69SB152-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	200
Vanadium	310 J

Site ID	69SB151
Sample ID	69SB151-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	120
Vanadium	170 J

Site ID	69SB151
Sample ID	69SB151-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	150
Mercury	0.14
Vanadium	220 J

SOIL SCREENING VALUE	
Inorganics (mg/kg)	
Cobalt	13
Copper	70
Mercury	0.1
Selenium	0.52
Vanadium	20

Site ID	69SB103
Sample ID	69SB103-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	140
Selenium	0.85 J
Vanadium	130

Site ID	69SB103
Sample ID	69SB103-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	180
Vanadium	330

Site ID	69SB150
Sample ID	69SB150-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	150
Vanadium	210 J

Site ID	69SB150
Sample ID	69SB150-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	280
Vanadium	260 J

Site ID	69SB149
Sample ID	69SB149-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	22
Copper	110
Selenium	0.72 J
Vanadium	170 J

Site ID	69SB149
Sample ID	69SB149-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	110
Vanadium	130 J

Site ID	69SB148
Sample ID	69SB148-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	170 J
Selenium	1.1 J
Vanadium	270

Site ID	69SB148
Sample ID	69SB148-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	160 J
Selenium	0.94 J
Vanadium	180

Site ID	69SB147
Sample ID	69SB147-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Selenium	0.75 J
Vanadium	250

Site ID	69SB147
Sample ID	69SB147-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	74 J

Site ID	69SB146
Sample ID	69SB146-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	87

Site ID	69SB146
Sample ID	69SB146-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	120

Site ID	69SB145
Sample ID	69SB145-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	77 J
Selenium	0.95 J
Vanadium	240

Site ID	69SB145
Sample ID	69SB145-02
Date	8/2/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	170 J
Selenium	0.63 J
Vanadium	280

Site ID	69SB144
Sample ID	69SB144-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	100 J
Selenium	0.9 J
Vanadium	380 J

Site ID	69SB144
Sample ID	69SB144-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	77 J
Vanadium	130

Site ID	69SB143
Sample ID	69SB143-01
Date	8/3/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	76 J
Selenium	0.73 J
Vanadium	200

Site ID	69SB143
Sample ID	69SB143-02
Date	8/3/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	190

Site ID	69SB142
Sample ID	69SB142-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	18
Copper	120 J
Selenium	0.96 J
Vanadium	220 J

Site ID	69SB142
Sample ID	69SB142-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	14
Copper	130 J
Selenium	0.88 J
Vanadium	320 J

Site ID	69SB141
Sample ID	69SB141-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	91 J
Mercury	0.11 J
Vanadium	260 J

Site ID	69SB141
Sample ID	69SB141-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	15
Copper	81 J
Vanadium	280 J

Site ID	69SB140
Sample ID	69SB140-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Selenium	0.64 J
Vanadium	530 J

Site ID	69SB140
Sample ID	69SB140-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	90 J
Vanadium	370 J

Site ID	69SB139
Sample ID	69SB139-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	140 J

Site ID	69SB139
Sample ID	69SB139-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	87 J
Mercury	0.15 J
Selenium	1.0
Vanadium	270 J

Site ID	69SB138
Sample ID	69SB138-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	19
Copper	78 J
Vanadium	200 J

Site ID	69SB138
Sample ID	69SB138-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	130 J
Selenium	1.1 J
Vanadium	280 J

Site ID	69SB137
Sample ID	69SB137-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	19 J
Copper	73
Vanadium	170

Site ID	69SB137
Sample ID	69SB137-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	16 J
Copper	71
Mercury	0.11
Vanadium	160

Site ID	69SB136
Sample ID	69SB136-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	19 J
Copper	73
Vanadium	170

Site ID	69SB136
Sample ID	69SB136-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	16 J
Copper	71
Mercury	0.11
Vanadium	160

Site ID	69SB135
Sample ID	69SB135-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	18 J
Copper	81
Vanadium	200

Site ID	69SB135
Sample ID	69SB135-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	130

Site ID	69SB134
Sample ID	69SB134-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	33 J
Copper	89
Vanadium	210

Site ID	69SB134
Sample ID	69SB134-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	14 J
Copper	73
Vanadium	180

Site ID	69SB133
Sample ID	69SB133-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	85
Selenium	0.79 J
Vanadium	220

Site ID	69SB133
Sample ID	69SB133-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Selenium	0.91 J

Site ID	69SB132
Sample ID	69SB132-01
Date	8/4/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	400

Site ID	69SB132
Sample ID	69SB132-02
Date	8/4/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	74
Vanadium	350

Site ID	69SB131
Sample ID	69SB131-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	130

Site ID	69SB131
Sample ID	69SB131-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	210

Site ID	69SB130
Sample ID	69SB130-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	75
Selenium	0.79 J
Vanadium	290

Site ID	69SB130
Sample ID	69SB130-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	140
Mercury	0.15
Selenium	1.9
Vanadium	580

Site ID	69SB124
Sample ID	69SB124-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	22
Copper	120
Vanadium	120

Site ID	69SB124
Sample ID	69SB124-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	120
Mercury	0.12 J
Vanadium	120

Site ID	69SB129
Sample ID	69SB129-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	250

Site ID	69SB129
Sample ID	69SB129-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	100
Selenium	2.2
Vanadium	560

Site ID	69SB125
Sample ID	69SB125-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	77

Site ID	69SB125
Sample ID	69SB125-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	34
Mercury	0.15
Selenium	1.7
Vanadium	240

Site ID	69SB126
Sample ID	69SB126-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Cobalt	17
Vanadium	100

Site ID	69SB126
Sample ID	69SB126-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	24
Copper	92
Vanadium	210

Site ID	69SB128
Sample ID	69SB128-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	110
Selenium	1.1 J
Vanadium	390

Site ID	69SB128
Sample ID	69SB128-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Vanadium	150

Site ID	69SB127
Sample ID	69SB127-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Copper	85
Selenium	1.6
Vanadium	580

Site ID	69SB127
Sample ID	69SB127-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Copper	85 J
Selenium	0.91 J

Site ID	69SB123
Sample ID	69SB123-01
Date	8/5/2010
Depth Range	1.0–2.0
Inorganics (mg/kg)	
Vanadium	85

Site ID	69SB123
Sample ID	69SB123-02
Date	8/5/2010
Depth Range	2.0–3.0
Inorganics (mg/kg)	
Cobalt	15
Copper	100
Vanadium	180

LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- –PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- –SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- –MONITORING WELL LOCATION (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

DRAWN	RRR
REVIEWED	HG
S.O.#	119197
CADD#	119197_69_C05

NORTH

SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

MICHAEL BAKER Jr., Inc.
Moon Township, Pennsylvania

Baker

DETECTED CONCENTRATIONS IN SUBSURFACE SOIL EXCEEDING SOIL SCREENING VALUES (2010)

SCALE 1"=50'

DATE APRIL 2011

FIGURE NO.

7-13

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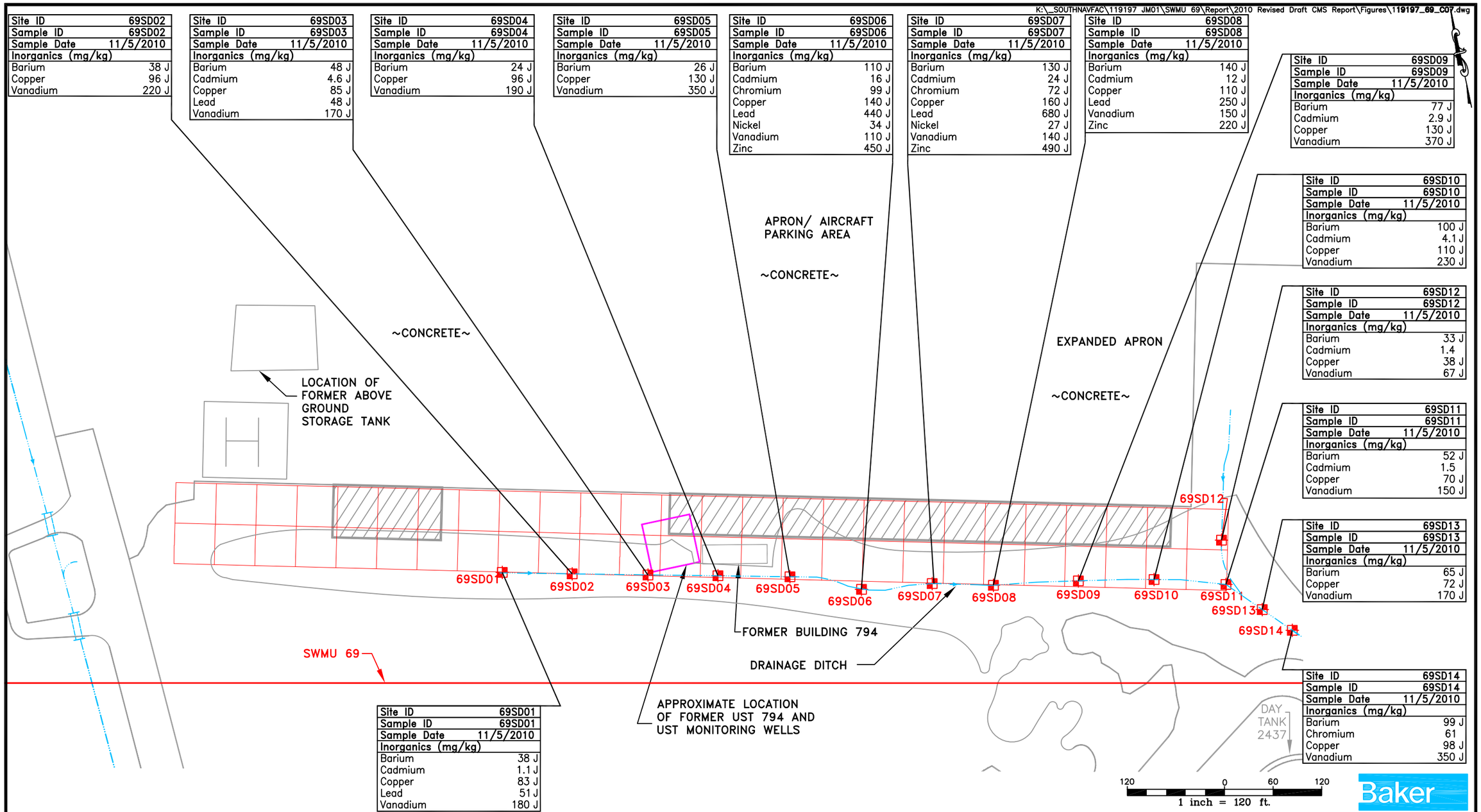

Site ID	69SD02
Sample ID	69SD02
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	38 J
Copper	96 J
Vanadium	220 J

Site ID	69SD03
Sample ID	69SD03
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	48 J
Cadmium	4.6 J
Copper	85 J
Lead	48 J
Vanadium	170 J

Site ID	69SD04
Sample ID	69SD04
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	24 J
Copper	96 J
Vanadium	190 J

Site ID	69SD05
Sample ID	69SD05
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	26 J
Copper	130 J
Vanadium	350 J

Site ID	69SD06
Sample ID	69SD06
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	110 J
Cadmium	16 J
Chromium	99 J
Copper	140 J
Lead	440 J
Nickel	34 J
Vanadium	110 J
Zinc	450 J

Site ID	69SD07
Sample ID	69SD07
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	130 J
Cadmium	24 J
Chromium	72 J
Copper	160 J
Lead	680 J
Nickel	27 J
Vanadium	140 J
Zinc	490 J

Site ID	69SD08
Sample ID	69SD08
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	140 J
Cadmium	12 J
Copper	110 J
Lead	250 J
Vanadium	150 J
Zinc	220 J

Site ID	69SD09
Sample ID	69SD09
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	77 J
Cadmium	2.9 J
Copper	130 J
Vanadium	370 J

Site ID	69SD10
Sample ID	69SD10
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	100 J
Cadmium	4.1 J
Copper	110 J
Vanadium	230 J

Site ID	69SD12
Sample ID	69SD12
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	33 J
Cadmium	1.4
Copper	38 J
Vanadium	67 J

Site ID	69SD11
Sample ID	69SD11
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	52 J
Cadmium	1.5
Copper	70 J
Vanadium	150 J

Site ID	69SD13
Sample ID	69SD13
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	65 J
Copper	72 J
Vanadium	170 J

Site ID	69SD14
Sample ID	69SD14
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	99 J
Chromium	61
Copper	98 J
Vanadium	350 J

Site ID	69SD01
Sample ID	69SD01
Sample Date	11/5/2010
Inorganics (mg/kg)	
Barium	38 J
Cadmium	1.1 J
Copper	83 J
Lead	51 J
Vanadium	180 J

SEDIMENT SCREENING VALUE	
Inorganics (mg/kg)	
Barium	20
Cadmium	1.0
Chromium	43.4
Copper	31.6
Lead	35.8
Nickel	22.7
Vanadium	57
Zinc	121

LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 7–14
DETECTED CONCENTRATIONS IN SEDIMENT EXCEEDING SEDIMENT SCREENING VALUES (2010)
SWMU 69–AIRCRAFT PARKING AREA

CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

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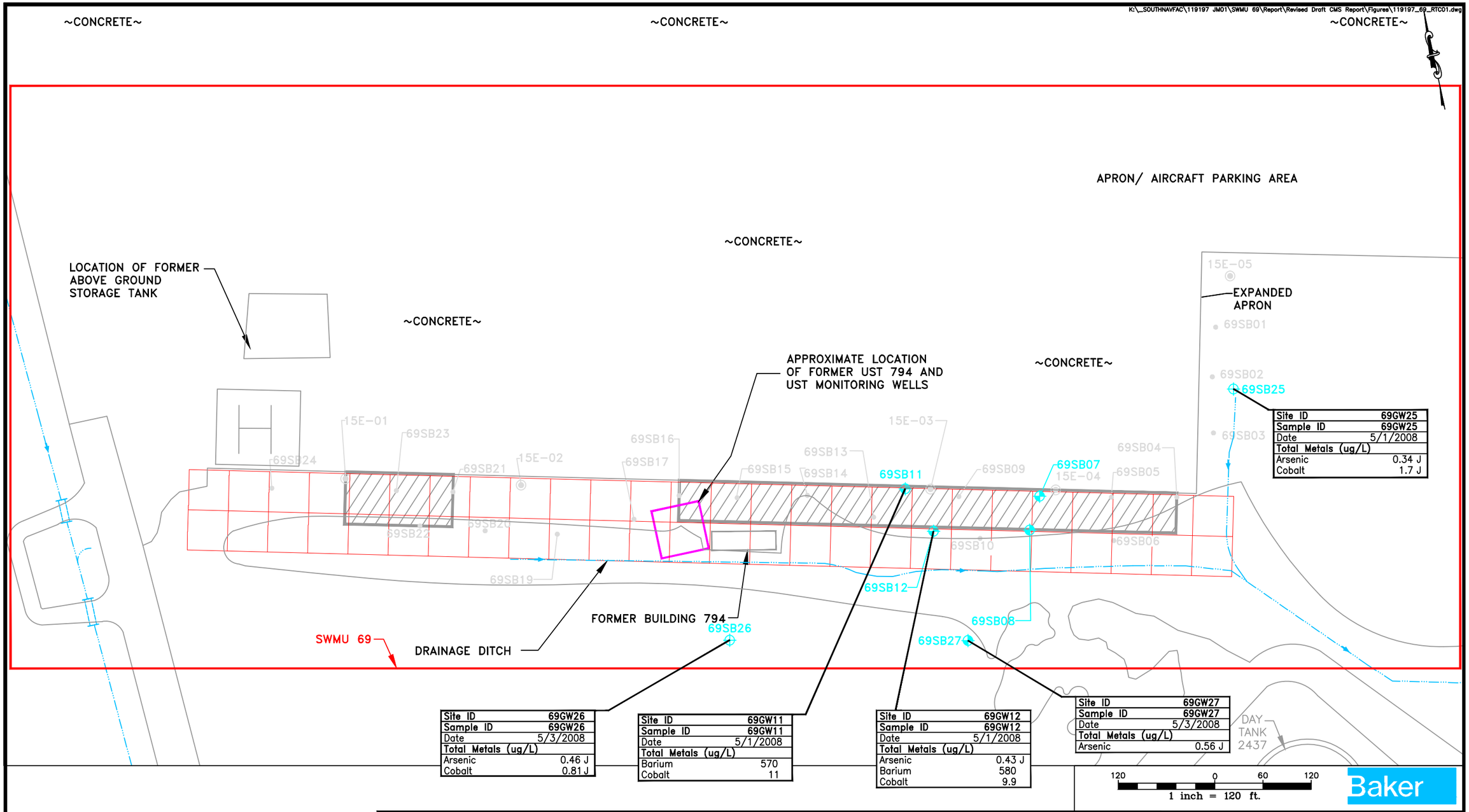


Site ID	69GW25
Sample ID	69GW25
Date	5/1/2008
Total Metals (ug/L)	
Arsenic	0.34 J
Cobalt	1.7 J

Site ID	69GW26
Sample ID	69GW26
Date	5/3/2008
Total Metals (ug/L)	
Arsenic	0.46 J
Cobalt	0.81 J

Site ID	69GW11
Sample ID	69GW11
Date	5/1/2008
Total Metals (ug/L)	
Barium	570
Cobalt	11

Site ID	69GW12
Sample ID	69GW12
Date	5/1/2008
Total Metals (ug/L)	
Arsenic	0.43 J
Barium	580
Cobalt	9.9

Site ID	69GW27
Sample ID	69GW27
Date	5/3/2008
Total Metals (ug/L)	
Arsenic	0.56 J

TAPWATER REGIONAL SCREENING LEVELS	
Total Metals (ug/L)	
Arsenic	0.045
Barium	290
Cobalt	0.47

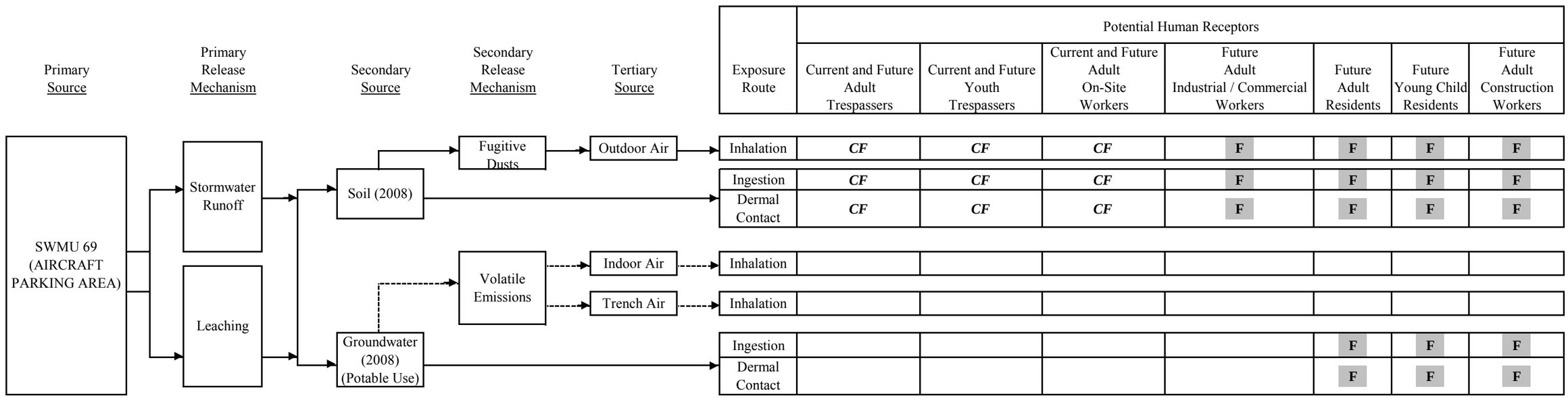
LEGEND

- SWMU BOUNDARY
- CURRENT DRAINAGE DITCH
- CURRENT DRAINAGE CULVERT
- STORMWATER FLOW DIRECTION (TYPICAL)
- PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- MONITORING WELL LOCATION (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)

FIGURE 8-1
DETECTED CONCENTRATIONS IN GROUNDWATER EXCEEDING TAPWATER REGIONAL SCREENING LEVELS (2008)
SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

FIGURE 8-2

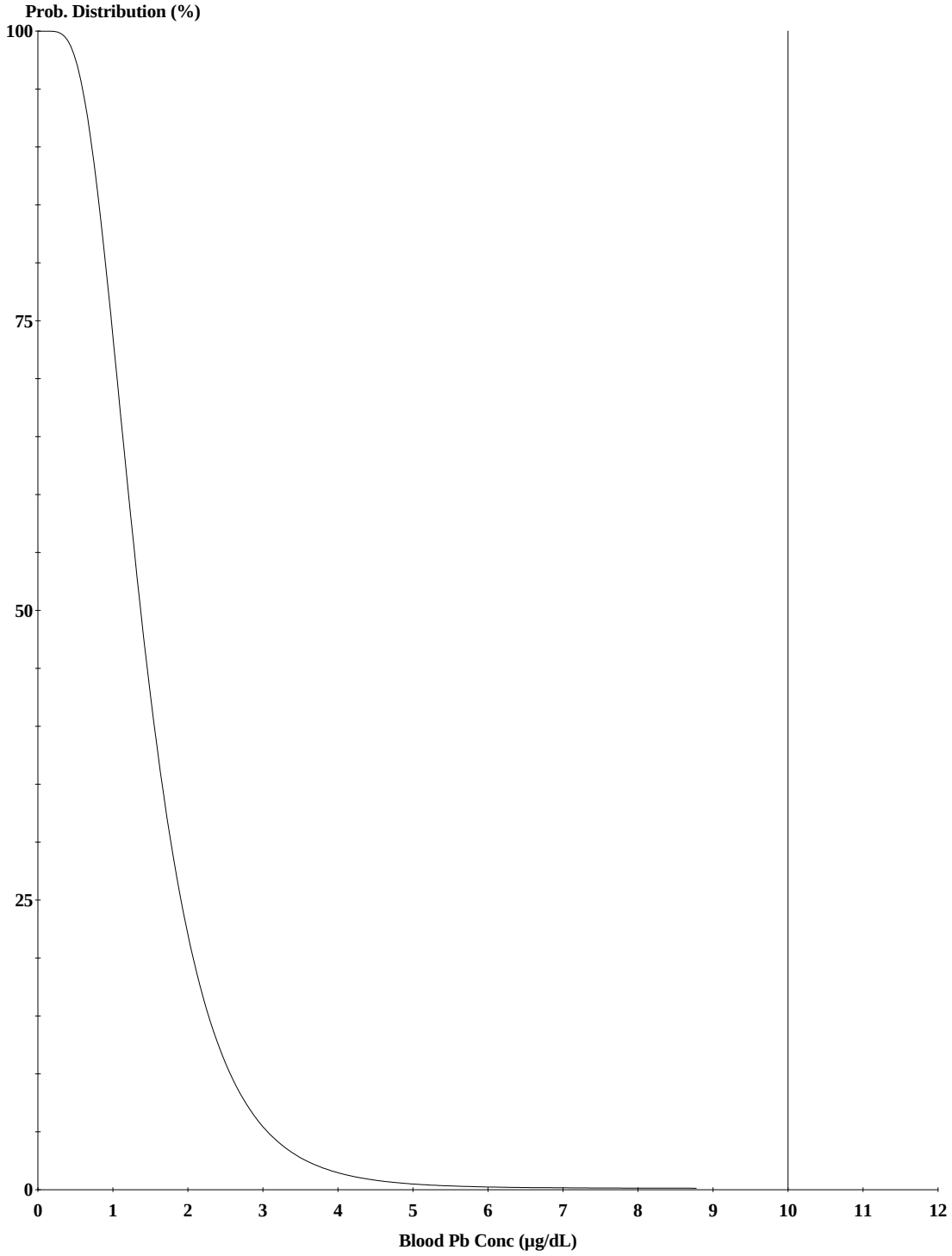
CONCEPTUAL SITE MODEL (2008)
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Legend

F	Future Exposure Pathway	⟶	Complete Exposure Pathway
CF	Current and Future Exposure Pathway	- · - · →	Incomplete Exposure Pathway

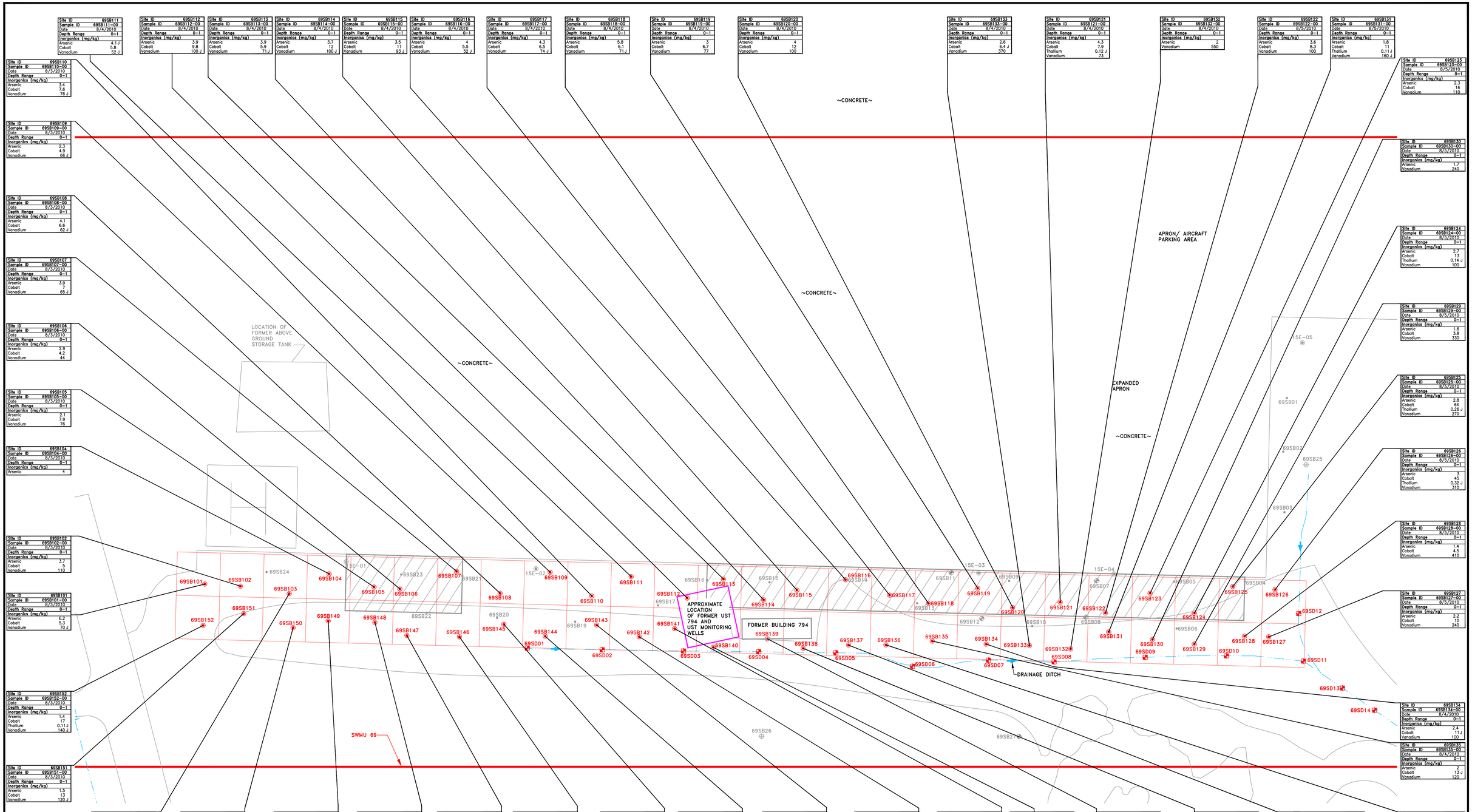
FIGURE 8-3
PROBABILITY DENSITY FUNCTION
BLOOD LEAD CONCENTRATIONS, 2008 SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Cutoff = 10.000 µg/dl
Geo Mean = 1.436
GSD = 1.600
% Above = 0.002

Age Range = User Designated: Ages 12 - 72 months

Run Mode = Research



Site ID	Sample ID	Date	Depth Range	Inorganics (mg/kg)
69SB111	69SB111-00	8/4/2010	0-1	Arsenic 4.1 J; Cobalt 5.8; Vanadium 52 J
69SB112	69SB112-00	8/4/2010	0-1	Arsenic 3.9; Cobalt 9.8; Vanadium 100 J
69SB113	69SB113-00	8/4/2010	0-1	Arsenic 3.9; Cobalt 5.9; Vanadium 71 J
69SB114	69SB114-00	8/4/2010	0-1	Arsenic 3.7; Cobalt 12; Vanadium 100 J
69SB115	69SB115-00	8/4/2010	0-1	Arsenic 3.5; Cobalt 11; Vanadium 93 J
69SB116	69SB116-00	8/4/2010	0-1	Arsenic 4; Cobalt 5.5; Vanadium 52 J
69SB117	69SB117-00	8/4/2010	0-1	Arsenic 4.3; Cobalt 6.5; Vanadium 74 J
69SB118	69SB118-00	8/4/2010	0-1	Arsenic 5.8; Cobalt 6.1; Vanadium 71 J
69SB119	69SB119-00	8/4/2010	0-1	Arsenic 3; Cobalt 6.7; Vanadium 77
69SB120	69SB120-00	8/4/2010	0-1	Arsenic 4; Cobalt 12; Vanadium 100
69SB133	69SB133-00	8/4/2010	0-1	Arsenic 2.6; Cobalt 6.4 J; Vanadium 370
69SB121	69SB121-00	8/4/2010	0-1	Arsenic 4.3; Cobalt 7.9; Thallium 0.12 J; Vanadium 73
69SB132	69SB132-00	8/4/2010	0-1	Arsenic 2; Vanadium 550
69SB122	69SB122-00	8/5/2010	0-1	Arsenic 3.6; Cobalt 8.3; Vanadium 100
69SB131	69SB131-00	8/5/2010	0-1	Arsenic 1.8; Cobalt 11; Thallium 0.11 J; Vanadium 160 J
69SB123	69SB123-00	8/5/2010	0-1	Arsenic 2.3; Cobalt 16; Vanadium 110
69SB130	69SB130-00	8/5/2010	0-1	Arsenic 1.7; Vanadium 240
69SB124	69SB124-00	8/5/2010	0-1	Arsenic 2.7; Cobalt 13; Thallium 0.14 J; Vanadium 100
69SB129	69SB129-00	8/5/2010	0-1	Arsenic 1.6; Cobalt 3.8; Vanadium 330
69SB125	69SB125-00	8/5/2010	0-1	Arsenic 2.8; Cobalt 64; Thallium 0.26 J; Vanadium 270
69SB126	69SB126-00	8/5/2010	0-1	Arsenic 3; Cobalt 45; Thallium 0.32 J; Vanadium 310
69SB128	69SB128-00	8/5/2010	0-1	Arsenic 1.4; Cobalt 4.5; Vanadium 410
69SB127	69SB127-00	8/5/2010	0-1	Arsenic 2.2; Cobalt 10; Vanadium 240
69SB134	69SB134-00	8/4/2010	0-1	Arsenic 2.4; Cobalt 11 J; Vanadium 100
69SB135	69SB135-00	8/4/2010	0-1	Arsenic 3; Cobalt 13 J; Vanadium 120
69SB136	69SB136-00	8/4/2010	0-1	Arsenic 1; Cobalt 17 J; Thallium 0.099 J; Vanadium 160
69SB137	69SB137-00	8/4/2010	0-1	Arsenic 0.93; Cobalt 11 J; Vanadium 190
69SB138	69SB138-00	8/4/2010	0-1	Arsenic 1.3; Cobalt 19; Thallium 0.15 J; Vanadium 210 J
69SB139	69SB139-00	8/4/2010	0-1	Arsenic 5.1
69SB140	69SB140-00	8/4/2010	0-1	Arsenic 1.2; Cobalt 8; Vanadium 210 J
69SB141	69SB141-00	8/4/2010	0-1	Arsenic 4.7; Cobalt 1.3 J; Vanadium 94 J
69SB142	69SB142-00	8/4/2010	0-1	Arsenic 2.6; Cobalt 12; Thallium 0.083 J; Vanadium 210 J
69SB143	69SB143-00	8/3/2010	0-1	Arsenic 1.8; Cobalt 4.5; Thallium 0.13 J; Vanadium 180 J
69SB144	69SB144-00	8/3/2010	0-1	Arsenic 2.1; Cobalt 14; Thallium 0.13 J; Vanadium 150
69SB145	69SB145-00	8/3/2010	0-1	Arsenic 1.8; Cobalt 14; Vanadium 120
69SB146	69SB146-00	8/3/2010	0-1	Arsenic 0.89; Cobalt 3.2; Vanadium 150
69SB147	69SB147-00	8/3/2010	0-1	Arsenic 0.96; Cobalt 310
69SB148	69SB148-00	8/3/2010	0-1	Arsenic 1.3; Cobalt 3.7; Thallium 0.079 J; Vanadium 160
69SB149	69SB149-00	8/3/2010	0-1	Arsenic 0.65; Cobalt 70
69SB150	69SB150-00	8/3/2010	0-1	Arsenic 0.86; Cobalt 15; Thallium 0.083 J; Vanadium 160 J
69SB103	69SB103-00	8/3/2010	0-1	Arsenic 2.6; Cobalt 4.1; Vanadium 75
69SB110	69SB110-00	8/3/2010	0-1	Arsenic 3.4; Cobalt 7.6; Vanadium 76 J
69SB109	69SB109-00	8/3/2010	0-1	Arsenic 2.3; Cobalt 4.9; Vanadium 66 J
69SB108	69SB108-00	8/3/2010	0-1	Arsenic 4.1; Cobalt 6.6; Vanadium 62 J
69SB107	69SB107-00	8/3/2010	0-1	Arsenic 3.9; Cobalt 7; Vanadium 65 J
69SB106	69SB106-00	8/3/2010	0-1	Arsenic 2.9; Cobalt 4.2; Vanadium 44
69SB105	69SB105-00	8/3/2010	0-1	Arsenic 2.1; Cobalt 7.9; Vanadium 76
69SB104	69SB104-00	8/3/2010	0-1	Arsenic 4
69SB102	69SB102-00	8/3/2010	0-1	Arsenic 3.7; Cobalt 5; Vanadium 110
69SB101	69SB101-00	8/3/2010	0-1	Arsenic 6.2; Cobalt 5.5; Vanadium 70 J
69SB152	69SB152-00	8/3/2010	0-1	Arsenic 1.4; Cobalt 17; Thallium 0.11 J; Vanadium 140 J
69SB151	69SB151-00	8/3/2010	0-1	Arsenic 1.5; Cobalt 13; Vanadium 120 J

RESIDENTIAL SOIL REGIONAL SCREENING LEVELS	
Inorganics (mg/kg)	
Arsenic	0.39
Cobalt	2.3
Thallium	0.078
Vanadium	0.55

LEGEND

- SWMU BOUNDARY
- CURRENT DRAINAGE DITCH
- STORMWATER FLOW DIRECTION (TYPICAL)
- PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- MONITORING WELL LOCATION (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- SEDIMENT SAMPLE LOCATION (CMS 2010)

DRAWN	RRR
REVIEWED	HG
S.O.#	119197
CADD#	119197_69_RTC03

NORTH

SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

MICHAEL BAKER Jr., Inc.
Moon Township, Pennsylvania

Baker

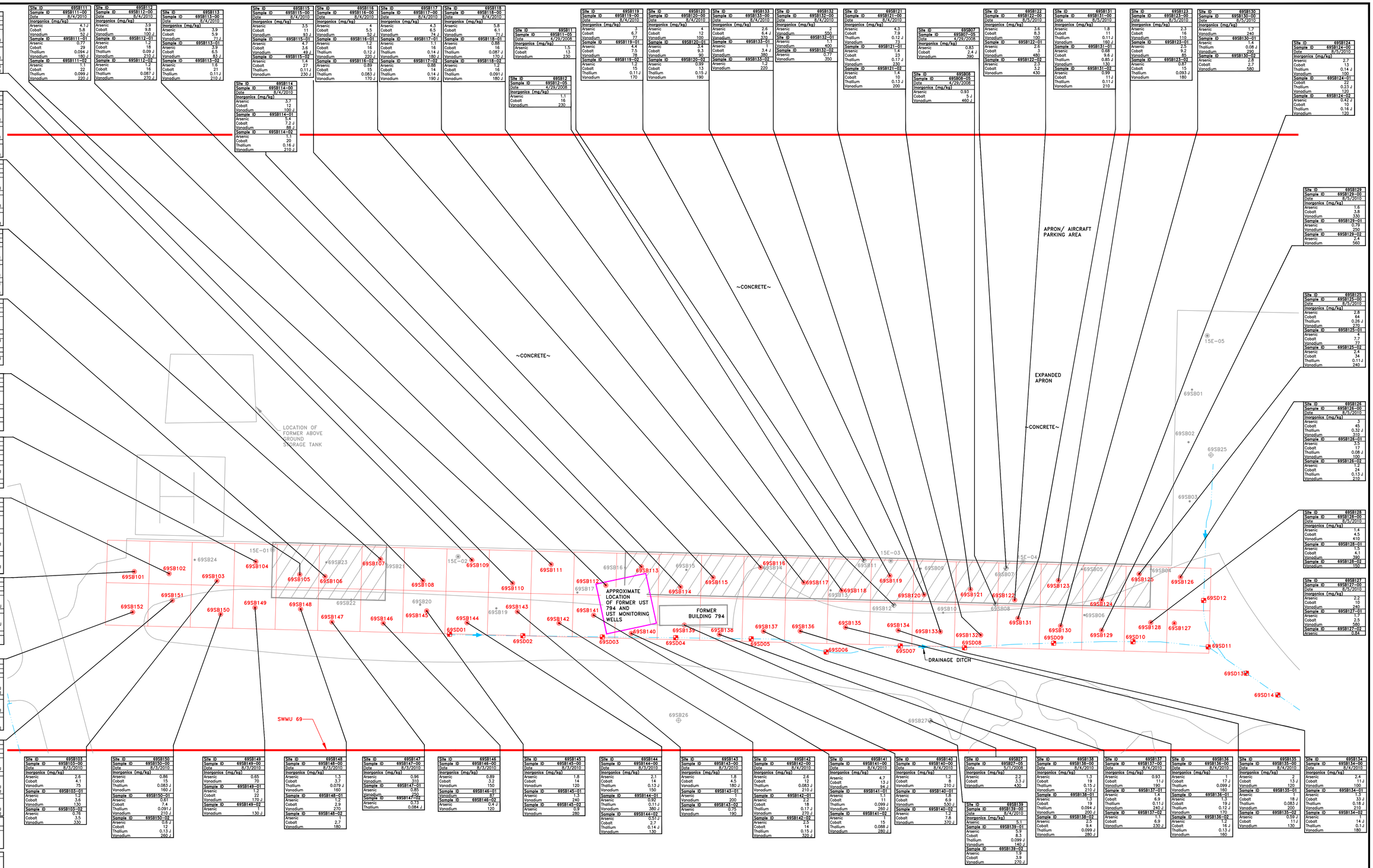
DETECTED CONCENTRATIONS IN SURFACE SOIL EXCEEDING RESIDENTIAL SOIL REGIONAL SCREENING LEVELS (2010)

SCALE 1"=50'

DATE MARCH 2012

FIGURE NO.

8-4



Site ID	69SB110
Sample ID	69SB110-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	3.4
Cobalt	7.6
Vanadium	76 J
Sample ID	69SB110-01
Arsenic	1.2
Cobalt	3.3
Vanadium	180 J
Sample ID	69SB110-02
Arsenic	0.45 J
Vanadium	110 J

Site ID	69SB111
Sample ID	69SB111-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	4.1 J
Cobalt	5.8
Vanadium	52 J
Sample ID	69SB111-01
Arsenic	0.77
Cobalt	29
Thallium	0.094 J
Vanadium	180 J
Sample ID	69SB111-02
Arsenic	1.1
Cobalt	22
Thallium	0.099 J
Vanadium	220 J

Site ID	69SB112
Sample ID	69SB112-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	3.9
Cobalt	9.8
Vanadium	120 J
Sample ID	69SB112-01
Arsenic	1.2
Cobalt	18
Thallium	0.09 J
Vanadium	210 J
Sample ID	69SB112-02
Arsenic	1.2
Cobalt	16
Thallium	0.087 J
Vanadium	270 J

Site ID	69SB113
Sample ID	69SB113-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	3.9
Cobalt	5.9
Vanadium	71 J
Sample ID	69SB113-01
Arsenic	3.9
Cobalt	6.5
Vanadium	83 J
Sample ID	69SB113-02
Arsenic	1.6
Cobalt	21
Thallium	0.11 J
Vanadium	210 J

Site ID	69SB114
Sample ID	69SB114-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	3.7
Cobalt	12
Vanadium	100 J
Sample ID	69SB114-01
Arsenic	5.4
Cobalt	7.2 J
Vanadium	88 J
Sample ID	69SB114-02
Arsenic	1.1
Cobalt	20
Thallium	0.16 J
Vanadium	210 J

Site ID	69SB115
Sample ID	69SB115-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	3.5
Cobalt	11
Vanadium	93 J
Sample ID	69SB115-01
Arsenic	4.7
Cobalt	3.6
Vanadium	49 J
Sample ID	69SB115-02
Arsenic	1.4
Cobalt	27
Thallium	0.11 J
Vanadium	230 J

Site ID	69SB116
Sample ID	69SB116-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	4
Cobalt	5.5
Vanadium	52 J
Sample ID	69SB116-01
Arsenic	1.2
Cobalt	16
Thallium	0.12 J
Vanadium	220 J
Sample ID	69SB116-02
Arsenic	0.89
Cobalt	15
Thallium	0.083 J
Vanadium	170 J

Site ID	69SB117
Sample ID	69SB117-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	4.3
Cobalt	6.5
Vanadium	74 J
Sample ID	69SB117-01
Arsenic	1.1
Cobalt	16
Thallium	0.14 J
Vanadium	180 J
Sample ID	69SB117-02
Arsenic	0.88
Cobalt	14
Thallium	0.14 J
Vanadium	190 J

Site ID	69SB118
Sample ID	69SB118-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	5.8
Cobalt	6.1
Vanadium	71 J
Sample ID	69SB118-01
Arsenic	0.88
Cobalt	16
Thallium	0.087 J
Vanadium	170 J
Sample ID	69SB118-02
Arsenic	1.2
Cobalt	16
Thallium	0.091 J
Vanadium	180 J

Site ID	69SB119
Sample ID	69SB119-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	3
Cobalt	6.7
Vanadium	77
Sample ID	69SB119-01
Arsenic	4.4
Cobalt	7.5
Vanadium	79
Sample ID	69SB119-02
Arsenic	1.2
Cobalt	15
Thallium	0.11 J
Vanadium	170

Site ID	69SB120
Sample ID	69SB120-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	4
Cobalt	12
Vanadium	100
Sample ID	69SB120-01
Arsenic	2.4
Cobalt	9.3
Vanadium	90
Sample ID	69SB120-02
Arsenic	0.99
Cobalt	13
Thallium	0.15 J
Vanadium	190

Site ID	69SB133
Sample ID	69SB133-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	2.6
Cobalt	6.4 J
Vanadium	370
Sample ID	69SB133-01
Arsenic	1
Cobalt	3.4 J
Vanadium	180
Sample ID	69SB133-02
Arsenic	1.2
Vanadium	220

Site ID	69SB132
Sample ID	69SB132-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	2
Vanadium	550
Sample ID	69SB132-01
Arsenic	1.1
Vanadium	400
Sample ID	69SB132-02
Arsenic	0.77
Vanadium	350

Site ID	69SB121
Sample ID	69SB121-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	4.3
Cobalt	7.9
Thallium	0.12 J
Vanadium	73
Sample ID	69SB121-01
Arsenic	1.4
Cobalt	23
Thallium	0.17 J
Vanadium	230
Sample ID	69SB121-02
Arsenic	1.4
Cobalt	10
Thallium	0.13 J
Vanadium	200

Site ID	69SB122
Sample ID	69SB122-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	3.6
Cobalt	8.3
Vanadium	100
Sample ID	69SB122-01
Arsenic	2.6
Cobalt	9
Vanadium	480
Sample ID	69SB122-02
Arsenic	2.3
Cobalt	3.2
Vanadium	430

Site ID	69SB131
Sample ID	69SB131-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	1.8
Cobalt	11
Thallium	0.11 J
Vanadium	160 J
Sample ID	69SB131-01
Arsenic	0.68
Cobalt	9.6 J
Thallium	0.85 J
Vanadium	130
Sample ID	69SB131-02
Arsenic	0.99
Cobalt	11 J
Thallium	0.11 J
Vanadium	210

Site ID	69SB123
Sample ID	69SB123-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	2.3
Cobalt	16
Vanadium	110
Sample ID	69SB123-01
Arsenic	2.3
Cobalt	9.2
Vanadium	85
Sample ID	69SB123-02
Arsenic	0.87
Cobalt	15
Thallium	0.093 J
Vanadium	180

Site ID	69SB130
Sample ID	69SB130-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	1.7
Vanadium	240
Sample ID	69SB130-01
Arsenic	1.4
Thallium	0.08 J
Vanadium	240
Sample ID	69SB130-02
Arsenic	2.8
Cobalt	2.7
Vanadium	580

Site ID	69SB124
Sample ID	69SB124-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	2.7
Cobalt	13
Thallium	0.14 J
Vanadium	100
Sample ID	69SB124-01
Cobalt	22
Thallium	0.23 J
Vanadium	120
Sample ID	69SB124-02
Arsenic	0.42 J
Cobalt	10
Thallium	0.16 J
Vanadium	120

Site ID	69SB129
Sample ID	69SB129-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	1.6
Cobalt	3.8
Vanadium	330
Sample ID	69SB129-01
Arsenic	0.79
Vanadium	250
Sample ID	69SB129-02
Arsenic	2.4
Vanadium	560

Site ID	69SB125
Sample ID	69SB125-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	2.8
Cobalt	64
Thallium	0.26 J
Vanadium	270
Sample ID	69SB125-01
Arsenic	2
Cobalt	7.7
Vanadium	7
Sample ID	69SB125-02
Arsenic	2.4
Cobalt	34
Thallium	0.11 J
Vanadium	240

Site ID	69SB126
Sample ID	69SB126-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	3
Cobalt	45
Thallium	0.32 J
Vanadium	310
Sample ID	69SB126-01
Arsenic	3.5
Cobalt	17
Thallium	0.08 J
Vanadium	100
Sample ID	69SB126-02
Arsenic	1.3
Cobalt	24
Thallium	0.13 J
Vanadium	210

Site ID	69SB128
Sample ID	69SB128-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	1.4
Cobalt	4.5
Vanadium	410
Sample ID	69SB128-01
Arsenic	1.3
Cobalt	4.1
Vanadium	360
Sample ID	69SB128-02
Vanadium	150

Site ID	69SB127
Sample ID	69SB127-00
Date	8/5/2010
Inorganics (mg/kg)	
Arsenic	2.3
Cobalt	7.6
Vanadium	240
Sample ID	69SB127-01
Arsenic	1.7
Cobalt	2.5
Vanadium	580
Sample ID	69SB127-02
Arsenic	0.84

Site ID	69SB109
Sample ID	69SB109-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	2.3
Cobalt	4.9
Vanadium	66 J
Sample ID	69SB109-01
Arsenic	0.99
Cobalt	6.6
Vanadium	200 J
Sample ID	69SB109-02
Arsenic	0.95
Cobalt	6.1
Vanadium	220 J

Site ID	69SB108
Sample ID	69SB108-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	4.1
Cobalt	6.6
Vanadium	60 J
Sample ID	69SB108-01
Arsenic	4
Cobalt	5.4
Vanadium	51 J
Sample ID	69SB108-02
Arsenic	3.4
Cobalt	5.2
Vanadium	110 J

Site ID	69SB107
Sample ID	69SB107-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	3.9
Cobalt	7
Vanadium	65 J
Sample ID	69SB107-01
Arsenic	4.1
Cobalt	7.3
Vanadium	65 J
Sample ID	69SB107-02
Arsenic	4.3 J
Cobalt	4.1
Vanadium	150 J

Site ID	69SB106
Sample ID	69SB106-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	2.9
Cobalt	4.2
Vanadium	44
Sample ID	69SB106-01
Inorganics (mg/kg)	
Arsenic	0.45 J
Vanadium	240
Sample ID	69SB106-02
Inorganics (mg/kg)	
Arsenic	0.41 J
Vanadium	48

Site ID	69SB105
Sample ID	69SB105-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	2.1
Cobalt	7.9
Vanadium	76
Sample ID	69SB105-01
Arsenic	1
Vanadium	300
Sample ID	69SB105-02
Arsenic	0.72
Vanadium	130

Site ID	69SB104
Sample ID	69SB104-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	4
Sample ID	69SB104-01
Arsenic	0.7
Cobalt	4.5 J
Vanadium	290
Sample ID	69SB104-02
Vanadium	140

Site ID	69SB102
Sample ID	69SB102-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	3.7
Cobalt	5
Vanadium	110
Sample ID	69SB102-01
Arsenic	1.5
Cobalt	3.7
Thallium	0.13 J
Vanadium	220
Sample ID	69SB102-02
Arsenic	0.84
Cobalt	4.2
Thallium	0.097 J
Vanadium	120

Site ID	69SB101
Sample ID	69SB101-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	6.3
Cobalt	5.3
Vanadium	70 J
Sample ID	69SB101-01
Arsenic	1.6
Cobalt	4.1
Thallium	0.11 J
Vanadium	270
Sample ID	69SB101-02
Arsenic	0.79
Vanadium	170

Site ID	69SB152
Sample ID	69SB152-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	1.4
Arsenic	1.4
Thallium	0.11 J
Vanadium	140 J
Sample ID	69SB152-01
Arsenic	0.79
Cobalt	5.5
Vanadium	200 J
Sample ID	69SB152-02
Arsenic	0.97
Cobalt	6.2
Vanadium	310 J

Site ID	69SB151
Sample ID	69SB151-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	1.5
Cobalt	13
Vanadium	120 J
Sample ID	69SB151-01
Arsenic	0.89
Cobalt	8
Thallium	0.15 J
Vanadium	170 J
Sample ID	69SB151-02
Arsenic	1.1
Cobalt	5.5
Thallium	0.1 J
Vanadium	220

RESIDENTIAL SOIL REGIONAL SCREENING LEVELS	
Inorganics (mg/kg)	
Arsenic	0.39
Cobalt	2.3
Thallium	0.078
Vanadium	39

SAMPLE ID	DEPTH CHART
69SB103-00	0-1
69SB103-01	1.0-2.0
69SB103-02	2.0-3.0
69SB27-05	9.0-11.0

Site ID	69SB103
Sample ID	69SB103-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	2.6
Cobalt	4.1
Vanadium	75
Sample ID	69SB103-01
Arsenic	1.2
Cobalt	3.6
Vanadium	130
Sample ID	69SB103-02
Arsenic	0.76
Cobalt	3.5
Vanadium	330

Site ID	69SB150
Sample ID	69SB150-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	0.86
Cobalt	15
Thallium	0.083 J
Vanadium	160 J
Sample ID	69SB150-01
Arsenic	0.61
Cobalt	7.4
Thallium	0.091 J
Vanadium	210 J
Sample ID	69SB150-02
Arsenic	0.6 J
Cobalt	12
Thallium	0.13 J
Vanadium	260 J

Site ID	69SB149
Sample ID	69SB149-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	0.65
Vanadium	70
Sample ID	69SB149-01
Arsenic	1.2
Cobalt	22
Vanadium	170 J
Sample ID	69SB149-02
Arsenic	1
Vanadium	130 J

Site ID	69SB148
Sample ID	69SB148-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	1.3
Cobalt	3.7
Thallium	0.079 J
Vanadium	160
Sample ID	69SB148-01
Arsenic	1.2
Cobalt	2.9
Vanadium	270
Sample ID	69SB148-02
Arsenic	1
Cobalt	2.7
Vanadium	180

Site ID	69SB147
Sample ID	69SB147-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	0.96
Vanadium	310
Sample ID	69SB147-01
Arsenic	0.85
Vanadium	250
Sample ID	69SB147-02
Arsenic	0.73
Thallium	0.084 J

Site ID	69SB146
Sample ID	69SB146-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	0.89
Cobalt	3.2
Vanadium	150
Sample ID	69SB146-01
Vanadium	87
Sample ID	69SB146-02
Arsenic	0.4 J
Vanadium	120

Site ID	69SB145
Sample ID	69SB145-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	1.8
Cobalt	14
Vanadium	120
Sample ID	69SB145-01
Arsenic	1.5
Vanadium	240
Sample ID	69SB145-02
Arsenic	0.9
Vanadium	280

Site ID	69SB144
Sample ID	69SB144-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	2.1
Cobalt	14
Thallium	0.13 J
Vanadium	150
Sample ID	69SB144-01
Arsenic	0.92
Thallium	0.11 J
Vanadium	380 J
Sample ID	69SB144-02
Arsenic	0.57 J
Cobalt	2.7
Thallium	0.14 J
Vanadium	130

Site ID	69SB143
Sample ID	69SB143-00
Date	8/3/2010
Inorganics (mg/kg)	
Arsenic	1.8
Cobalt	4.5
Vanadium	180 J
Sample ID	69SB143-01
Arsenic	1
Vanadium	200
Sample ID	69SB143-02
Arsenic	0.75
Vanadium	190

Site ID	69SB142
Sample ID	69SB142-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	2.6
Cobalt	12
Thallium	0.083 J
Vanadium	210 J
Sample ID	69SB142-01
Arsenic	2.2
Cobalt	18
Thallium	0.17 J
Vanadium	270 J
Sample ID	69SB142-02
Arsenic	2.5
Cobalt	14
Thallium	0.15 J
Vanadium	320 J

Site ID	69SB141
Sample ID	69SB141-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	4.7
Cobalt	13 J
Vanadium	94 J
Sample ID	69SB141-01
Arsenic	1.1
Cobalt	11
Thallium	0.099 J
Vanadium	260 J
Sample ID	69SB141-02
Arsenic	1
Cobalt	15
Thallium	0.088 J
Vanadium	280 J

Site ID	69SB140
Sample ID	69SB140-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	1.2
Cobalt	8
Vanadium	210 J
Sample ID	69SB140-01
Arsenic	1.8
Cobalt	6.9
Vanadium	530 J
Sample ID	69SB140-02
Arsenic	1.2
Cobalt	7.8
Vanadium	370 J

Site ID	69S827
Sample ID	69S827-05
Date	5/7/2008
Inorganics (mg/kg)	
Arsenic	2.2
Cobalt	3.3 J
Vanadium	430

Site ID	69S807
Sample ID	69S807-05
Date	4/29/2008
Inorganics (mg/kg)	
Arsenic	0.83
Cobalt	2.4 J
Vanadium	390

Site ID	69SB08
Sample ID	69SB08-05
Date	4/29/2008
Inorganics (mg/kg)	
Arsenic	0.93
Cobalt	5 J
Vanadium	460 J

Site ID	69SB12
Sample ID	69SB12-05
Date	4/29/2008
Inorganics (mg/kg)	
Arsenic	1.1
Cobalt	16
Vanadium	230

Site ID	69SB139
Sample ID	69SB139-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	5.1
Cobalt	8.3
Thallium	0.099 J
Vanadium	140 J
Sample ID	69SB139-01
Arsenic	3.9
Cobalt	8.3
Thallium	0.099 J
Vanadium	140 J
Sample ID	69SB139-02
Arsenic	3.9
Cobalt	3.9
Vanadium	270 J

Site ID	69SB138
Sample ID	69SB138-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	1.3
Cobalt	19
Thallium	0.094 J
Vanadium	200 J
Sample ID	69SB138-02
Arsenic	2.5
Cobalt	9.4
Thallium	0.099 J
Vanadium	280 J

Site ID	69SB137
Sample ID	69SB137-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	0.97
Cobalt	11 J
Vanadium	190
Sample ID	69SB137-01
Arsenic	1.4
Cobalt	6.9
Thallium	0.11 J
Vanadium	240 J
Sample ID	69SB137-02
Arsenic	1.1
Cobalt	6.9
Vanadium	230 J

Site ID	69SB136
Sample ID	69SB136-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	2
Cobalt	17 J
Thallium	0.099 J
Vanadium	160
Sample ID	69SB136-01
Arsenic	1.3
Cobalt	19 J
Thallium	0.12 J
Vanadium	170
Sample ID	69SB136-02
Arsenic	1.2
Cobalt	16 J
Thallium	0.13 J
Vanadium	160

Site ID	69SB135
Sample ID	69SB135-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	2
Cobalt	13 J
Vanadium	120
Sample ID	69SB135-01
Arsenic	1
Cobalt	18 J
Thallium	0.083 J
Vanadium	200
Sample ID	69SB135-02
Arsenic	0.59 J
Cobalt	11 J
Vanadium	130

Site ID	69SB134
Sample ID	69SB134-00
Date	8/4/2010
Inorganics (mg/kg)	
Arsenic	2.4
Cobalt	11 J
Vanadium	100
Sample ID	69SB134-01
Arsenic	1.3
Cobalt	33 J
Thallium	0.18 J
Vanadium	210
Sample ID	69SB134-02
Arsenic	1
Cobalt	14 J
Thallium	0.1 J
Vanadium	180

LEGEND

- SWMU BOUNDARY
- CURRENT DRAINAGE DITCH
- STORMWATER FLOW DIRECTION (TYPICAL)
- PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- PREVIOUS SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- SURFACE SOIL SAMPLING LOCATION (CMS 2008)
- MONITORING WELL LOCATION (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE AND MONITORING WELL LOCATIONS (CMS 2008)
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- SEDIMENT SAMPLE LOCATION (CMS 2010)

DRAWN	RRR
REVIEWED	HG
S.O.#	119197
CADD#	119197_69_RTC04.dwg

NORTH

SWMU 69-AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

MICHAEL BAKER Jr., Inc.
Moon Township, Pennsylvania

Baker

DETECTED CONCENTRATIONS IN TOTAL SOIL EXCEEDING RESIDENTIAL SOIL REGIONAL SCREENING LEVELS (2010)

SCALE 1"=50'

DATE MARCH 2012

FIGURE NO.

8-5

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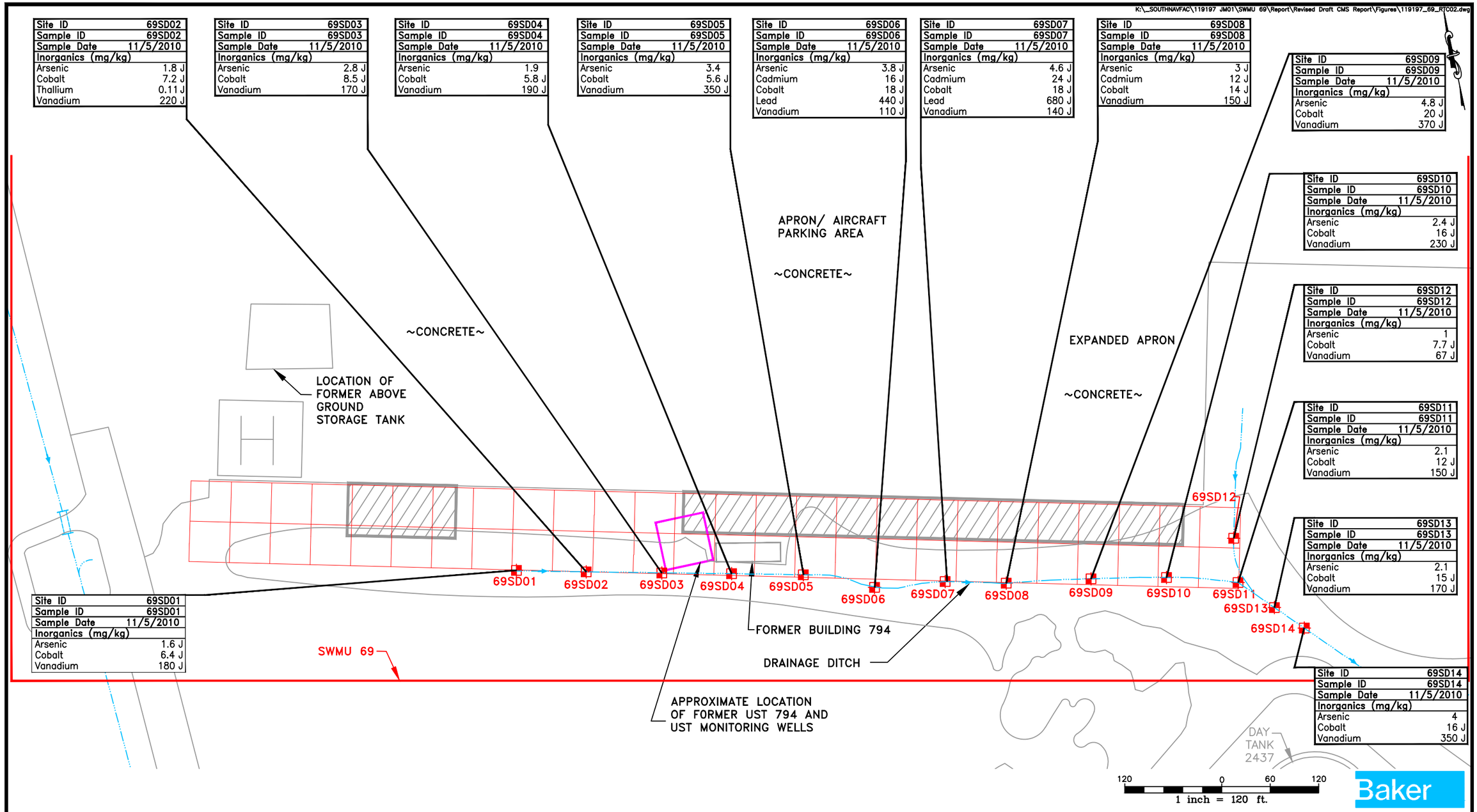


Site ID	69SD02
Sample ID	69SD02
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	1.8 J
Cobalt	7.2 J
Thallium	0.11 J
Vanadium	220 J

Site ID	69SD03
Sample ID	69SD03
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	2.8 J
Cobalt	8.5 J
Vanadium	170 J

Site ID	69SD04
Sample ID	69SD04
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	1.9
Cobalt	5.8 J
Vanadium	190 J

Site ID	69SD05
Sample ID	69SD05
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	3.4
Cobalt	5.6 J
Vanadium	350 J

Site ID	69SD06
Sample ID	69SD06
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	3.8 J
Cadmium	16 J
Cobalt	18 J
Lead	440 J
Vanadium	110 J

Site ID	69SD07
Sample ID	69SD07
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	4.6 J
Cadmium	24 J
Cobalt	18 J
Lead	680 J
Vanadium	140 J

Site ID	69SD08
Sample ID	69SD08
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	3 J
Cadmium	12 J
Cobalt	14 J
Vanadium	150 J

Site ID	69SD09
Sample ID	69SD09
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	4.8 J
Cobalt	20 J
Vanadium	370 J

Site ID	69SD10
Sample ID	69SD10
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	2.4 J
Cobalt	16 J
Vanadium	230 J

Site ID	69SD12
Sample ID	69SD12
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	1
Cobalt	7.7 J
Vanadium	67 J

Site ID	69SD11
Sample ID	69SD11
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	2.1
Cobalt	12 J
Vanadium	150 J

Site ID	69SD13
Sample ID	69SD13
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	2.1
Cobalt	15 J
Vanadium	170 J

Site ID	69SD01
Sample ID	69SD01
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	1.6 J
Cobalt	6.4 J
Vanadium	180 J

Site ID	69SD14
Sample ID	69SD14
Sample Date	11/5/2010
Inorganics (mg/kg)	
Arsenic	4
Cobalt	16 J
Vanadium	350 J

RESIDENTIAL SOIL REGIONAL SCREENING LEVELS	
Inorganics (mg/kg)	
Arsenic	0.39
Cadmium	7
Cobalt	2.3
Lead	400
Thallium	0.078
Vanadium	39

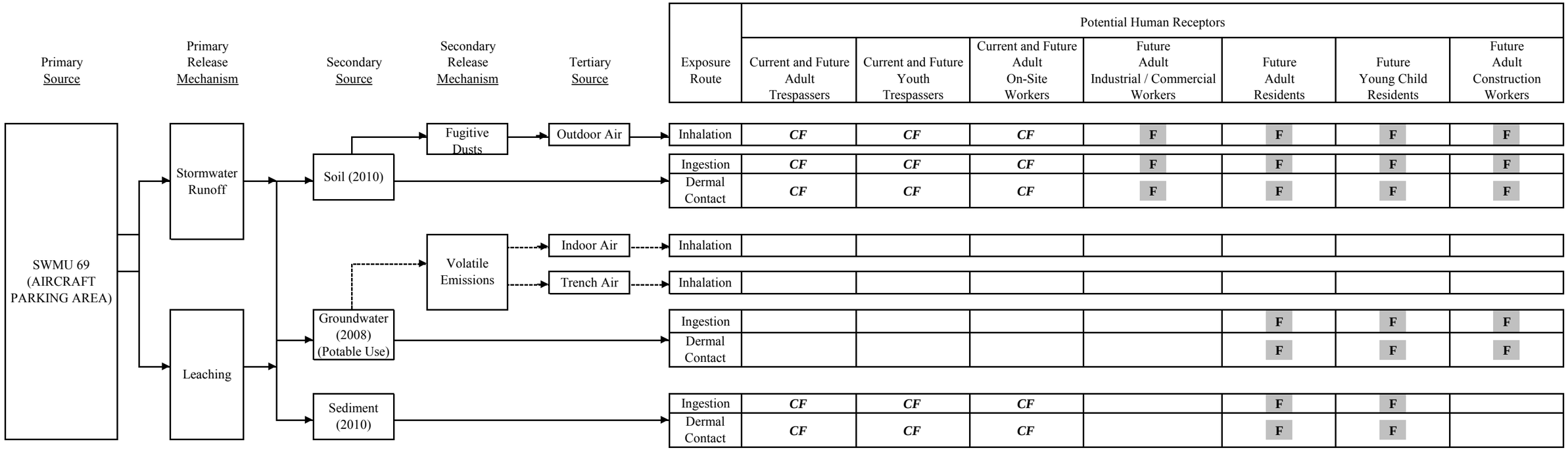
LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –PROPOSED SOIL SAMPLING GRID CELL (50' X 50')
- –SURFACE SOIL AREA PROPOSED FOR EXCAVATION IN CMS PRIOR TO SITE DISTURBANCE
- –SEDIMENT SAMPLE LOCATION (CMS 2010)

FIGURE 8–6
DETECTED CONCENTRATIONS IN SEDIMENT EXCEEDING RESIDENTIAL SOIL REGIONAL SCREENING LEVELS (2010)
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

FIGURE 8-7

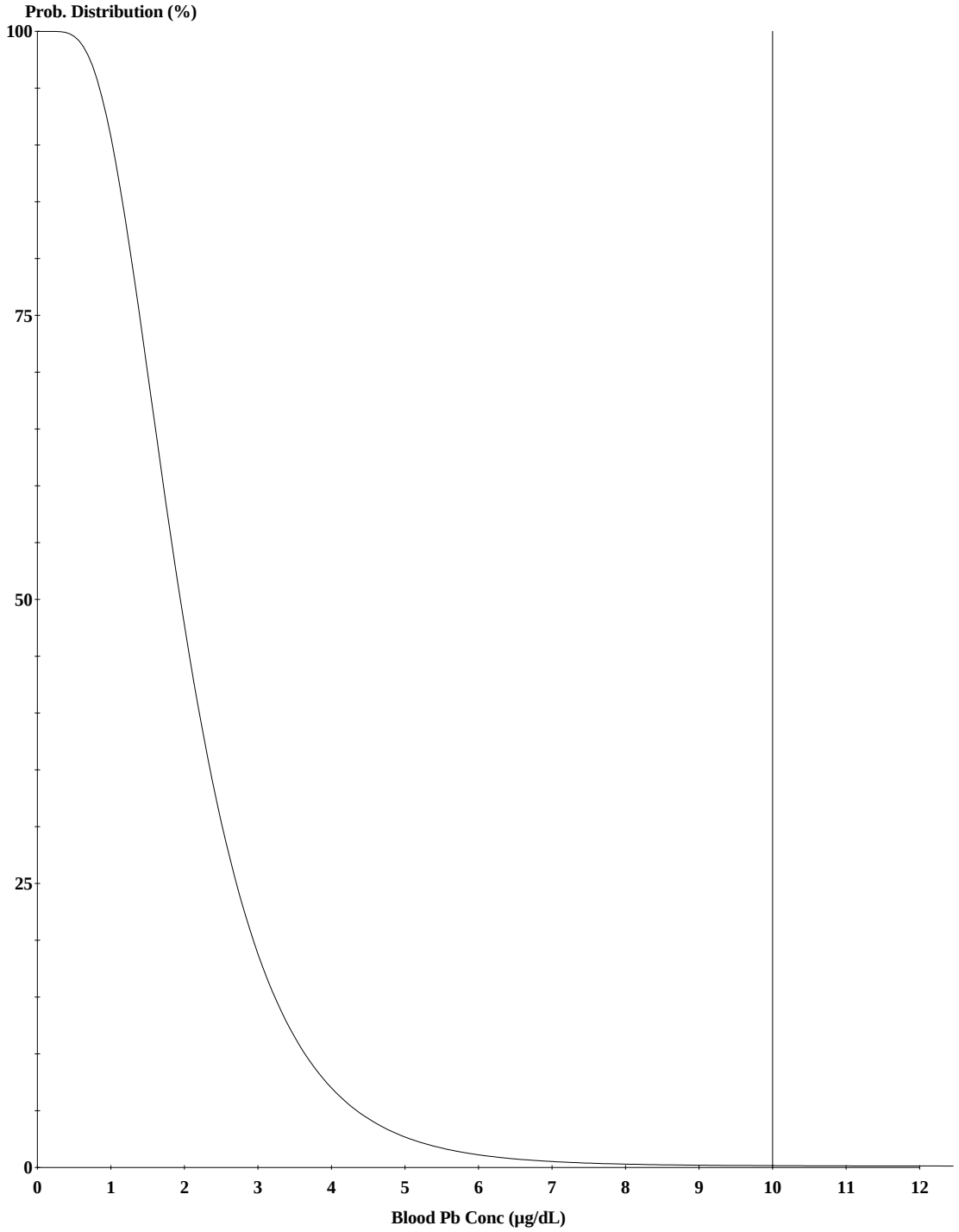
CONCEPTUAL SITE MODEL (2010)
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Legend

F	Future Exposure Pathway	→	Complete Exposure Pathway
CF	Current and Future Exposure Pathway	- · - · →	Incomplete Exposure Pathway

FIGURE 8-8
PROBABILITY DENSITY FUNCTION
BLOOD LEAD CONCENTRATIONS, 2010 SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Cutoff = 10.000 µg/dl
Geo Mean = 2.038
GSD = 1.600
% Above = 0.036

Age Range = User Designated: Ages 12 - 72 months

Run Mode = Research

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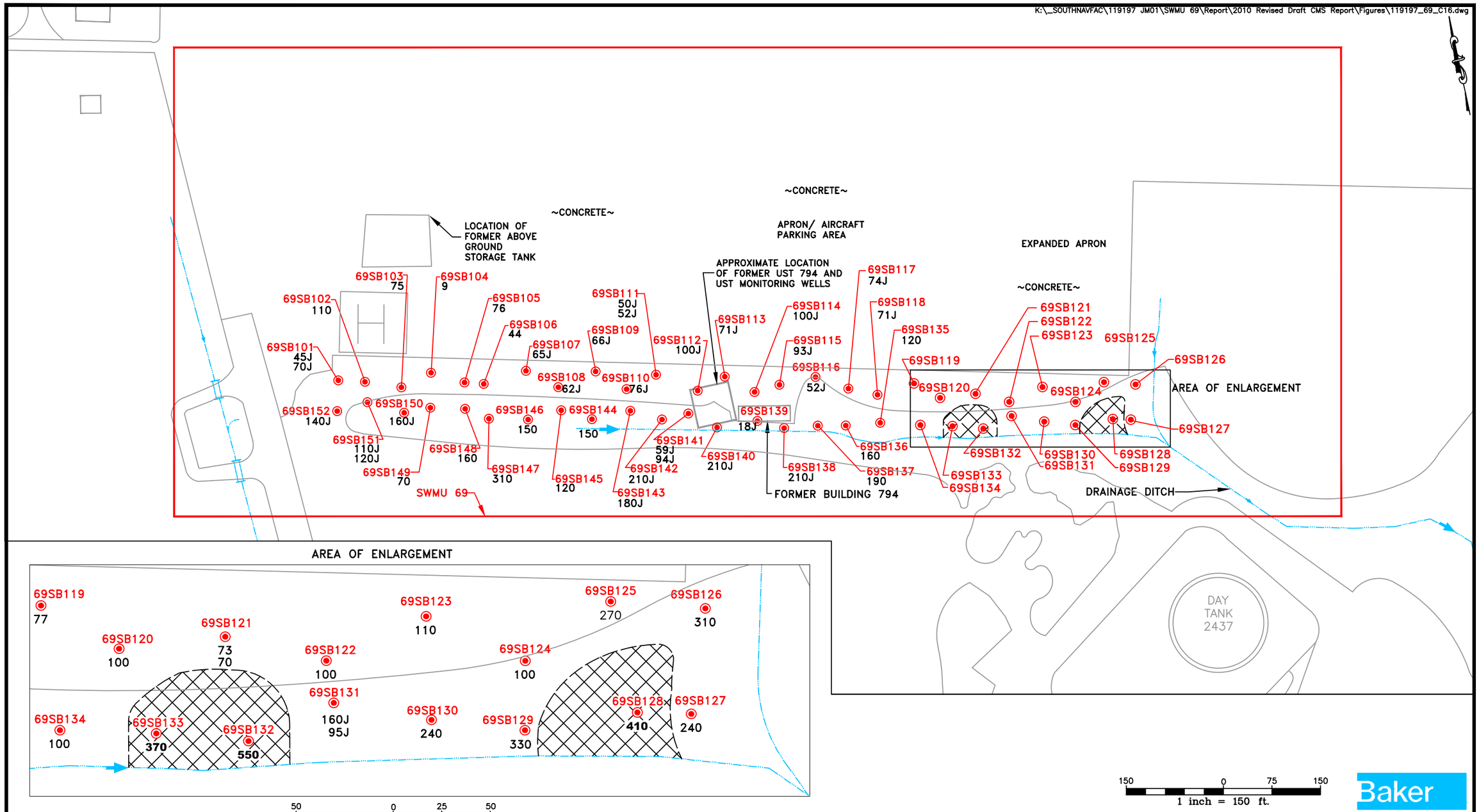


SURFACE SOIL CAO LEVEL	
COC (mg/kg)	
Vanadium	367

NOTE:
ALL CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

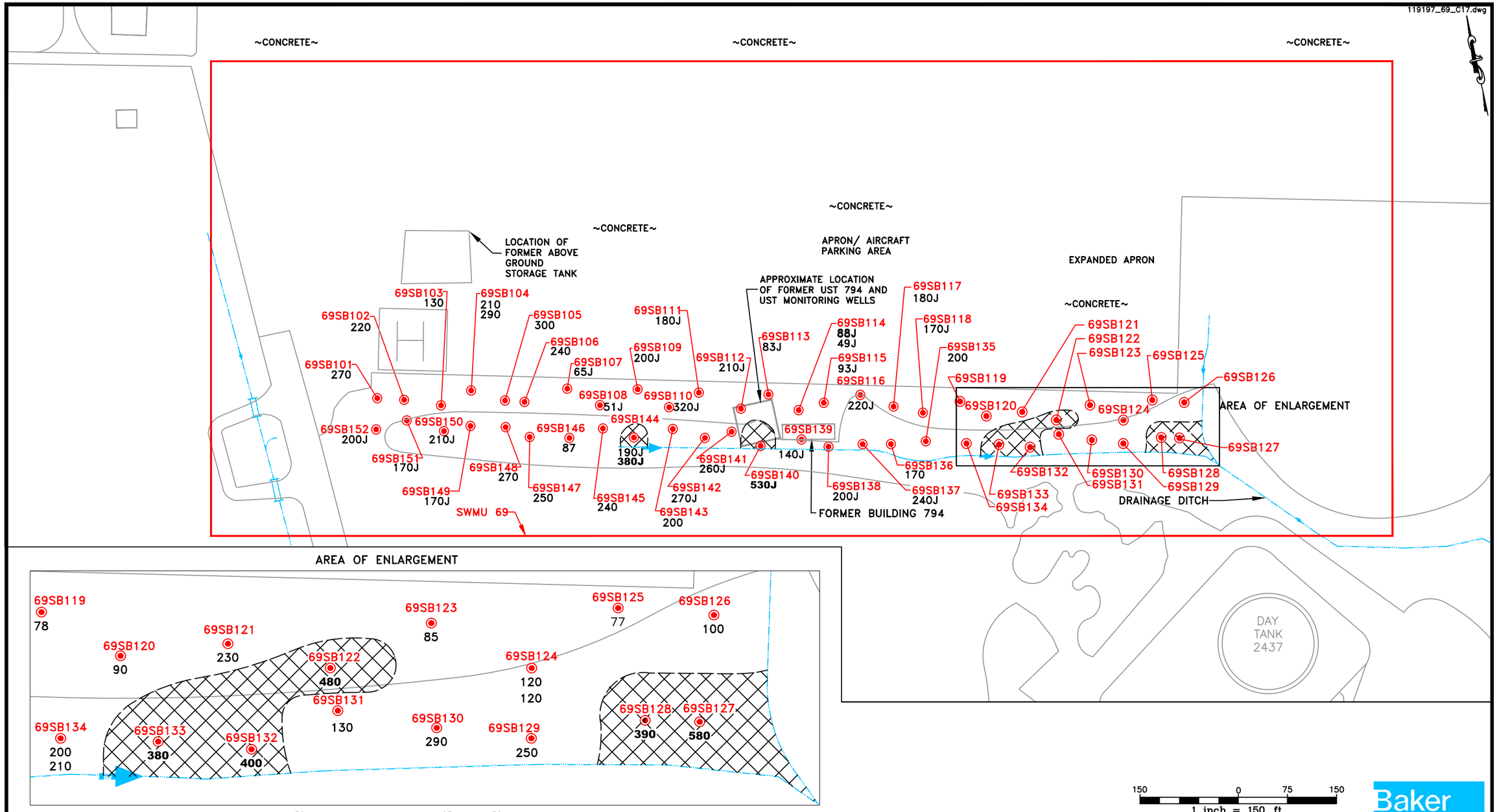
LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –ESTIMATED EXTENT OF VANADIUM CONCENTRATIONS EXCEEDING CAO
- mg/kg –MILLIGRAMS PER KILOGRAM
- J –ESTIMATED VALUE
- BOLD –EXCEEDS CAO

Baker

FIGURE 9–1
VANADIUM CONCENTRATIONS IN SURFACE SOIL
SWMU 69–AIRCRAFT PARKING AREA

CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO



SUBSURFACE SOIL CAO LEVELS	
COC (mg/kg)	
Vanadium	367

NOTE:
ALL CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –ESTIMATED EXTENT OF VANADIUM CONCENTRATIONS EXCEEDING CAO
- mg/kg –MILLIGRAMS PER KILOGRAM
- J –ESTIMATED VALUE
- BOLD –EXCEEDS CAO

Baker

FIGURE 9–2
VANADIUM CONCENTRATIONS IN SUBSURFACE SOIL (1.0–2.0 FT BGS)
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

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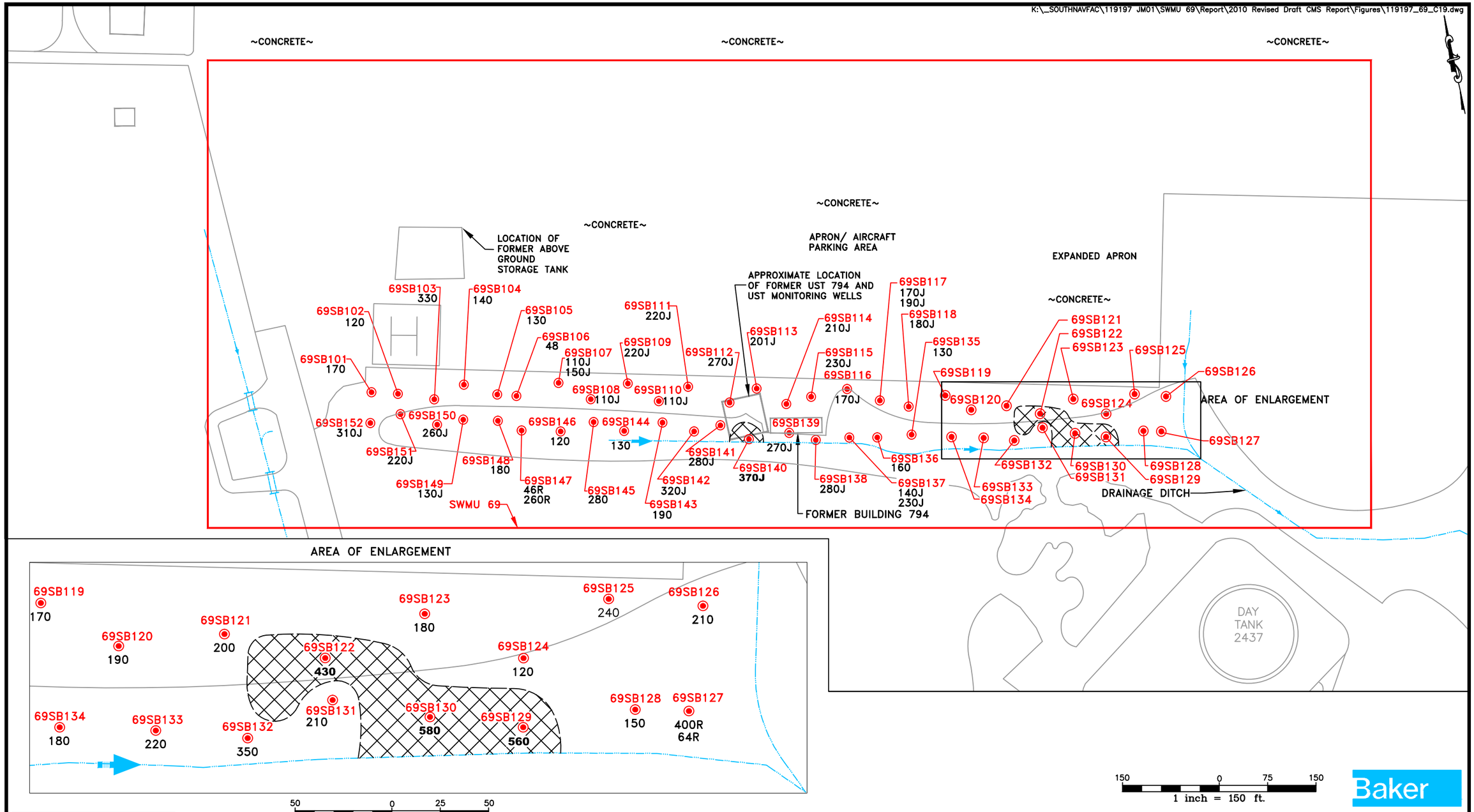

SUBSURFACE SOIL CAO LEVELS	
COC (mg/kg)	
Vanadium	367

NOTE:
ALL CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –ESTIMATED EXTENT OF VANADIUM CONCENTRATIONS EXCEEDING CAO
- mg/kg –MILLIGRAMS PER KILOGRAM
- J –ESTIMATED VALUE
- BOLD –EXCEEDS CAO

Baker

FIGURE 9–3
VANADIUM CONCENTRATIONS IN SUBSURFACE SOIL (2.0–3.0 FT BGS)
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

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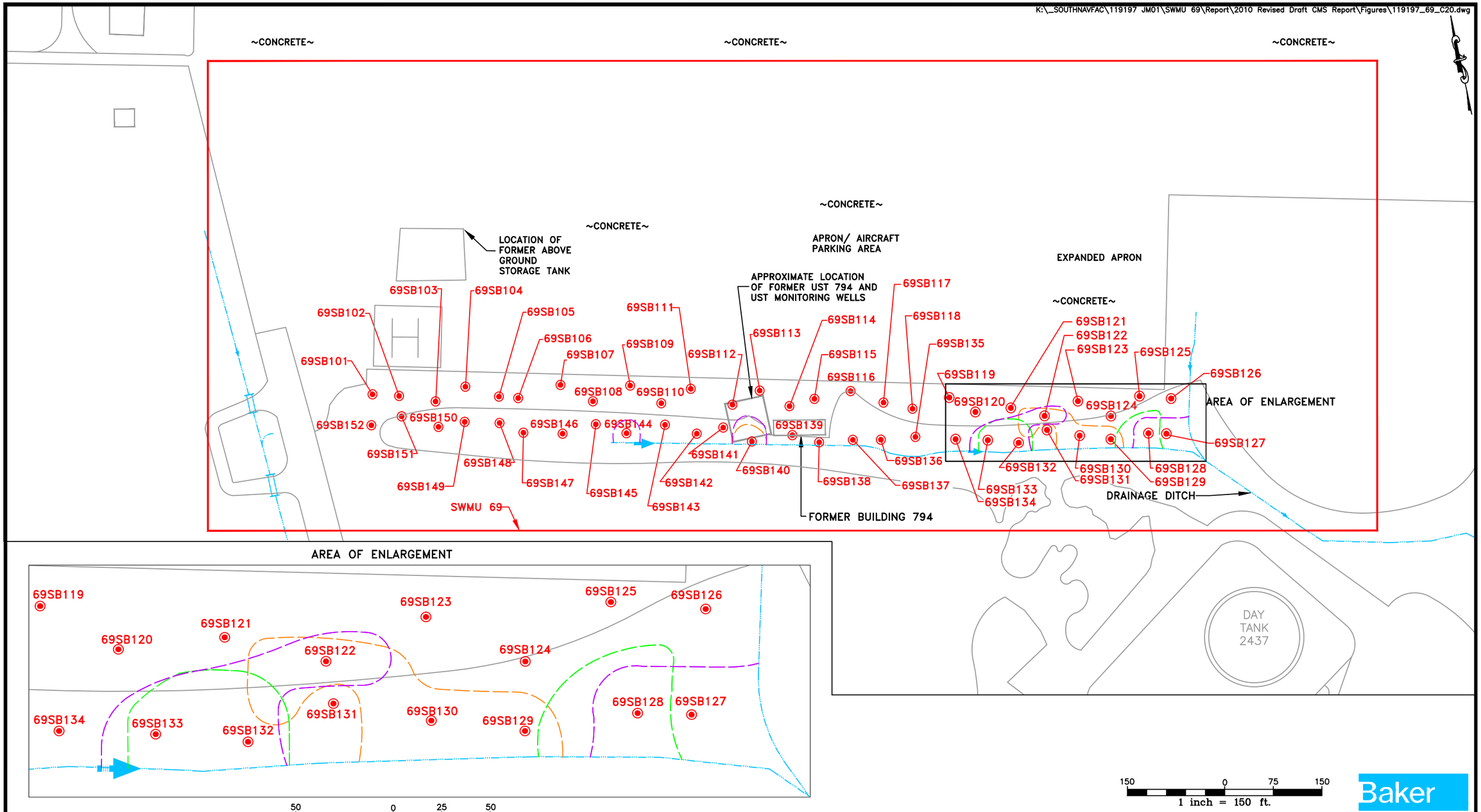

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LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –ESTIMATED EXTENT OF VANADIUM IN SURFACE
- –ESTIMATED EXTENT OF VANADIUM IN SUBSURFACE 1–2 FEET
- –ESTIMATED EXTENT OF VANADIUM IN SUBSURFACE 2–3 FEET

FIGURE 9–4
ESTIMATED EXTENT OF SOIL CONTAMINATION IN EXCESS OF CAO
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 69\Report\2010 Revised Draft CMS Report\Figures\119197_69_C18.dwg

Site ID	69SD02
Sample ID	69SD02
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	0.77 J
Lead	8.3 J
Vanadium	190 J
Zinc	44 J

Site ID	69SD02
Sample ID	69SD02D
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	0.52 J
Lead	6.9 J
Vanadium	220 J
Zinc	33 J

Site ID	69SD03
Sample ID	69SD03
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	4.6 J
Lead	48 J
Vanadium	170 J
Zinc	100 J

Site ID	69SD04
Sample ID	69SD04
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	0.38
Lead	6.4
Vanadium	190 J
Zinc	40

Site ID	69SD05
Sample ID	69SD05
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	0.44
Lead	8.6
Vanadium	350 J
Zinc	55

Site ID	69SD06
Sample ID	69SD06
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	16 J
Lead	440 J
Vanadium	110 J
Zinc	450 J

Site ID	69SD07
Sample ID	69SD07
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	24 J
Lead	680 J
Vanadium	140 J
Zinc	490 J

Site ID	69SD08
Sample ID	69SD08
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	12 J
Lead	250 J
Vanadium	150 J
Zinc	220 J

Site ID	69SD09
Sample ID	69SD09
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	2.9 J
Lead	30 J
Vanadium	370 J
Zinc	89 J

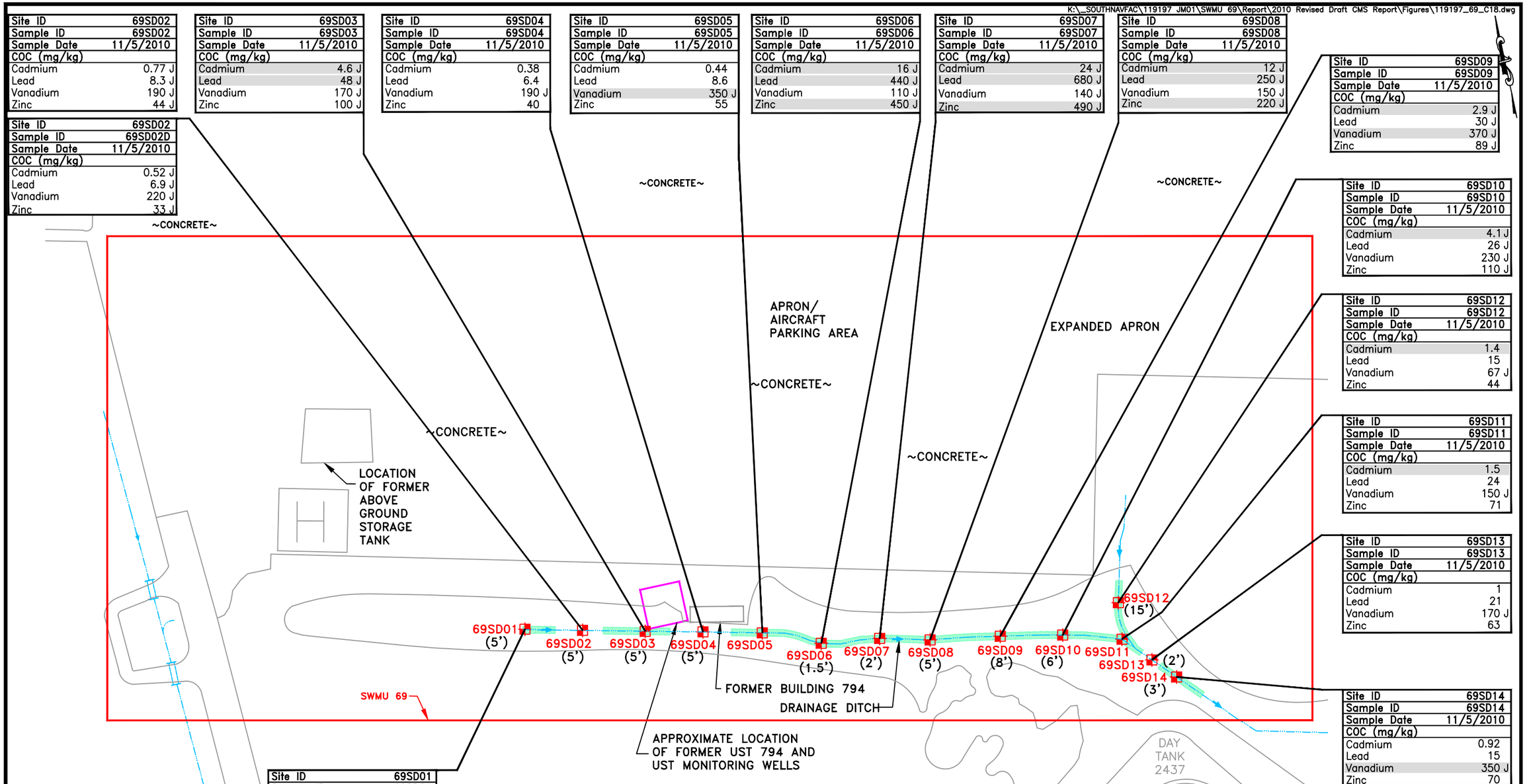
Site ID	69SD10
Sample ID	69SD10
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	4.1 J
Lead	26 J
Vanadium	230 J
Zinc	110 J

Site ID	69SD12
Sample ID	69SD12
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	1.4
Lead	15
Vanadium	67 J
Zinc	44

Site ID	69SD11
Sample ID	69SD11
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	1.5
Lead	24
Vanadium	150 J
Zinc	71

Site ID	69SD13
Sample ID	69SD13
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	1
Lead	21
Vanadium	170 J
Zinc	63

Site ID	69SD14
Sample ID	69SD14
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	0.92
Lead	15
Vanadium	350 J
Zinc	70



Site ID	69SD01
Sample ID	69SD01
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	0.89 J
Lead	51 J
Vanadium	140 J
Zinc	49 J

Site ID	69SD01
Sample ID	69SD01D
Sample Date	11/5/2010
COC (mg/kg)	
Cadmium	1.1 J
Lead	14 J
Vanadium	180 J
Zinc	41 J

SEDIMENT CAO LEVELS	
COC (mg/kg)	
Cadmium	1.0
Lead	35.8
Vanadium	241
Zinc	148

LEGEND

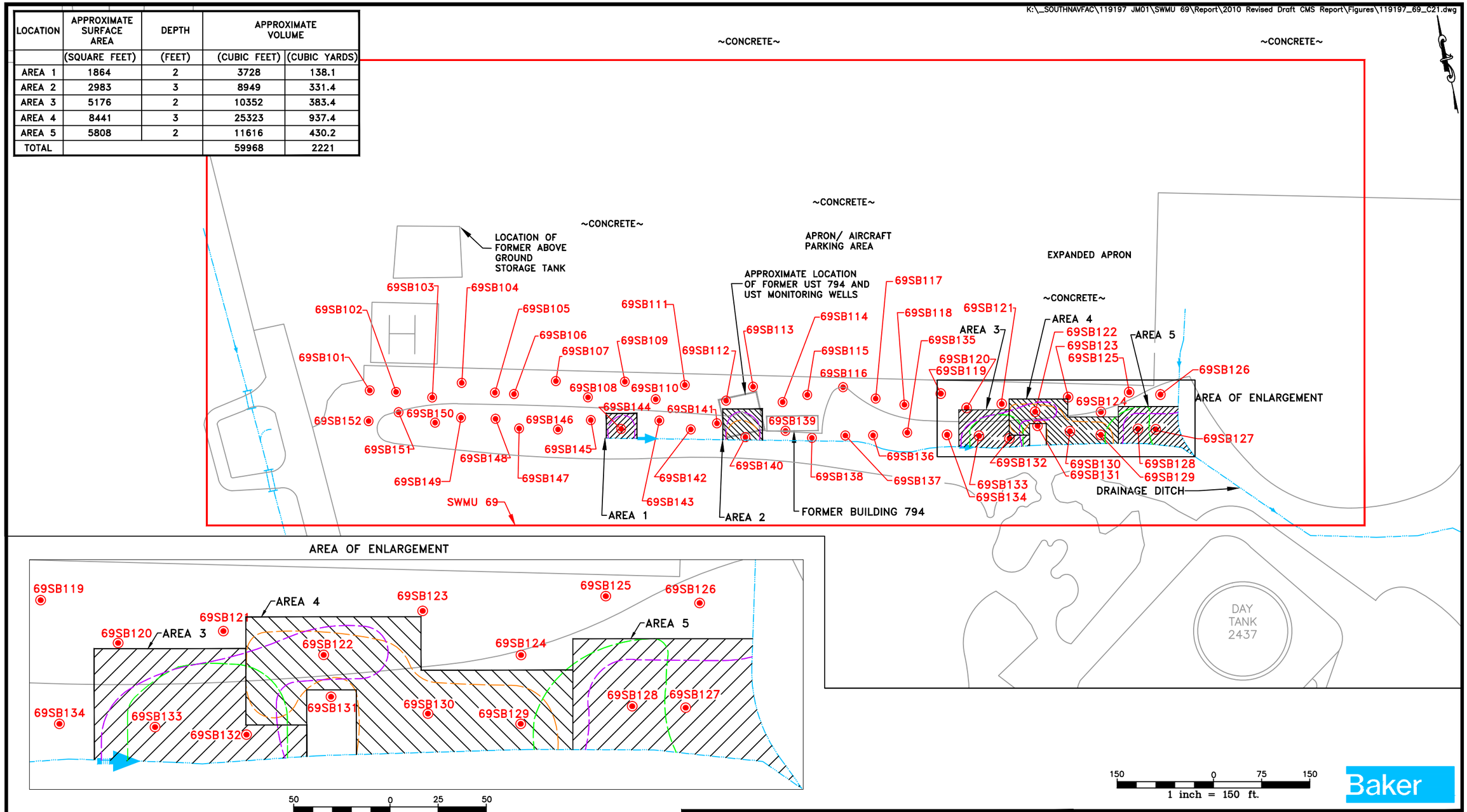
- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)
- (5') –APPROXIMATE WIDTH OF DITCH
- –ESTIMATED EXTENT OF COC CONCENTRATIONS EXCEEDING CAOs
- mg/kg –MILLIGRAMS PER KILOGRAM
- J –ESTIMATED VALUE
- SHADE –EXCEEDS CAO

Baker

FIGURE 9–5
COC CONCENTRATIONS IN SEDIMENT
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

LOCATION	APPROXIMATE SURFACE AREA	DEPTH	APPROXIMATE VOLUME	
	(SQUARE FEET)	(FEET)	(CUBIC FEET)	(CUBIC YARDS)
AREA 1	1864	2	3728	138.1
AREA 2	2983	3	8949	331.4
AREA 3	5176	2	10352	383.4
AREA 4	8441	3	25323	937.4
AREA 5	5808	2	11616	430.2
TOTAL			59968	2221

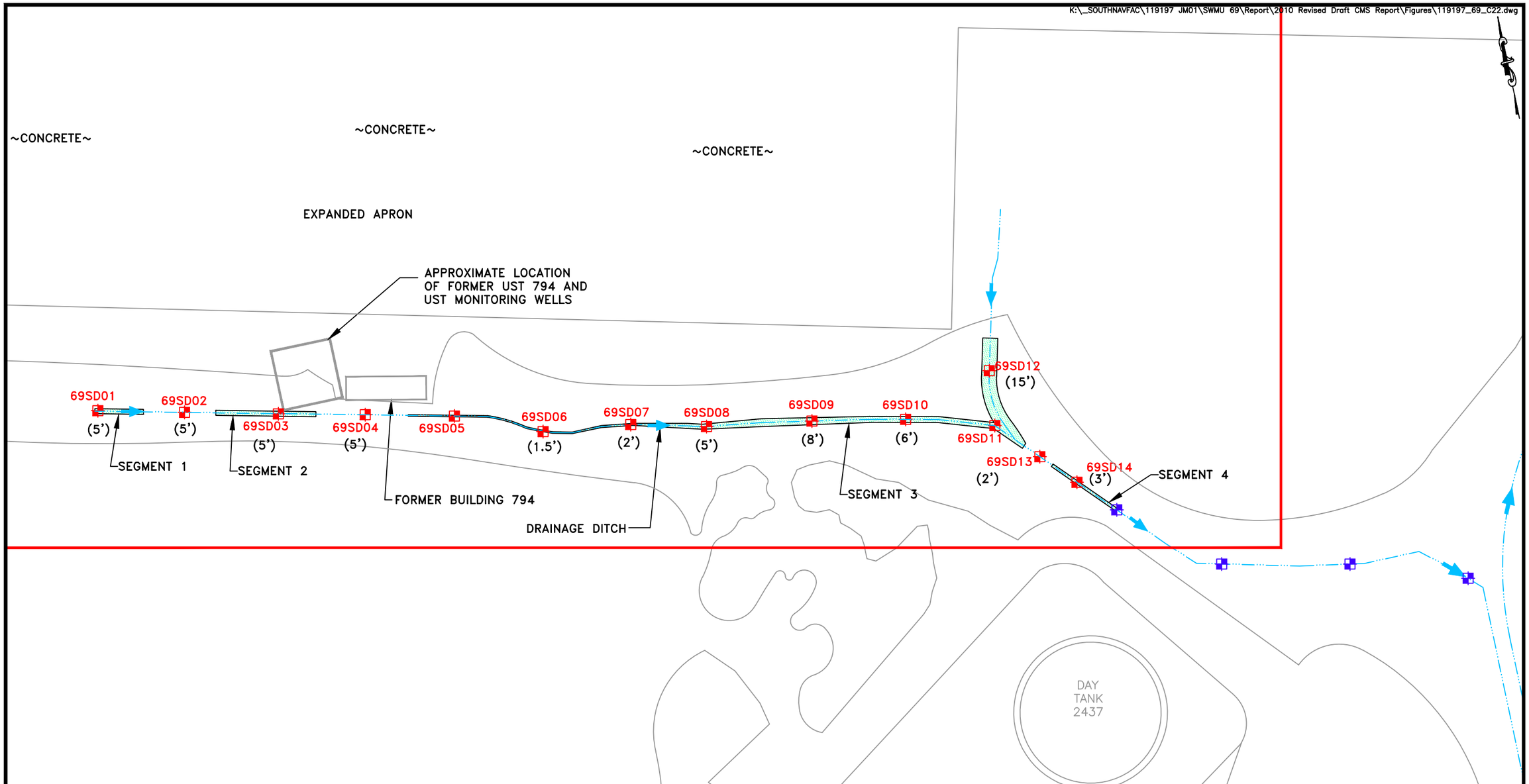


LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –ESTIMATED EXTENT OF VANADIUM IN SURFACE
- –ESTIMATED EXTENT OF VANADIUM IN SUBSURFACE 1–2 FEET
- –ESTIMATED EXTENT OF VANADIUM IN SUBSURFACE 2–3 FEET
- –EXCAVATION AREA 0–2 FEET
- –EXCAVATION AREA 0–3 FEET

FIGURE 10–1
ESTIMATED MAXIMUM LIMIT OF SOIL CONTAMINATION
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



LOCATION	APPROXIMATE SURFACE AREA	DEPTH	APPROXIMATE VOLUME	
	(SQUARE FEET)	(FEET)	(CUBIC FEET)	(CUBIC YARDS)
SEGMENT 1	241.2	1	241.2	8.9
SEGMENT 2	498.6	1	498.6	18.5
SEGMENT 3	4212.5	1	4212.5	156
SEGMENT 4	230.2	1	230.2	8.5
TOTAL			5182.5	192

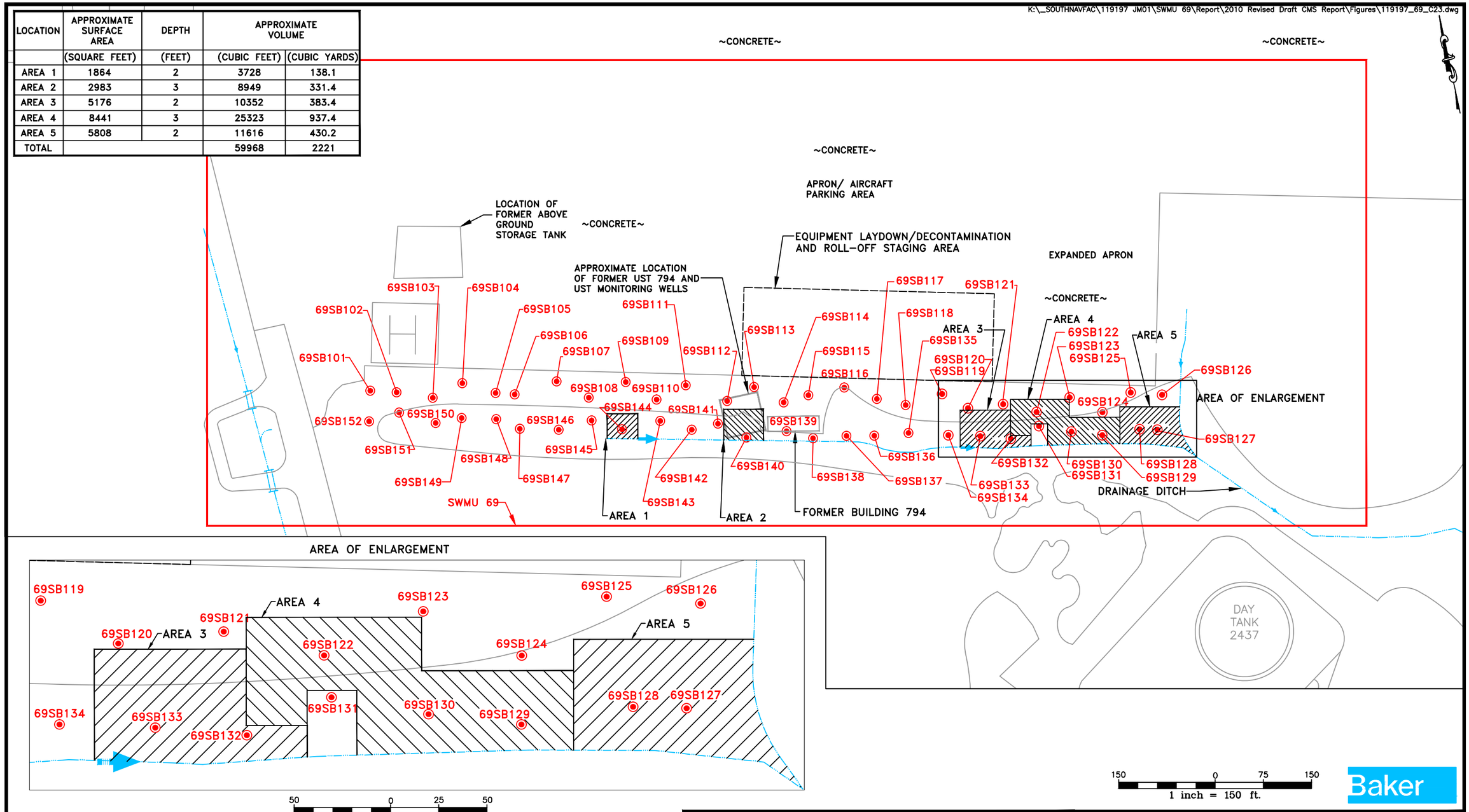
LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)
- –PROPOSED PRE–EXCAVATION SEDIMENT DELINEATION SAMPLES
- (5') –APPROXIMATE WIDTH OF DITCH
- –DITCH EXCAVATION AREA

FIGURE 10–2
ESTIMATED MAXIMUM LIMIT OF SEDIMENT CONTAMINATION
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

LOCATION	APPROXIMATE SURFACE AREA	DEPTH	APPROXIMATE VOLUME	
	(SQUARE FEET)	(FEET)	(CUBIC FEET)	(CUBIC YARDS)
AREA 1	1864	2	3728	138.1
AREA 2	2983	3	8949	331.4
AREA 3	5176	2	10352	383.4
AREA 4	8441	3	25323	937.4
AREA 5	5808	2	11616	430.2
TOTAL			59968	2221

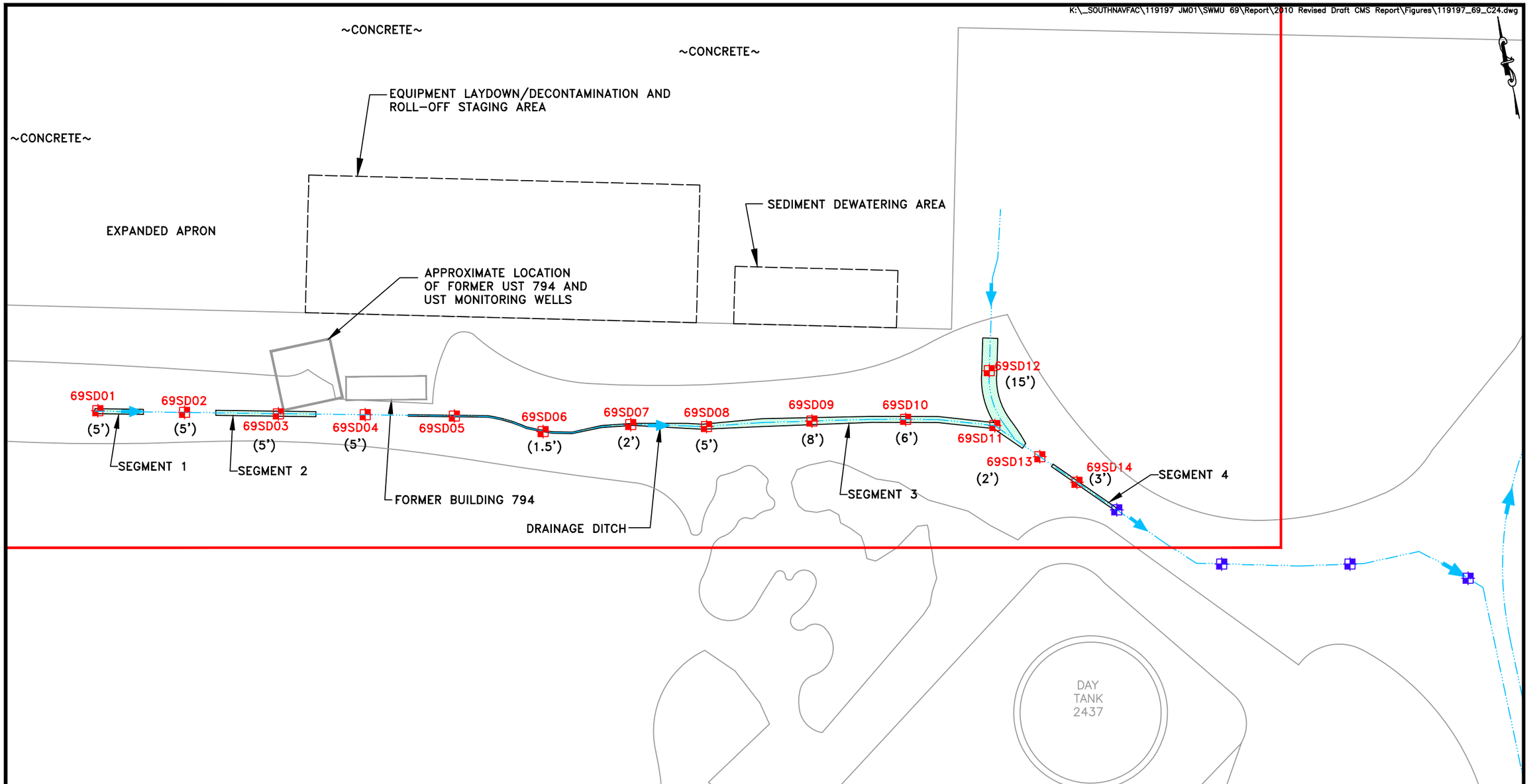


LEGEND

- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (CMS 2010)
- –EXCAVATION AREA 0–2 FEET
- –EXCAVATION AREA 0–3 FEET

FIGURE 11–1
CONCEPTUAL DESIGN FOR SOIL EXCAVATION
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



LOCATION	APPROXIMATE SURFACE AREA	DEPTH	APPROXIMATE VOLUME	
	(SQUARE FEET)	(FEET)	(CUBIC FEET)	(CUBIC YARDS)
SEGMENT 1	241.2	1	241.2	8.9
SEGMENT 2	498.6	1	498.6	18.5
SEGMENT 3	4212.5	1	4212.5	156
SEGMENT 4	230.2	1	230.2	8.5
TOTAL			5182.5	192

LEGEND

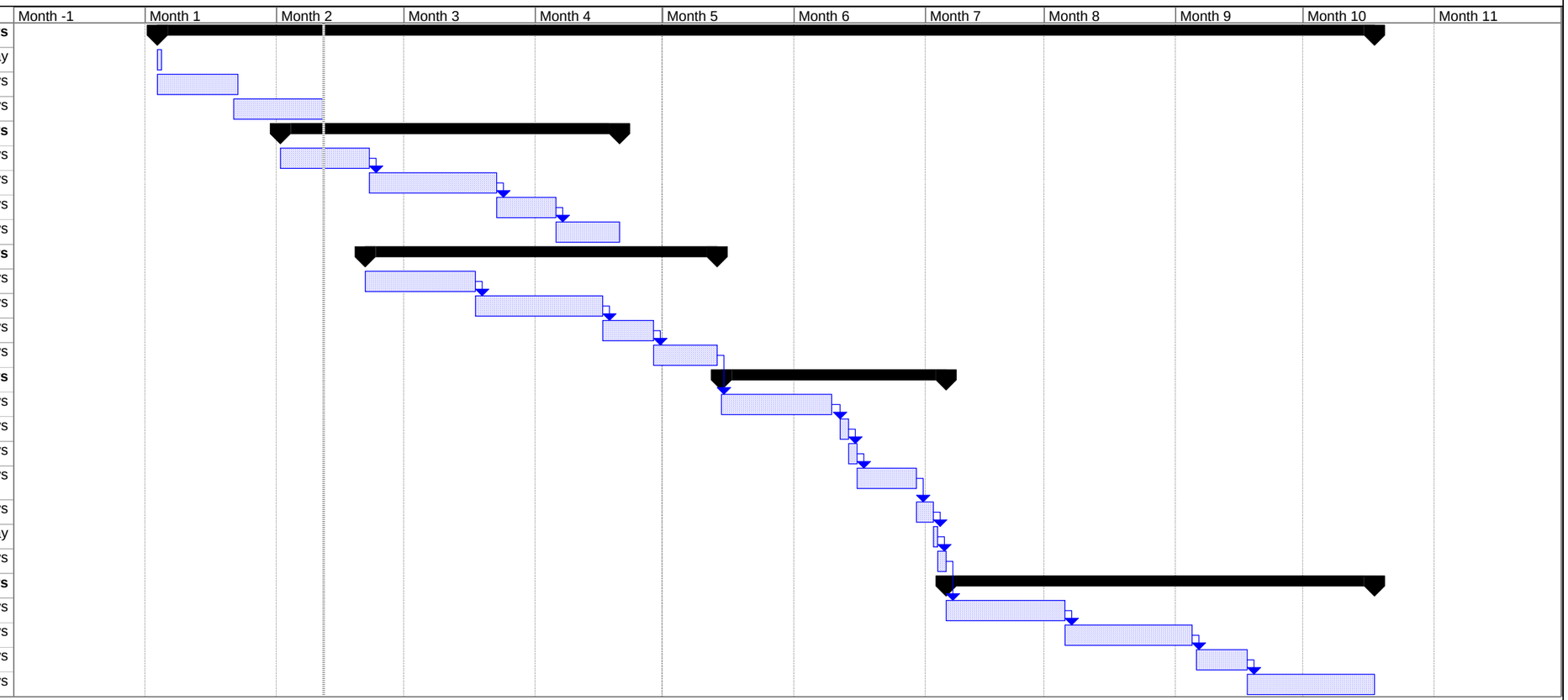
- –SWMU BOUNDARY
- –CURRENT DRAINAGE DITCH
- –STORMWATER FLOW DIRECTION (TYPICAL)
- –SEDIMENT SAMPLE LOCATION (CMS 2010)
- –PROPOSED PRE–EXCAVATION SEDIMENT DELINEATION SAMPLES
- (5') –APPROXIMATE WIDTH OF DITCH
- –DITCH EXCAVATION AREA

FIGURE 11–2
CONCEPTUAL DESIGN FOR SEDIMENT EXCAVATION
SWMU 69–AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

FIGURE 11-3
CONCEPTUAL CMI SCHEDULE
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

ID	Task Name	Duration
1	**SWMU 69 - CMI**	**205 days**
2	Notice to Proceed	1 day
3	Delineation Sampling	15 days
4	Laboratory Analysis	21 edays
5	**CMI Design**	**58 days**
6	100 % Design	15 days
7	Design Review	30 edays
8	Final Design	10 days
9	Final Design Approval	15 edays
10	**Contractor Planning Documents**	**60 days**
11	Draft Documents	20 days
12	Review	30 edays
13	Final Documets	10 days
14	Planning Document Approval	15 edays
15	**Cleanup Action**	**39 days**
16	Mobilization	20 days
17	Survey	2 days
18	Excavation and Staging	2 days
19	Confirmation and Characterization Sampling and Analysis	14 edays
20	Transportation and Off-Site Disposal	2 days
21	Backfill and Revegetation	1 day
22	Demobilization	2 days
23	**CMI Final Report**	**71 days**
24	Draft	20 days
25	Report Review	30 edays
26	Final Report	10 days
27	Report Approval	30 edays



APPENDIX A
2008 AND 2010 FIELD ACTIVITIES

GROUNDWATER MEASUREMENTS FROM JULY 2008

APPENDIX A

GROUNDWATER MEASUREMENTS FROM JULY 2008
SWMU 69 - AIRCRAFT PARKING AREA
CMS INVESTIGATION REPORT
NAVAL ACTIVITY PUERTO RICO, CIEBA, PUERTO RICO

SWMU	WELL ID	DATE	TIME	DTW (ft)
56	56GW01	7/22/2008	824	3.10
56	56GW02	7/22/2008	826	3.08
56	56GW03	7/22/2008	818	3.94
56	56GW04	7/22/2008	828	2.66
56	56GW05	7/22/2008	830	5.77
56	56GW06	7/22/2008	835	3.28
56	56GW07	7/22/2008	838	6.67
56	56GW08	7/22/2008	1325	6.20
61	61GW01	7/22/2008	1235	8.29
61	61GW02	7/22/2008	1228	8.37
61	61GW03	7/22/2008	1233	3.75
61	61GW04	7/22/2008	1230	7.45
61	61GW05	7/22/2008	1237	6.20
61	61GW06	7/22/2008	1239	8.57
69	69GW07	7/22/2008	800	11.55
69	69GW08	7/22/2008	803	10.68
69	69GW11	7/22/2008	809	14.28
69	69GW12	7/22/2008	806	11.88
69	69GW25	7/22/2008	755	10.65
69	69GW26	7/22/2008	812	13.17
69	69GW27	7/22/2008	815	14.38
71	71GW04	7/22/2008	1310	18.55
71	71GW05	7/22/2008	1308	15.10
71	71GW06	7/22/2008	1305	7.18
71	71GW08	7/22/2008	1315	4.46
74	74GW05	7/22/2008	848	8.66
74	74GW22	7/22/2008	856	11.61
74	74GW26	7/22/2008	858	13.00
74	74GW74	7/22/2008	1332	9.86
74	74GW84	7/22/2008	1335	9.05
74	74GW145	7/22/2008	1510	11.30
74	74GW151	7/22/2008	1529	7.33
74	74GW236	7/22/2008	1617	11.87
74	74GW246	7/22/2008	1612	9.50
74	74GW256	7/22/2008	1607	12.00
74	74GW273	7/22/2008	1434	16.30
74	74GWVP01Aa	7/22/2008	1349	18.75
74	74GWVP01Bb/9	7/22/2008	1346	17.95
74	74GWVP02A	7/22/2008	925	10.08
74	74GWVP02B	7/22/2008	927	9.70
74	74GWVP05A	7/22/2008	1413	24.12
74	74GWVP05B	7/22/2008	1415	22.15
74	74GWVP06	7/22/2008	1512	10.37
74	74GWVP06Aa	7/22/2008	1507	24.35
74	74GWVP06Ab	7/22/2008	1505	DRY
74	74GWVP06Ba	7/22/2008	1500	15.30
74	74GWVP06Bb	7/22/2008	1502	16.10
74	74GWVP06Cb	7/22/2008	1455	20.17

APPENDIX A

GROUNDWATER MEASUREMENTS FROM JULY 2008
SWMU 69 - AIRCRAFT PARKING AREA
CMS INVESTIGATION REPORT
NAVAL ACTIVITY PUERTO RICO, CIEBA, PUERTO RICO

SWMU	WELL ID	DATE	TIME	DTW (ft)
74	74GWVP07	7/22/2008	1531	7.77
74	74GWVP08A	7/22/2008	1539	14.81
74	74GWVP08B	7/22/2008	1537	14.41
74	74GWVP11B	7/22/2008	1339	17.10
74	74GWVP09A-JP5 HILL	7/22/2008	1422	22.55
74	74GWVP09B-JP5 HILL	7/22/2008	1420	21.69
74	74GWVP10A-JP5 HILL	7/22/2008	1427	13.00
74	74GWVP10B-JP5 HILL	7/22/2008	14.25	22.20
74	74GWVP10B-DFM	7/22/2008	1544	19.70
74	74GWVP11A-JP5 HILL	7/22/2008	1430	21.48
74	74GWVP11B-JP5 HILL	7/22/2008	1432	22.42
74	74GWVP19A	7/22/2008	1721	DRY
74	74GWVP19B	7/22/2008	1719	11.40
74	74GWVP20	7/22/2008	N/A	N/A
74	74GWVP1982	7/22/2008	1609	9.20
74	74GW34	7/22/2008	905	9.00
74	74GW09	7/22/2008	845	10.78
74	74GW57	7/22/2008	931	6.05
74	74GW285	7/22/2008	1438	DRY
74	74GWVP01A	7/22/2008	916	10.75
74	74GWVP06Cb	7/22/2008	1455	20.17
74	74GWVP10A-DFM	7/22/2008	1542	17.57
74	74GWVP01B	7/22/2008	917	10.35
74	74GWVP03B	7/22/2008	1358	13.85
74	74GWVP01Cb	7/22/2008	1351	17.60
74	74GWVP01Ca	7/22/2008	1353	17.00
74	74GWVP03A/9	7/22/2008	1356	13.67
74	74GWVP03B/9	7/22/2008	1358	13.85
74	AIRFIELD 1	7/22/2008	1127	5.92
74	AIRFIELD 2	7/22/2008	1129	5.93
74	AIRFIELD 3	7/22/2008	1207	5.33
74	74GWVP2b/9	7/22/2008	1400	20.70
74	74GWVP1Ab/9	7/22/2008	1348	18.90
74	74GWVP2a/9	7/22/2008	1401	20.60
74	74GWVP1Ba/9	7/22/2008	1345	19.07
74	74GW9MW02S	7/22/2008	1409	11.90
74	74GWVP6Ca	7/22/2008	1456	20.92
74	74UGW-04-VP-24	7/22/2008	N/A	N/A
74	74GW-M2-2-VP-56	7/22/2008	N/A	N/A
74	74GW-12-VP-56	7/22/2008	N/A	N/A
74	74GWVP6Bb	7/22/2008	1502	16.10

SITE PHOTOGRAPHS
2008 CMS INVESTIGATION

Photo A-1. SWMU 69 view looking south across expanded concrete apron (Day Tank 2437 in background)

Photo A-2. Groundwater monitoring well 69SB07 along the southern edge of the concrete apron and upland vegetation (periodically maintained), view looking west

Photo A-3. Upland vegetation abutting southern edge of concrete apron looking north

Photo A-4. Site drilling activities for 69SB26.
Day Tank 2437 in the background looking southeast

Photo A-5. Headwater portion of on-site drainage ditch parallel to the southern edge of the concrete apron looking east. Upland scrub-shrub vegetation in background

Photo A-6. Drainage ditch parallel to the southern edge of the concrete apron devoid of water

SITE PHOTOGRAPHS
2010 DISTURBED SOIL SAMPLING INVESTIGATION

Photo A-7. Excessive rainfall and regional flooding – investigation postponed. Photo taken July 20, 2010. View looking west

Photo A-8. SWMU 69 Drainage ditch - Photo taken July 20, 2010.

Photo A-8. Baker personnel and Drilling subcontractor, GeoEnviroTech, Inc.
Photo taken August 9, 2010 – view looking southwest.

Photo A-9. SWMU 69 soil boring advancement. View looking north.
Photo taken August 9, 2010.

Photo A-9. SWMU 69 soil boring grouting - photo taken August 9, 2010.

Photo A-10. SWMU 69 soil sampling - photo taken August 9, 2010.

Photo A-11. SWMU 69 Drainage ditch - saturated conditions (November 5, 2010)

Photo A-12. November 5, 2010 - SWMU 69 sediment sampling

FIELD LOG BOOK NOTES
2008 CMS INVESTIGATION

Environmental Geologist – Joe Burawa

Naval Activity Puerto Rico

CMS Investigations

SWMU	69	Aircraft Parking
SWMU	56	Hanger 200
SWMU	74	JP-5 Pipeline
SWMU	61	
SWMU	62	
SWMU	71	

4/29/08
Partly Cloudy
85°F

On-site 6:05 am
Prep bottles for sumu 69

UFA Drilling on site 7:00
load equipment at NAPR
prepare to mobilize to Airfield.

7:45am arrive at GATE 1, Attempt to access airfield. Guards won't let us on, call Fernando Diaz and arrange notification to access to airfield

Inside airfield @ 8:10

Begin drilling and sampling.

695B07

0-4'
2.7' Rec.
<1 PID

Sandy Clay grayish brown mod soft, with gravel, damp some limestone gravel @ 0.5' to 0.8'

1.0' Clay reddish brown, stiff damp, some silt, some mottling

4.0'
4.6' Rec
<1 PID

@ 4.5' mottled maroon and reddish brown, clay, mod. soft damp

8-12'
4.0' Rec
<1 PID

clay becomes yellowish @ 10' stiffer less mottled damp

4/29/08

Samples collected

695B07-00	830
695B07-01	840
695B07-05	855

695B08

0-4' Sand and shells first 4"
4.0' Rec loose, damp
<1 ppm then brown clay, stiff, damp
some silt
@ 3.5' become reddish brown and
light yellow clay, mod soft
mottled, damp to moist

4-8'
4.0' Rec. same as above
<1 ppm becomes soft and moist @ 7'

8-12' same as above, occasional
4.0' Rec sandy zone damp to moist.
<1 ppm

4/29/08

Samples collected

695B08-00	915
695B08-01	925
695B08-05	945
695B08-05D	945
695B08-05MS/MSD	945

(4/30/08) Install two inch well to 16'
10' Screen, sand to 4' Bgs
then bentonite to 2'

69SB[redacted]11

0-4' 4' Rec. <1 ppm — 2" Topsoil black, soft, moist then sand and gravel, damp to moist, loose, some silt @ 1.8' becomes damp brown gray clay, very lean, stiff, damp

4-8' 4' Rec. <1 ppm — changes to brown clay @ 4.2' same silt, mod stiff damp

8-12' 4' Rec. <1 ppm — becomes sandy clay @ 8.4' softer, damp to moist, some mottling medium brown color fine-grained sand

12-16' 3' Rec <1 ppm — sand and gravel @ 12.5' to 14' then light reddish brown clay sand and gravel is saturated, loose gray brown.

4/29/08

Samples collected

69SB[redacted]11-00	1010
69SB11-00D	1010
69SB11-01	1025
69SB11-05	1035

Install two-inch well to 16'
10 feet of screen, sand to 4'
then bentonite to top.
Cut off stick @ 40"

69SB12

0-4' Topsoil first 2" black, moist
4' Rec. then sand and gravel to 1.1'
<1ppm loose, moist
@ 1.1' Lean clay brownish gray
stiff, some silt, damp

4-8' same
4' Rec. at 4.5' Silty clay, mud brown
<1ppm gray, mod. stiff, damp
becomes sandy @ 7.6' moist

8-12' Sandy clay to 11' then
4' Rec. sand and gravel, saturated,
<1ppm brown, medium grained sand,
angular gravel

4/29/08

Samples collected

69SB012-00 1050
69SB12-01 1055
69SB12-05 1105

Install two inch well to
15' Bgs 10' Screen
Sand to 3' then bentonite to one.
Cut off stick up to 40"

JFA Decon and travel to Base
for supplies for tomorrow.
off-site 400pm 1600

Mark at 74 GPS locations
pass Day Tank.

4/30/08
Sunny 85°F

On-site 630 am
Drillers JFA on-site 700

Build wells @ 69GW07
and 69GW08.

1200 Mobilize to 69TW01

Build well @ 69TW01

1300 Decon Augers

JFA & GeoEnvirotech off site
1700

SB 25
69 BW

0-4' Topsoil first one inch
4' Rec black, soft moist
<1 ppm then
Sand and gravel (rocks) med. gray
loose, hard, dry.
@ 0.8' Dark Brown clay, very
lean, stiff, damp

4-8'
4' Rec. @ 5.6' Becomes Reddish brown
<1 ppm sandy clay, damp, moderately stiff
mottled,

8-12' → light gray
4' Rec. @ 10' White and red clay, some
<1 ppm silt, stiff, damp

12-16' @ 13' becomes Sandy clay with
4' Rec. sand fractures med. brown, wet
<1 ppm med soft., mottled clay, some
silt throughout

4/30/08

No Samples collected!

Install 2" well
T.D. 18'
10' of 2" Well Screen
Sand to 6' Bgs
Bentonite to 4' Bgs.

5/1/08
Sunny 87°F
90° Humidity

On-site 645am
Prep for day at Bldg 31

Meet JFA @ Airfield @ 730

SB
69GW26

0-4'	First 0.1' Topsoil, brown, mod. soft
4' Rec.	then lean clay, brown, mod
<1 ppm	stiff to stiff, damp. some pebbles
	@ 1.8' Silty clay, reddish brown
	some sand, dry, fractured
4-8'	@ 4.2' Sandy clay, mod stiff
4' Rec.	damp to dry, reddish brown
<1 ppm	& olive brown
	@ 5.6' becomes softer
8-12'	Same as above
4' Rec.	
<1 ppm	
12-16'	lean clay from 12-12.8 very
4' Rec.	hard, brownish red,
0-5 ppm	@ 12.8 Sandy Clay, mod soft
	mottled damp to moist, becomes
	more brown @ 15'

5/1/08

No Soil Samples collected @ 69GW26

Set well @ 18' Bgs
10' 2" Screen (0.010")
Sand to 6'
Bentonite to 4'
Stick-up
Finish @ 11:00

GW
[redacted] 69SB27

0-4' Brown silty clay, mod stiff
4' Rec. damp to dry,
5-10 PPM @ 3.5' becomes reddish tan
clay with some silt
mod stiff, damp to dry
broken,

4-8'
4' Rec. becomes sandy clay @ 4.5'
30-40 ppm damp, light red/brown
mod hard, stiff

8-12' Same sandy clay, damp,
4' Rec. red/brown, some white clay
100-300ppm throughout, hard, strong odor

12'-16' Sandy clay, becomes some more
4' Rec gray in color, strong odor,
300+ ppm damp to moist, clay is more
plastic

5/1/08

Samples collected

69SB27-00 1210
69SB27-01 1215
69SB27-05 1230

Set 2" Well to 18' Bgs
10' Screen - 0.010" Slot
Sand to 6'
Bentonite to 4'
Stick-up

Environmental Technician – Darrin Hupe

4/29/08

SWMU 69 [Surface Soil Sampling.]

Weather: Mostly sunny, windy, ~95°F

Sample Point	Time	Description
69SB01-00	0850	S.Hy, some rocks/roots, Med. Br. moist
00MS	"	
00MSD	"	
00D	0855	
69SB02-00	0940	S.Hy clay, roots, Med. to dark brown, moist.
69SB03-00	0950	Sandy clay, Root & Shell frags, Med. Br. moist to wet.
69SB04-00	1035	Clay, some S.H, Roots, some rocks/shells, Med. Brown.
69SB05-00	1110	S.Hy clay, Roots, some sand, dark Brown, moist
69SB06-00	1120	clayey S.H, Roots, Med. Br., moist
69SB09-00	1135	S.H, some sand, lots of Roots, DK. Brown, moist to wet.
69SB10-00	1345	S.Hy clay, lots of Roots, some rock/shells Med. Br., damp.
69SB13-00	1400	S.H, some sand/clay, roots, some rocks/shells, Med. Br., damp
69SB14-00	1415	Clayey S.H, roots, rocks/shells, Med. to DK. Br., Damp.

4/29/08

Sample Point	Time	Descrip.
69SB15-00	1425	S.Hy Sand, trace clay, roots, rocks/shells, Md. Br., Damp.
69SB16-00	1430	S.Hy sand, roots, rocks/shells, light Br., damp.
69SB17-00	1445	S.H, some sand, rocks/shells, Med. to dk Br., damp.
69SB18-00	1450	S.Hy Sand, rocks, Med. to light Br., Moist.
69SB19-00	1500	S.Hy Sand, rocks, Med. to light Br., Moist.
69SB20-00	1500	S.Hy Sand, rocks/shell, some Coral, Med. to Dk. Br., damp.
69SB21-00	1520	Sand, rocks/shells, light Br./Tan, damp.
~~69SB22-00~~	~~1530~~	
69SB21D-00	1520	
21MS	"	
21MSD	"	
69SB22-00	1530	S.Hy Sand, rocks, Med. Br., damp.
69SB23-00	1535	" " " " "
69SB24-00	1550	" " " " "

4/30/08

SLMU 69 [Well Development]

Weather -- Mostly sunny, breezy, ~95°F

69GW11

TD: 19.46 (Hard bottom)

SWL: 12.76

Time: 0915

Time	Vol. (gal.)	Temp.	Cond.	D.O.	pH	ORP	Turb.
0954 - Start							
0957	.75 gal.	31.79	0.687	2.11	7.22	87	>1k
1003	2	31.74	0.679	2.71	6.90	91	"
1010	4	31.90	0.680	2.20	6.86	84	"
1017	6	31.97	0.657	1.93	6.96	64	717
1025	8	32.03	0.577	1.83	6.90	63	227
1030	10	32.06	0.542	1.76	6.85	61	60

Ending SWL = 12.84

Pump Speed = Full

4/30/08

69GW12

TD: 18.10 (Hard Bottom)

SWL: 10.38

Time: 1040

Time	Vol. (gal.)	Temp.	Cond.	D.O.	pH	ORP	Turb.
1045 - start							
1053	2	29.40	0.716	2.10	6.81	69	>1k
1100	4	29.49	0.723	1.94	6.76	55	"
1106	6	29.42	0.711	1.87	6.76	40	"
1113	8	29.48	0.459	1.82	6.74	29	279
1120	10	29.43	0.716	1.80	6.72	19	199
1126	12	29.45	0.714	1.74	6.80	8	41

Ending SWL = 10.45

Pump Speed = Full

4/30/08

696W08

TD: 19.05 (Hard Bottom)

SWL: 8.95

Time: 1205

Time	Vol.	Temp. (°C)	Cond.	D.O.	pH	ORP	Turb.
1208 - Start							
1215	2	28.75	0.629	9.05	7.01	32	>1k
1221	4	28.62	0.618	3.47	6.98	35	"
1227	6	28.56	0.554	3.38	6.95	37	845 ~~844~~
1233	8	28.57	0.622	3.05	6.91	43	436
1238	10	28.49	0.623	3.17	6.94	43	971
1243	12	28.48	0.587	3.08	6.94	43	780
1250	14	28.39	0.484	3.00	6.94	42	528
1255	16	28.45	0.580	2.33	6.98	41	136
1304	18	28.29	0.609	2.92	6.96	41	89

Ending SWL = 9.33

Pump Speed = Full

4/30/08

696W07

TD: 19.45 (Hard Bottom)

SWL: 10.83

Time: 1458

Time	Vol.	Temp. (°C)	Cond.	D.O.	pH	ORP	Turb.
1502 - Start							
1510	2	29.96	0.661	6.15	7.29	40	>1k
1518	4	29.63	0.630	~~7.15~~	7.15	51	"
1524	6	29.50	0.646	4.09	6.94	56	866
1531	8	29.45	0.633	3.65	6.85	69	318
1537	10	29.33	0.572	3.42	6.81	78	68

Ending SWL = 11.50

Pump Speed = Full

4/30/08

69GW25

TD: 20.39 (Hard Bottom)
SWL: 8.33
Time: 1549

Time	Vol. (gal.)	Temp.	Cond.	D.O.	pH	ORP	Turb.
1552 - Start							
1600	2	29.90	0.758	5.51	6.83	51	>1K
1606	4	29.50	0.739	5.39	6.75	57	37
1613	6	29.37	0.745	4.61	6.69	57	528
1619	8	29.19	0.740	4.20	6.66	46	51

5/1/08

SWMW 69 [Well Sampling]

Weather: Partly cloudy, breezy, ~55°F

69GW07

SWL = 10.93 @ 0938 TD = ~~10.93~~ 19.45
1 Vol. = ~~1~~ 1.4 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
0941 - Start							
0952	1	29.20	0.693	2.16	6.89	77	11
1000	2	28.88	0.685	1.84	6.87	78	7.8
1007	3	29.09	0.674	1.44	6.84	68	3.0
1013	4	29.09	0.668	1.39	6.81	74	1.5

1020 - Sample Taken

5/1/08

696W-08

TD = 19.05

SWL = 9.09 @ 1043

1 Well Vol. = 1.6 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1046	—	Start					
1054	1	28.54	0.676	2.01	6.91	52	7.7
1101	2	29.00	0.668	1.43	6.91	45	4.5
1109	3	28.18	0.660	1.37	6.88	42	3.2
1115	4	28.09	0.655	1.28	6.87	37	3.5

1125 - Sample Taken

5/1/08

696W-11

TD = 19.46

SWL = 12.86 @

1 Well Vol. = 1.1 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1145	-	Start					
1152	1	32.11	0.670	1.24	6.81	45	19
1156	2	32.10	0.670	1.18	6.80	43	9.4
1201	3	32.20	0.668	1.19	6.80	41	5.7
1207	4	32.10	0.670	1.17	6.80	38	3.2

1215 - Sample Taken

" - MS/MSD

1220 - Dup.

5/1/08

69GW12

TD = 18.10

SWL = 10.49 @ 1344

1 Well Vol. = 1.2 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1346 – Start							
1353	1	29.49	0.714	1.28	6.75	-5	6.7
1358	2	29.12	0.714	1.48	6.75	-8	3.7
1409	3	29.00	0.712	1.28	6.73	-9	3.8
1413	4	29.	0.712	1.26	6.73	-8	3.3

1420. Sample Taken

5/1/08

69GW25

TD = 20.39

SWL = 8.81 @

1 Well Vol. = 1.9 gal

Time	Vol.	Temp	Cond.	D.O.	pH	ORP	Turb.
1451	1	28.71	0.765	~~2.05~~ 1.93	6.51	43	17
1458	2	28.67	0.760	1.54	6.49	41	6.3
1506	3	28.70	0.748	1.50	6.47	57	3.2
1515	4	28.68	0.743	1.47	6.45	61	3.0

1520 – Sample Taken

5/2/08 [Well Developement]

Weather: Mostly Sunny, Breezy, ~95°F

69GW26

TD = 21.44 (Hard Bottom).

SWL = 11.50

Time = 0854

Time	Vol. 3gal.	Temp.	Cond.	D.O	pH	ORP	Turb.
0906	1	27.08	1.063	6.82	6.60	138	63
0910	2	26.84	1.057	5.71	6.54	136	15
0914	3	26.79	1.069	5.42	6.52	134	6
0920	4	26.93	1.074	5.13	6.49	134	27
0924	5	26.92	1.084	5.09	6.45	135	29
0929	6	26.95	1.089	5.01	6.42	133	27
0934	7	26.06	1.092	4.81	6.42	133	7
0939	8	26.02	1.094	4.73	6.41	132	7

Ending SWL = 19.83

Pump Speed = Full

5/2/08

69GW27

TD = 21.57 (Hard Bottom)

SWL = 13.28

Time = 1030

Time	Vol. 3gals.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1035 - Start							
1040	1	27.18	0.768	3.30	6.59	107	178
1043	2	26.94	0.788	5.32	6.53	112	53
1048	3	26.95	0.826	4.51	5.66	105	310
1051	4	27.00	0.848	5.07	6.69	105	13
1056	5	27.11	0.843	4.61	6.58	107	6
1100	6	27.15	0.826	4.39	6.50	93	2

1101 - Dry

Pump Speed = Full

5/2/08

56GW06

TD= 18.41

SWL= 2.96

Time= 1306

Time	Vol. gal.	Temp	Cond.	D.O.	pH	ORP	Turb.
1319	2						
1325	4	28.34	0.966	2.80	6.76	70	>1K
1333	6	28.58	0.954	2.16	6.74	72	871
1341	8	28.59	0.946	1.76	6.72	73	>1K
1347	10	28.59	0.943	1.40	6.70	74	987
1354	12	28.53	0.940	1.34	6.71	73	656
1358	13	28.60	0.938	1.23	6.70	73	217
1401	14	28.56	0.933	1.21	6.71	72	85

Ending SWL = 4.56

Pump Speed = Full

5/3/08

Weather: Overcast, breezy, ~80°F

SWMU69 [Well Sampling]

~~69GW2~~

69GW27

TD = 21.57

SWL = 12.91 @ 0813

1 Well Vol. = 1.4 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
0818	.3	26.48	0.822	2.13	6.57	93	6.5
0821	.6	26.47	0.819	2.14	6.61	87	6.7
↳ SWL = 14.62							
0824	1	26.48	0.817	2.48	6.60	88	4.6
0829	1.3	26.47	0.818	3.03	6.60	88	3.4
↳ SWL = 15.63							
0834	1.6	26.50	0.820	3.08	6.60	89	2.8
0839	2	26.55	0.819	3.06	6.59	87	2.0
↳ SWL = 16.53							

0850 - Sample Taken

Note: Sample was clear but with a smell of slag/cement.

Pump Speed = 2/3

5/3/08

696W26

TD = 21.44

SWL = 11.06 @ 0915

1 Well Vol. = 1.7 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
0918	.3	26.61	1.057	4.96	6.44	98	1.7
0922	.6	26.62	1.059	4.63	6.43	98	1.3
SWL = 12.48							
0926	1	26.63	1.058	4.73	6.45	97	1.2
0933	1.3	26.64	1.060	4.50	6.44	94	0.7
SWL = 13.34							
0937	1.6	26.67	1.062	4.41	6.45	93	0.8
0944	2	26.67	1.060	4.39	6.43	93	0.6
SWL = 13.97							

0950 - Sample Taken

Pump Speed = little more than 1/2

5/3/08

SWMU56 [Well Sampling]

56GW06

TD = 18.41

SWL = 2.69 @ 1052

1 Well Vol. = 2.6

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1107	.5	28.78	0.951	0.91	6.70	71	25
1114	1	28.68	0.952	1.01	6.71	72	13
SWL = 3.45							
1120	1.5	28.66	0.944	0.74	6.69	71	7
1126	2	28.75	0.949	0.71	6.69	69	6.4
SWL = 3.58							
1132	2.5	28.72	0.947	0.67	6.69	68	5.3

1140 - Sample Taken

Pump Speed = ~ 3/4

5/7/08

SWMU 56 [Well Sampling]

56GW08

TD = 16.47

SWL = 5.47

1 Well Vol. = 1.8 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
0717 - Start							
0729	1	27.23	4.096	1.95	6.63	30	421
1 SWL = 6.15							
0743	2	27.33	4.155	1.21	6.63	21	189
1 SWL = 6.18							
0753	3	27.40	4.165	1.07	6.62	19	27
0806	4	27.57	4.193	1.01	6.61	18	18
1 SWL = 6.16							

0815 - Sample Taken

Pump Speed = 2/3

5/7/08

Water Level Readings

	Level	Time
69GW25	9.19	0954
08	8.87	0956
07	9.98	0957
12	10.40	1000
11	12.78	1002
26	11.00	1008
27	12.61	1010
56GW01	2.55	1105
02	2.99*	1107
03	3.43	1110
04	2.35	1113
05	5.44*	1114
06	2.91	1116
07	6.48*	1118

* "Possible" floater detected in the top 100th of the column

FIELD LOG BOOK NOTES
2010 DISTURBED SOIL SAMPLING INVESTIGATION

Environmental Scientist – Adam Gailey

Monday July 19, 2010

0720 Depart PIT to SJU for SWMU 69 CMS - Disturbed Soils Investigation.

Field Team: J. Oliver
D. Hupe
A. Guiley

Arrive at SJU 1330. Secure Rental Vehicles and Travel to JAT Airport in Ceiba, PR. Heavy Rain and localized flooding.

1550 - Arrive at JAT and discuss Access to SWMU 69 for tomorrow.

1615 - Depart JAT for Fajardo and Check-In to Fajardo Inn. Heavy Rains continue - However, before checking in → stop at Gate 3 (NAPR) - guard informed us that only essential base personel are permitted due to flooding and heavy Rains.

Tuesday July 20, 2010

0620 - Call NAPR dispatch to see if essential personel still only permitted - Yes. Flooding along roadway near old golf course.

0740 - Arrive at JAT Airport.

0845 - Clear access with Airport operations to SWMU 69.

SWMU 69 Drainage Ditch Evaluation:

Weather conditions over the past 24 hrs. have included steady rains, often heavy. For safety - many roadways in the Ceiba area have been blocked by police.

SWMU 69 Drainage ditch carries a large amount of surface runoff downgradient. Adjacent (paved) apron has a significant influence on the amount

of water the ditch conveys via concrete runoff from the apron. A large amount of runoff from the concrete apron (Approx. 1-2" of H_2O) was entering the adjacent disturbed soil area (i.e. proposed soil grid system area). No other sources of influence (culvert, etc.) were observed.

As observed today, water within the SWMU 69 Ditch - only conveys surface runoff during precipitation events - to clarify, it does not appear as permanently saturated or inundated system supporting hydrophytic veg and hydric soils. It is assumed that the samples proposed within the ditch will be evaluated as soil and not sediment. However, a field det. will be made at a later date.

1000 - Call to dispatch verifies that only "essential personnel" are still only permitted at NAFR due to heavy rains and flooding.

1015 - Depart SWMU 69 - travel to Fajardo Inn to monitor weather situation and discuss field effort strategy and future approach. Local weather forecast has indicated add'l heavy rains could continue for the next 24-48 hrs.

Given the current weather situation in the area and subsequent issues; the decision was made to postpone this field effort. The proper steps will be taken in the near future to re-visit this investigation.

1410 - Depart Fajardo Inn - travel to SJU for flight to PIT.

1700 - Depart SJU

ADG

7/20/10

ADK

Friday September 17, 2010

1445 - Arrive at JAT operations area to obtain vehicle clearance to SWMU 69.

1455 - Arrive at SWMU 69.

- SWMU 69 Ditch System is contains water, Approximately 8-10" at deepest areas (furthest downgradient areas). Further upgradient water depth decreases to approx. 2-4 inches. Observed a few small areas with (scouring Rush) adjacent to ditch at furthest point downgradient - assoc. with Apron. Majority of dominant veg within ditch ~~is~~ are predominancy upland species.

1550 - Depart SWMU 69 and JAT Airport.

ADK

Friday November 5, 2010

0720 - Arrive at JAT - check in with Airport Personell

0730 - Arrive at SWMU 69.

0746 - Using GPS - Navigate to 69SD12 - Downgradient Sample Location - Small finger (tributary) to main ditch. Hydric Soil.
69SD12: 0-6", anaerobic Conditions - Saturated. No Vegetation within the ditch. Riparian or banks - White leaf tree is dominant species. No benthics observed. This portion of the ditch is approx. 15 ft. wide. Avg. Water depth Approx. 1 ft.

69SD11 - 0755. Hydric soils Low chroma colors. No Vegetation within ditch. Some veg. along banks as with SD12. Water depth approx 4". Sample depth 0-6".

11/5/10

0805 - 69SD14 - furthest downstream portion of main channel. Water depth approx. 1ft. Channel width 3 ft at sample location. Sand and, Silt, and cobble. White leaf tree along banks. No fish or benthics observed. Sample depth to 0-6". Flow is minimal.

0812 - 69SD13. Water depth approx. 10". Channel width 2 ft. Mostly Coarse Sand, Some shell fragments (Gastropod), and Silt. Saturated. Riparian vegetation similar to SD14. Note that the Adjacent banks are very steep

0820 - 69SD10. Channel width 6 ft. Water depth 8". Flow Not as obvious as it is at SD13 or 14. No fish or benthics. Mostly silt, Some coarse sand + clay.

11/5/10

0835 - 695D09 - Sand, little silt, gravel. Some shell fragments. Dense vegetation - White lead tree, Ocean blue morning glory, are majority - however, some hydrophytes are in the vicinity to sample location like Scouring Rush and Typha. sp. Channel width 8 ft. and water depth is approx. 11".

0842 - 695D08 - Channel width 5 ft. Water depth 8-9". No veg. within channel. Banks with White lead tree, and Ocean blue Morning glory - Some guinea grass.
Mostly silt, some shells. Little clay. 0-6" sample depth obtained. Minimal flow - Almost stagnant. Sulfur smell in sample.

11/5/10

0852 - 695D07 - Water stagnant No flow. White lead tree and morning glory, with some guinea grass. All along the banks. Water depth 3-4". Ditch width 2 ft. Hydric soils - low chroma colors (almost black) Sulfur odor. Sample depth to 6".

0901 - 695D06 - Small + clear shell fragments. Banks are eroded + steep. Channel width 1.5 ft. Water depth 3-4". Mostly sand + silt. Little clay. Minimal flow - Almost stagnant. No veg. in channel. White lead tree and morning glory along banks. Also along banks a very fragrant herbaceous species with a yellow flower (unknown species).

11/5/10

0926 - 69SD05 - Clayey silt, some sparse gravel. Saturated and hydric. Veg. within channel believed to be hydrophytic. 0-6" depth obtained for sample. No standing water.

0935 - 69SD04 - Vegetation within ditch (hydrophytic). White leadtree, Morning glory, and guinea grass along the banks. 0-6" sample depth. Clayey silt, sparse gravel. Saturated hydric soils (low chroma colors) (FAC) but Biscayne Creeping Oxeye

0940 - 69SD03 - Veg. within entire ditch. No water. Saturated. Silt and clay. dark brown in color.

0947 - 69SD02 + 69SD02 D/MS/MSD Veg. within ditch. No water in channel but saturated. Clayey silt. Hydric soils.

right turn at 0953

11/5/10

0956 - 69SD01 + D

Saturated. Hydric soils - low chroma colors. No water in channel. Clay mostly - grey in color. Mostly guinea grass + white leadtree in channel. No hydrophytes. This area channel begins to diminish.

→ Collect 69FB-SD 1005

1025 - Check-out with OPS.

1030 - Depart Summit 69.

→ LATE ENTRY: Before leaving - Collect 69ER SD if using D.I. water over an un-used stainless steel spoon.

1015

1100 - Back at Sec. to prep/pack for FedEX shipment.

Veg. At 69SD02 - 69SD05 identified as Wedelia Trilobata OR Sphagneticola Trilobata } by Biscayne Creeping Oxeye

Environmental Technician – Darrin Hupe

CONTENTS

PAGE NO.	REFERENCE	DATE

7/19/10

[Event: SWMU 63 Re-Sampling
Crew: D. Hope, J. Oliver, A. Gaeley]

0700. Depart PIT for Island.
1330. Arrive on Island proceedure to pick-up rental cars & Drive to Jose Aponte De La Torre Airport (JAT). Due to very heavy rains Rt. 53 was closed just south of Fajardo forcing us to negotiate our way around & to Airport via a longer backroads way.
1630. Arrived @ JAT & introduced ourselves to Mr.'s Santiago & Martinez (operation Supervisors). Mr. Santiago instructed us on proceedure for entering Airport's grounds tomorrow.
Arrived @ NAPR gate & was informed by the guard that access thru the base is closed to all 'non-essential' personnel - due to flooding, so access to Bld. 1205 (and all our supplies) is denied.

DNH

7/20/10

0615. Adam called NAPR Dispatch & confirmed that our route through the base is still flooded, therefore we cannot access Bld. 1205 & our supplies.
0745. Arrived @ JAT. Waited for operations Manager Santiago. Drove to SWMU 69 so that Adam ~~can~~ could observe drainage ditch.
1000. Adam called dispatch @ NAPR to ascertain if they would/could give us access to NAPR thru the Airport gate. Was told by watch commander that No - only "Essential (DOD) personnel are allowed on base due to flooding conditions & instru. from the base commander.

Due to flooding conditions, no access to NAPR & continued forcast of rain & possible Tropical storm, we aborted this weeks event & flew home on Wed. 7/21 - will re-schedule for a later date - DNH (8/12)

8/2/10

[Event: SWMU69
Crew: D. Hope / J. Oliver]

0615: Arrived @ PIT. Initial flight delayed 3hrs. - Diverted to Boston & arrived in San Juan @ 1550.
- 1740 Arrived @ NAPR, Bld. 1205 to Sort & load Supplies.
- 1815 - Depart Base

8/3/10

0700 - Arrive @ JAT operations Bld. Have to wait for Mr. Santiago to inform him of our arrival & intentions for this week.
0720 - Talk w/ Mr. Santiago.
0735. Arrive @ SWMU 69 to begin laying out Grid.
0825. Drillers @ SWMU 69 *
0905 - Drillers begin drilling operations

*Drillers are 'Geoenvironmental' (William & Nesser)

Weather: Breezy, Mostly Sunny (Drizzle in Am) ~85°F

8/3/10

0930 - Grid Complete

0925 - 69SB101-00 + 00D + MS/MSD

0- 10": Sandy gravel, light grey, moist

10"-36": clay reddish brown, moist
'Sandy'

0944 - 69SB101-01

0945 " -02

0957 69SB102-00

0959 " -01

1002 " -02

1010 69SB~~103~~ 152 -00

1012 " 152 -01

1014 " 152 -02

1015 69SB104 -00

1020 " -01

1020 " -01D

1023 " -02

1024 69SB151 -00

1024 " -00D

1025 " -01

1026 " -02

1033 69SB103 -00

1035 " -01

1036 " -02

* See J. Olivers Field Book for Sample Descriptions

8/3/10

1037 69SB150 -00

1038 " -01

1039 " -02

1041 69SB149 -00

1042 " -01

1044 " -02

1046 69SB105 -00

1047 " -01

1048 " -02

1050 69SB148 -00

1051 " -01

1052 " -02

1101 69SB106 -00

1102 " -01

1103 " -02

1105 - Performed Equip. Rinsate (69ER01) on Macro Core Liner

1117 69SB147 -00

1118 " -01

1120 " -02

" " -02D

" " -02MS/MSD

8/3/10

1130 695B107 - 00
1131 " -01
1133 " -02
1133 " -02D
1133 " -02MS/MSD
1136 695B146 - 00
1137 " -01
1138 " -02
1145 - 1245 : Drillers on Lunch

1248 695B108 - 00
1249 " -01
1250 " -02
1254 695B145 - 00
1255 " -01
1256 " -02
1306 695B109 - 00
1307 " -01
1308 " -02
1313 695B144 - 00
1314 " -01
1314 " -01D
1316 " -02

6
DNH

8/3/10

1320 695B110 - 00
1321 " -01
1322 " -02
1325 695B143 - 00
1326 " -01
1327 " -02

1400 - Drillers off Site
1410 - Depart SAT to head to BW. 1205
1435 - Arrived @ Bld. 1205 to ice samples, etc.
1600 - Depart Site

7
DNH

8/4/10 Weather: Mostly cloudy, breezy, 88°F

0730. Arrive @ JAT
0755. Collect Equip. Rinsate (69ER02) w/ SS Spoon
0810. Drillers on site @ SWMU 69
0820. Commence Drilling.

0827	69SB111	-00
0827	"	-00D
0829	"	-01
0830	"	-02
0836	69142(SB)	-00
0837	"	-01
0838	"	-02
0841	69SB112	-00
0842	"	-01
0843	"	-02
0849	69SB141	-00
0849	"	-00D
0849	"	-00MS/MSD
0854	"	-01
0855	"	-02

3

DNH

8/4/10

0855	69SB113	-00
0856	"	-01
0857	"	-02
0907	69SB140	-00
0908	"	-01
0909	"	-02
0915	69SB114	-00
0916	"	-01
0916	"	-01D
0916	"	-01MS/MSD
0918	"	-02
0924	69SB139	-00
0925	"	-01
0926	"	-02
0930	69SB115	-00
0931	"	-01
0932	"	-02
0935	69SB138	-00
0936	"	-01
0937	"	-02
0955	69SB116	-00
0956	"	-01
0957	"	-02

9

DNH

8/4/10

1005	69SB137	-00
1006	"	-01
1007	"	-02
1007	"	-02D
1013	69SB117	-00
1014	"	-01
1015	"	-02
1015	"	-02D
1022	69SB136	-00
1023	"	-01
1024	"	-02

1020: Surveyors (PSDC) on-site. Will work to bring control points over to SWMU 69. (Victor + Guillermo)

1052	69SB118	-00
1053	"	-01
1054	"	-02
1103	69SB135	-00
1104	"	-01
1105	"	-02

8/4/10

Weather: Mostly Sunny, breezy, ~90°F

1127	69SB119	-00
1128	"	-01
1130	"	-02

1135-1240 Drillers on Lunch.

1140 - Jay + I look for Surveying control points. Easily found Station "Cruces". "Able" is on other side of barbed wire gate/fence. Access from the other side is barred by road Barriers.

1300	69SB134	-00
1301	"	-01
1301	"	-01D
1301	"	-01 MS/MSD
1305	"	-02
1313	69SB120	-00
1314	"	-01
1315	"	-02

8/4/10

1327 69SB133 -00
1328 " -01
1330 " -02
1342 69SB121 - 00
1342 " -00D
1342 " -00MS/MSD
1345 " -01
1347 " -02
1355 69SB132 -00
1356 " -01
1357 " -02
1410 - Drillers off site.
1500 - Depart JAT to head to Bld. 1205.
1600 - Depart Bld. 1205.

Did not see Surveyors or observe when they departed.

8/5/10 Weather: Mostly cloudy, breezy, ~85°F

0800 - Arrive @ JAT
0830 - Drillers on Site

0850 69SB122 - 00
0851 " -01
0852 " -02
0855 69SB131 - 00
0855 " -00D
0857 " -01
0858 " -02
0900 69SB123 - 00
0901 " -01
0902 " -02
0904 69SB130 - 00
0905 " -01
0906 " -02
0909 69SB124 - 00
0910 " -01
0910 " -01D
0912 " -02
0915 69SB129 - 00
0916 -01
0917 -02

8/5/10

0924	69SB125	-00
0925	"	-01
0926	"	-02
0930	69SB128	-00
0931	"	-01
0932	"	-02
* 1010	69SB126	-00
1012	"	-01
1014	"	-02
0935	69SB127	-00
0936	"	-01
0937	"	-02
0937	"	-02D
0937	"	-02 MS/MSD

0940 - Drillers developed a cut/hole in hydrolic line - attempt to fix - cannot fix on-site *(see page 15)

* This sample taken w/ 2" Dia. Bucket Auger.

1110 - Called Surveyors office as we had yet to see them on-site. Office said that there was a problem w/ them coming today & that they are expected on site tomorrow.

8/5/10

1130 - Obtained Equip. Rinsate (69ER03) w/ pic pam

1140 - Obtained Field Blank (69FB01) (Lab grade DI)

Note: Within our grid visible there were no 'piles' or debris ~~Retrced~~. Most of the grass is waste high with patches of tree growth ~ 20' high. No ditch samples were taken due to up to 2' of standing water in all low-lying areas. Water does not seem to be dissapointing over time.

* A track Hydrolic line was punctured. Drillers were able to obtain new line & install on-site.
- While William worked on the rig, Nasser grouted boring holes.

1430 - Drillers loaded up off site - SWMU 69 Sampling complete. We will stop by on Mon. 8/9 to see if the status of the ditch has improved.

8/5/10

1440. Depart SWMU 69 to head to Bld. 1205. to process samples & retrieve rental equip. & supplies shipped by Field Environ. for MNA - will go thru all to verify working operation.
* Heavy rain squall just as we departed.

Departed Bld. 1205 @ 1600.

8/6/10

0815 - Arrived @ NAPR to prepare pack, label & ship samples from 69.

0855 - Received a call from Victor (PSDC) to inform me that they are @ SWMU 69 today. They will work to shoot in grid points then will bring in control. He does not expect to finish today. I asked about working over the weekend. He said No to that & that they will be back on Monday.

* Noticed on Tue. that there was no power to the outlets in our storage room @ Bld. 1205. Arranged with dispatch to have checked out by electrician this morning. Waiting in room till work →

K DNH

→ complete as don't wish to leave room unattended.
- 1300: Electricians completed fixing room outlets.

~~- Performed~~

1330 - proceeded to begin MNA groundwater sampling @ Site 124.

- Fed-X pickup up coolers btw. 2:30-3:30pm.

• Say I to perform groundwater sampling (MNA) thru 8/8/10.

8/9/10

0840 - Arrived @ SAT to take a look at the status of water in the ditches. Surveyors

0845 - ~~Surveyors~~ called. Said they needed to get onto NAPR to pull a 2nd control point over to SAT. Met them @ Gate 3 @ 0920 - Said they would be on base for ~ 1hr., then over to SAT. They should complete the site today.

0845

17
DNH

8/9/10

Note: More water (& over a bigger area) was noticed in the low-lying areas leading up to the Ditches @ SWMU69. Also more water noticed in Ditches from last week - up to 2ft in areas. Obvious signs of recent rains all over SAT. Took pictures.

0930 - Back to Bld. 1205. Done with this portion of SWMU69 Sampling.

1140 - Surveyors called to say they have finished at the Airfield - SAT.

1630 - Depart NAPR, after MNA De-Mobe. Fly back to PIT tomorrow, 8/10.

18
DNH

Environmental Geologist – Jason Oliver

mostly sunny breezy 80's

Site 69 JAT airport T - 8/3/10

0700 - on site @ main operations building to check in - waiting on J. Springer to check in.

0733 - Checked in at airport - departed to site 69 - preparing to gps/map site layout grid

0825 Drillers on site -

0835 - Darrin pull out of laying grids - move to make drillers - J. continue laying out grid.

0940 - grid layed out/complete - may not be able to get SB127 & SB128 - currently >1' of standing water in locations - 128 may be possible - 127 not as likely.

0950 - return to drillers to begin sample processing/collection - logging borings while Darrin collects samples & refer to following pages -

1145 - drillers break for lunch.

1245 - drillers resume drilling - refer to following pages for boring logs

1345 - drillers begin backing down - walk through site - 20 borings done ~32 remaining - check 127, 128 - w/ drillers - should be able to get 128 - will

mostly sunny breezy 80's

Site 69 JAT Airport T - 8/3/10

have to check grid on 128 to confirm whether we can get samples in grid or not. walked through with drillers

- found ditch again - 5-7.11 standing water. some higher grass dry - 6-8" water through most of ditch.
- 4.5" water standing off from ditch near 128 location

1400 - drillers outbound for day - will resume tomorrow
- will return to room 1205 to ice samples and get additional coolers / materials

1410 - check out w/ operations @ airport.

1435 - Arrive @ 1205 on NABR - will ice samples & get new coolers. check schedules for next day.

1600 - finishing for day - outbound. samples iced - placed into coolers. inventory checked all good

mostly sunny breezy 80's

Site 69 JAT Airport T - 8/3/10

SB 152 (0954) 0-.9' dark brown dry silty sand w/ some angular (#57) gabbles - Dry
0.9 - 1.7 - light tan shelly coarse sand w/ some sparse gravel - moist
1.7 - 4' red/orange mottled clays - dry

SB 102 (0958)
0 - .1' - dark brown organic rich silty sand - dry
.1 - .4 grey coarse sand w/ some gravel rounded - damp
.4 - 4' - orange/red inhomogeneous/mottled clay - dry

SB 151 - (1002)
- 0 - .6' brown silty sand w/ some clay
- .6 - 1.1 - dark brown silty sand w/ some clay some white gravel & some asphalt chunks present.
1.1 - 4 - orange/red mottled clay

SB 103 - (1005)
0 - .1 - dark brown organic rich top soil
.1 - .8 tan - light grey sand w/ sparse gravel & few cobbles - dry
.8 - 4' orange/red mottled clay

SB 150 - (1008)
0 - .2' dark brown organic top soil
.2 - .6 - orange - red silt w/ clay sparse gravel
.6 - 4' orange/red clay

mostly sunny 80s
breezy

Site 69 JAT Airport T- 8/3/10

SB 104 . (1012)

0-.2 - dark brown organic rich top soil

.2- 1.1 - light tan medium sand

gets finer with depth - sparse gravel

1.1 - 4- red/orange clay

SB 149 - (1031)

0- .1' dark brown organic rich top soil

.1- .9 orange clayey silt w/ some sand

.9 - 4' orange / orange/red mottled

SB 105 (1033)

0- .2 organic top soil

.2 - 1.1 - gray gravel & sand (21 ft.)

1.1 - 4' orange & red clay

SB 148 - (1045)

0- .2" dark brown organic top soil

.2 - 4' orange / red intermingled clays

SB 106 - (1100)

0- .2 dark brown organic top soil

.2 - 1.3 - tan sand - getting finer w/ depth

some gravel near top

1.3 - 4- orange/red clay

SB 147 - (1113)

0- .2" dark brown top soil

.2 - 2.5' orange-red intermingled clay - some sand

2.5 - 4' light tan clay some red clay interbedded

mostly sunny 80's
breezy

Site 69 JAT Airport T- 8/31/10

SB 107 (1124)

0- .2 - dark brown top soil

.2 - 3.2 - light gray sand - coarse moist bottom

3.2 - 4 - red/orange clay

SB 146 (1132)

0- .2 dark brown silty top soil

.2 - .4 orange - red intermingled clay

.4 - 1.4' light gray clay w/ some silt

1.4 - 2.8 - orange silty clay w/ sparse sand

2.8 - 4 - light gray clay w/ some red clay bedding

SB 108 (1246)

0- .2" dark brown - organic rich sandy top soil

.2 - 2.4' light gray coarse sand w/ some shelly material & coral fragments - some gravel

2.4 - 4' orange/red clay

SB 145 (1252)

0- .2' dark brown organic sandy top soil

.2 - .7' black & white sand some shell fragments

.7 - 1.4 - red/orange clay w/ some black nodules

1.4 - 4 - red/orange clay w/ some light gray lenses - dry

SB 109 (1304)

0- .3 dark brown organic silty sand top soil

.3 - .6 - light gray coarse sand - some shell material

.6 - 3.5 - brown / dark orange interbedded clay

3.5 - 4 . dark red sandy clay

sunny - high 80s
breezy

Site 69 JAT Airport T-8/3/10

SB144 (1312)

0-.2" dark brown sandy top soil

.2-.4 grey sand w/ gravel & shell fragments

.4-.8- black & orange interbedded clays

.8-2'- red/orang clay

2-4' light gray clay w/ some red/orang interbeds

SB110 (1328)

0-.15 dark brown silty organic top soil

.15-1.1' brown - light tan coarse sand some shelly material, some sparse gravel - some silt

1.1-4 red/orang clay

SB143 (1322)

0-.2- dark brown-black organic sandy top soil

.2-.5 brown-tan silty sand w/ some gravel.

.5-4' orange/red clay

mostly sunny mid 80s

Site 69 JAT Airport W - 8/4/10

0730- on site @ JAT Airport/Site 69 - begin daily prep awaiting arrival of drillers - set up & collect field blank.

0800- drillers on site.

0815- begin geoprobe, resuming where left off from previous day - refer to following pages for boring logs of probes.

1130- Drillers break for lunch.

1140- move to attempt to locate benchmarks for surveyors - can't

1200- could not access Able station - found Cruces station - surveyors should be able to carry in from Cruces.

1240- confirm with surveyors on points - they will go & check on how to bring in control.

- Drillers return from lunch, resume setup

1400- drillers begin breakdown.

1415- drillers off site.

- move to look @ ditch & try to map out a spot in 127 - 128 previously mapped.

1500- managed to stop pump in front corner of 127 grow - checked ditch - still 6-8" plus of standing water in ditch throughout 4-6" water off of grass - water appears

mostly sunny low 80s

Site 69 - JAT Airport W - 8/4/10

to have receded some, but still depth throughout - still questionable -

- move off site - return to 1205 to pack samples & ice them - & clean remaining supplies -

1100 - finish separating coolers - filling samples & checking PPE - depart NAPR.

finished on site for day/

mostly sunny mid 80s

Site 69 JAT Airport W - 8/4/10

SB111 (0827)

0-.2 - dark brown organic sandy top soil

.2-.7 - light tan med-coarse sand w/ some silt - some gravel & some shelly material

.7-2.6' - dark brown silty clay grading to orangish red to bottom

2.6-4' orange/red clay

SB142 (0837)

0-.2 dark brown silty organic top soil

.2-1 - light brown/black gravelly sand

1-4' orange/red clay

SB112 (0842)

0-.1 dark brown organic top soil

.1-1 tan silty sand getting finer w/ depth some silt / cobble & gravel present sparse shelly material

1-2' brown silty clay

2-4' orange/red clay some silt beds

SB141 (0847)

0-.2 organic sandy top soil

.2-.4 dark brown silty sand

.4-1' light orange sand (med) w/ some gravel & shell fragments

1-1.5' brown silty clay

1.5-4' orange-red clay w/ some silt

Sunny - mid 80's

Site 69 JAT airport w/ 8-4-10

SB 113 (0852)

0-2' light tan medium sand w/ gravel/ shell fragments, sparse cobble & some silt

2-4' dark brown clay w/ some dark orange interbeds & red nodules

SB 140 (0905)

0-.2- dark brown sandy top soil

.2-1.2- brown silty clay w/ sparse gravel. some sand

1.2-4' light orange silty clay

SB 114 (0914)

0-.2 - dark brown organic sandy top soil

.2-.5 brown sandy silt, moist

.5-1.5- tan silty sand gets finer w/ depth some sparse gravel/shell fragments - dry

1.5-3- brown silty clay w/ some red/ orange clay nodules - dry

3-4- red/orange clay w/ some silt

SB 139 (0921)

0-.2 dark brown sandy top soil

.2-1.5' tan med sand w/ ~~some~~ shell fragments & sparse gravel/ cobbles

1.5-4 - orange/red clay w/ some silt

Sunny mid 80's

Site 69 - JAT airport w-8/4/10

SB 115 (0926)

0-.2- dark brown sandy top soil

.2-1 dark brown med sand w/ some gravel

1-1.7- tan med sand - gets finer w/ depth some gravel present

1.7-4 - brown/orange silty clay

SB 138 (0934)

0-.3- dark brown silty top soil - dry

.3-2' brown silty clay transitioning to orange w/ depth - dry

2-4' orange/red silty clay - dry

SB 116 (0955)

0-.2- dark brown silty sand top soil

.2-1 brown/tan silty sand w/ some gravel & coral fragments

1-1.7 - light tan sand w/ coral & shell fragments

1.7-4' dark orange silty clay some red silty nodules towards bottom

SB 137 (1002)

0-.5 dark brown clayey silt w/ some sand

.5-4' orange silty clay w/ some light grey and red nodules (red) dry

Sunny high 80s

Site 69 JAT Airport w/ 8-9-10

SB117 (1012)

0-.2 - dark brown organic sandy top soil

.2-1.2 - tan sand w/ some silt & shell fragments. - coarse lens at 1.1 depth w/ some gravel

1.2-4 dark brown silty clay - some orange transition at depth.

SB 136 (1022)

0-.5 - brown clayey silt

.5-1.5 - brown silty clay w/ some black nodules

1.5-3 - brown & grey interbedded clay some red nodules

3-4 - orange & grey interbedded clays

SB 118 (1051)

0-.1 dark brown sandy top soil

.1-1.1 tan sand - med-coarse with gravel and some cobble interdispersed

1.1-4 - brown - dark orange silty clay

SB135 (1104)

0-.2' dark brown sandy top soil

.2-1 dark gray blue / orange interbedded clay

1-4 - orange silty clay

SB 119 (1116)

0-.2 - dark brown organic top soil

.2-2.8 - tan silty sand w/ some concrete fragments gravel, cobble

2.8-4 - orange dark - silty clay

mostly sunny high 80's - low 90s

Site 69 JAT Airport - w - 8/4/10

SB 134 (1255)

0-.2 - dark brown organic silty top soil

.2-4' orange / brown silty clay

SB 120 (1304)

0-.3 - dark brown silty top soil

.3-.7 silty gravel - brown silt through angular gravel / cobble. (21 ft)

.7-1.2 - tan silty sand w/ some shell fragments

1.2-2 - brown silty clay

2-4 - orange / red clay.

SB 133 (1313)

0-.2 - dark brown silty sand on top soil

.2-4' orange & light gray silty clay - silt decreases with depth to mostly clay at 4' interval.

SB 121 (1318)

0-.3" dark brown silty sand top soil

.3-.9' light tan medium sand w/ some shell fragments & sparse gravel

.9-4' brown silty clay - color transition to orange-ish brown w/ depth

SB 132 (1324)

0-.2 - dark brown silty sand top soil

.2-1.7 tan & orange silty clay

1.7-4' gray silty clay w/ some red nodules & sparse cobble.

Cloudy 80's

Site 69 - JAT Airport R - 8/5/10

0800 - Arrive on Site @ JAT - check in at operations - move to site 69 area

0830 - Drillers on site set-up / prep

0845 - Start drilling - refer to following pages for boring logs on remaining borings for site 69 -

1000 - Cracked hydraulic line on geoprobe rig - All spilled out to be cleaned up & will see if a field repair is possible

1015 - All spilt oil recovered - Very little oil released - but all cleaned & removed no visible leak in hoses when machine not in operation -

- William will continue to work on machine.

- Will hand auger the final sample.

1030 - Final sample collected using hand auger - William continue to work on machine

1045 - Drillers setting up to grout holes -

1130 - Drillers out to lunch & out to pick up a new hose for the geoprobe rig - Will return

1230 - Geoenvirotech return from lunch -

1 - goes to fixing geoprobe rig, 1 resume grouting -

- - Field team

Cloudy 80's

Site 69 - JAT Airport R - 8/5/10

1300 - Site walk through -

- no piles were observed on site during site walk - recommend to try to find any piles, none were observed, but may be attributed to dense vegetation throughout site - no debris observed

1400 - William had geoprobe rig repaired - loading up to remove from site - Continued grouting borings - Continue looking over site

1430 - Drillers backs up & outbound - leave site to return to Bldg 1205 - NABR

1500 - Back in room - processing / icing samples - swapping ice out - getting ready for shipment - received equipment for MIA - inventory & check that everything is functional -

- problem in room - outlets not working in room - check w/ front desk - put in maint. q.th.

1545 - out to gauge wells

1600 - headed outbound for NABR for day

Cloudy 80's

Site 69 SAT Airport. R- 8/5/10

SB 122 (0846)

0-.2' dark brown silty organic top soil

.2-.7' brown silty sand some clay

.7-4' orange/red clay w/ some silt

SB 131 (0851)

0-.2 - dark brown silty topsoil

.2-.6 - dark tan med sand

.6-1.2 dark brown silty clay w/ some gravel mixed in, some sand

1.2-2 - brown silty clay

2-4 red/orange silty clay

SB 123 - (0855)

0-.3- dark brown silty top soil

.3-1.2 black & white silty sand w/ shell fragments, gravel, cobble, coral interdispersed

1.2-4- brown/orange silty clay - red appears at depth

SB 130 (0900)

0-.2- dark brown organic silty top soil

.2-.4 silty gravel lens - angular (21B)

.4-4' red/orange clay - some gray nodules
clay content increases w/ depth

SB 124 (0908)

0-.2' dark brown silty top soil

.2-.8 med brown/white sand w/ some gravel & shell material

.8-2.2- bluish grey clay - damp

2.2-4' brown silty clay

85

Cloudy 80's

Site 69 SAT Airport R- 8/5/10

SB 129 (0912)

0-.1 dark brown sandy top-soil

.1-4' orange/red silty clay w/ lenses of grey clay
- clay content increases w/ depth

SB 125 (0918)

0-.2' dark brown sandy top soil

.2-1.2' dark orange silty clay w/ sparse gravel

1.2-4' Black & white sand w/ shell & coral fragments moist.

2.4-4. dark orange silty clay

SB 128 - (0924)

0-.2" dark brown organic silty top soil

.2-2' orange silty clay w/ grey nodules
red silty lenses sporadically dispersed.

2-4' grey clay w/ red silty nodules

SB 127 (0931)

0-1.1- dark brown silty clay - wet

1.1-1.5 light tan loose sand & shell fragments

1.5-4' grey silty clay w/ red silty nodules interdispersed. clay ↑ w/ depth

SB 126 - (1021)

0-.3 dark brown silty sand top soil

.3-2.0 brown silty clay w/ shelly material
grey clay nodules w/ depth.

2.0-2.5 brown shelly sand w/ brown clay nodules

2.5-4 - dark orange silty clay w/ brown nodules

86

Mostly Sunny mid-high 80s

MPA AOLP-10C J803 11/4/10

1445 Returned to 1205 to finish & get samples ready for shipment.

1500- All samples packed / ready to ship.

1600- All field equipment decomned / packed for shipment back to FEI will ship tomorrow.

1630- Set up for tomorrow for Site 69

1730- on way to 731 for info Fedex -

- issue with samples - sample coolers MIA

- working w/ fedex to determine where sample coolers are

1800- found coolers in Bldg 192 - got them to fedex - outbound.

- finished for day - outbound.

12 on station

22.8

Mostly Sunny mid 80s

Site 69 11/5/10

0720 Arrive @ JAT - check in @ operations w/ Andy

0730- At 69 beginning set-up - refer to AG field book for references to 69 soil/sed samples and sample notes

0930- Continue sampling @ 69

1030 - Check out w/ operations at airport - sampling complete outbound for JAT Airport

1100- Return to 1205 to inv/pack samples & prep for shipment

- All field equipment packed & moved to main patio for pickup

1300- continued prep / pack of other miscellaneous

1400- Start decon through housing - notified watch desk that I would

1530- move to station to rebuild & finish out

1600- outbound for NAPR for day

0 on station

22.8

SOIL BORING LOGS AND WELL CONSTRUCTION RECORDS
2008 CMS INVESTIGATION

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB07
COORDINATES:	EAST: 930178.4	NORTH:	808325.9
ELEVATION:	138.3	TOP OF PVC CASING:	140.77

Rig: Geoprobe 66DT	MC Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"	--	4-1/4"	--	4/29/2008	16.5	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2"	0	6.5
Schedule 40 PVC Screen	2"	6.5	16.5

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1					69SB07-00 (0-1')		Sandy clay, grayish brown moderately soft, damp		
2		D-1	2.7 68%		69SB07-01 (1-3')	<1	gravel from 0.5 to 0.8' Clay reddish brown, stiff, damp some silt	2" PVC Riser	
3								Bentonite 2.5 to 4.5'	135.8
4	4.0								
5							Sandy Clay becomes maroon and reddish brown, moderately soft damp		133.8
6		D-2	4.0 100%			<1		Top of 2" PVC Screen @6.5'	131.8
7									
8	8.0								
9		D-3	4.0 100%			<1		Sand 4.5 to 16.5'	
10					69SB07-05 (9-11')		Clay becomes yellow at 10', stiffer, damp		

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.:	69SB07

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB07

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger	SPT = Standard Penetration Test (ASTM D1586)
T = Shelby Tube W = Wash	PID = Photo Ionization Detector Measurement
R = Air Rotary C = Core	MSL = Mean Sea Level
D = Denison P = Piston N = No Sample	ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11		D-3	4.0 100%			<1	continued Clay, yellow brown, stiff damp to moist		
12	12.0								
13		A	NA					Sand 2"PVC Screen	
14									
15									
16	16.5						Bottom of Well		121.8
17									
18									
19									
20									
21									
22									
23									
24									
25									

DRILLING CO.: JFA BAKER REP.: Joe Burawa

DRILLER: Domingo Gonzalez BORING NO.: 69SB07 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB08
COORDINATES:	EAST: 930157.4	NORTH:	808287.4
ELEVATION:	136.8	TOP OF PVC CASING:	139.82

Rig:	Geoprobe 66DT				Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	MC Sampler	Casing	Augers	Core Barrel				
Size (ID)	2.5"	--	4-1/4"	--	4/29/2008	16	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2"	0	6.0
Schedule 40 PVC Screen	2"	6.0	16.0

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1, 2, 3, 4	4.0	D-1	4.0 100%		69SB08-00 (0-1') 69SB08-01 (1-3')	<1	Sand and shells first 4", loose, damp; Reddish brown and light yellow clay dry to moist	2" PVC Riser; Bentonite 2.0 to 4.0'	134.8; 132.8
5, 6, 7, 8	8.0	D-2	4.0 100%			<1	becomes soft and moist at 7'	Top of 2" PVC Screen@6.0'	130.8
9, 10		D-3	4.0 100%		69SB08-05 69SB08-05D 69SB08-05MS/MSD (9-11')	<1	occasional sandy zone dry to moist	Sand	

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.:	69SB08 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11		D-3	4.0 100%			<1	continued Reddish brown and light yellow clay		
12	12.0								
13		A	NA					Sand	
14								2" PVC Screen	
15									
16	16.0						Bottom of Well		120.8
17									
18									
19									
20									
21									
22									
23									
24									
25									

DRILLING CO.: JFA BAKER REP Joe Burawa

DRILLER: Domingo Gonzalez BORING NO 69SB08 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB11
COORDINATES:	EAST: 930016.7	NORTH:	808370.0
ELEVATION:	141.3	TOP OF PVC CASING:	144.44

Rig: Geoprobe 66DT	MC Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"	--	4-1/4"	--	4/29/2008	16	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2"	0	6.0
Schedule 40 PVC Screen	2"	6.0	16.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1, 2, 3, 4 (4.0)	D-1	4.0 100%		69SB11-00 69SB11-00D (0-1') 69SB11-01 (1-3')	<1	2" topsoil black, soft, moist then sand and gravel, damp to moist loose, some silt; Brown gray clay, very lean, stiff, damp	2" PVC Riser; Bentonite 2.0-4.0'	139.3; 137.3
5, 6, 7, 8 (8.0)	D-2	4.0 100%			<1	becomes brown clay at 4.2 ' some silt, moderately stiff, damp	Sand 4.0-16.0'; Top of 2" PVC Screen @6.0'	135.3
9, 10	D-3	4.0 100%		69SB11-05 (9-11')	<1	Sandy clay at 8.4' softer, damp to moist, some mottling medium brown color, fine-grained sand	Sand	

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.:	69SB11

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB11

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11							continued		
		D-3	4.0			<1	Sandy clay, brown		
12	12.0		100%						
13							Sand and gravel at 12.5' to 14' saturated, rose colored	Sand	
14		D-4	3.0 75%			<1		2" PVC Screen	
15							Light reddish brown clay		
16	16.0						Bottom of Well		125.3
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

DRILLING CO.: JFA BAKER REP.: Joe Burawa

DRILLER: Domingo Gonzalez BORING NO.: 69SB11 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB12
COORDINATES:	EAST: 930040.1	NORTH:	808311.0
ELEVATION:	138.9	TOP OF PVC CASING:	142.09

Rig: Geoprobe 66DT	MC Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"	--	4-1/4"	--	4/29/2008	15	Sunny, Hot	
Length	5'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2"	0	5.0
Schedule 40 PVC Screen	2"	5.0	15.0

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID ppm	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1				69SB12-00 (0-1')		Topsoil first 2", black, moist sand and gravel to 1.1, loose		137.9
2	D-1	4.0 100%		69SB12-01 (1-3')	<1	Lean clay, brownish gray stiff, some silt, damp	2" PVC Riser; Bentonite 1.0 to 3.0'	
3								135.9
4	4.0							
5						Silty clay, medium brown and gray, moderately stiff damp		133.9
6	D-2	4.0 100%			<1		Top of 2" PVC Screen @6.0'	
7						Becomes moist at 7.6'		
8	8.0							
9	D-3	4.0 100%		69SB12-05 (9-11')	<1	Sandy clay, brownish gray,	Sand 3.0 to 15.0'	
10								

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.: 69SB12	SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB12

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11		D-3	4.0 100%			<1	continued, sandy clay		
12	12.0						Sand and gravel, saturated medium-grained sand, angular gravel		
13		A	NA					Sand	
14									
15	15.0						Bottom of Well		123.9
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

DRILLING CO.: JFA BAKER REP. Joe Burawa

DRILLER: Domingo Gonzalez BORING NO. 69SB12 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB25
COORDINATES:	EAST: 930442.2	NORTH:	808406.0
ELEVATION:	SURFACE: 135.7	TOP OF PVC CASING:	138.62

Rig:	Geoprobe 66DT				Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	MC Sampler	Casing	Augers	Core Barrel				
Size (ID)	2.5"	--	4-1/4"	--	4/30/2008	18	Sunny, 85	
Length	4'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2.0"	0	8.0
Schedule 40 PVC Screen	2.0"	8.0	18.0

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1							Topsoil first one inch black, soft		
					N		Sand and gravel (rocks), med.gray	2" PVC	
			4.0		O		Dark brown clay, very lean,	Riser	
2			100%			< 1	stiff, damp		
		D-1			S			Cement/	
3					A			Bentonite	
					M			Grout	
4	4.0				P				131.7
					L			Bentonite	
5					E			4.0 to 6.0'	
			4.0		S				
6		D-2	100%			< 1	Reddish brown sandy clay, damp		129.7
					C		moderately stiff, mottled		
7					O				
					L				
8	8.0				L				127.7
					E			Top of	
9			4.0		C			PVC Screen	
		D-3	100%		T	< 1		at 8.0'	
10					E			Sand	
					D		White/light gray with red clay	6.0 to 18.0'	

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.:	69SB25 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB25

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger	SPT = Standard Penetration Test (ASTM D1586)
T = Shelby Tube W = Wash	PID = Photo Ionization Detector Measurement
R = Air Rotary C = Core	MSL = Mean Sea Level
D = Denison P = Piston N = No Sample	ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11							continued		
		D-3	4.0 100%			<1	White/light gray with red clay some silt, stiff, damp		
12	12.0							Sand	
13							Sandy clay, with sand fractions medium brown, wet, moderately soft mottled clay, some silt throughout		
14		D-4	4.0 100%			<1		2" PVC Screen	
15									
16	16.0								
17		A	NA						
18	18.0						Bottom of well 18.0'		117.7
19									
20									
21									
22									
23									
24									
25									

DRILLING CO.: JFA BAKER REP.: Joe Burawa

DRILLER: Domingo Gonzalez BORING NO.: 69SB25 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB26
COORDINATES:	EAST: 929763.83	NORTH:	808231.47
ELEVATION:	SURFACE: 143.5	TOP OF PVC CASING:	146.30

Rig: Geoprobe 66DT	MC Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"	--	4-1/4"	--	5/1/2008	18	Sunny 85	
Length	4'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2.0"	0	8.0
Schedule 40 PVC Screen	2.0"	8.0	18.0

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1, 2, 3, 4	4.0	D-1	4.0 100%		NO SAMPLES COLLECTED	< 1	First 0.1' topsoil, brown, medium soft Lean clay, brown, moderately stiff to stiff, damp, some pebbles Silty clay, reddish brown, some sand, dry, fractured	2" PVC Riser Cement/ Bentonite Grout	139.5
5, 6, 7, 8	8.0	D-2	4.0 100%			< 1	Sandy clay, moderately stiff, damp to dry, reddish brown & olive brown, at 5.6' becomes softer	Bentonite 4.0 - 6.0 Sand 6.0 - 18.0	137.5 135.5
9, 10		D-3	4.0 100%			<1		2" PVC Screen 7.8 - 17.8'	

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.:	69SB26 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB26

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger	SPT = Standard Penetration Test (ASTM D1586)
T = Shelby Tube W = Wash	PID = Photo Ionization Detector Measurement
R = Air Rotary C = Core	MSL = Mean Sea Level
D = Denison P = Piston N = No Sample	ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11							continued		
12	12.0	D-3	4.0 100%			<1	Brown sandy clay		
13							Lean clay from 12 - 12.8', very hard brownish red	Sand	
14		D-4	4.0 100%			5	Sandy clay, moderately soft, dry to moist, becomes more brown at 15'	2" PVC Screen	
15									
16	16.0								
17		A	NA						
18	18.0						Bottom of well 18.0'		125.5
19									
20									
21									
22									
23									
24									
25									

DRILLING CO.: JFA BAKER REP.: Joe Burawa

DRILLER: Domingo Gonzalez BORING NO.: 69SB26 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico - SWMU 69		
PROJ. NO.:	111626	BORING NO.:	69SB27
COORDINATES:	EAST: 930053.6	NORTH:	808169.0
ELEVATION:	SURFACE: 140.6	TOP OF PVC CASING:	143.44

Rig:	Geoprobe 66DT				Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	MC Sampler	Casing	Augers	Core Barrel				
Size (ID)	2.5"	--	4-1/4"	--	5/1/2008	18	Sunny 85	
Length	4'	--	5'	--				
Type	--	--	Hollow	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Schedule 40 PVC Riser	2.0"	0	8.0
Schedule 40 PVC Screen	2.0"	8.0	18.0

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1, 2, 3		D-1	4.0 100%		69SB27-00 (0-1') 69SB27-01 (1-3')	5 to 10	Brown silty clay, moderately stiff, damp to dry	2" PVC Riser; Cement/ Bentonite Grout	
4	4.0						Clay with some silt, red/brown moderate stiff, damp to dry		136.6
5, 6, 7		D-2	4.0 100%			30 to 40	Sandy clay, damp, light red/brown moderate hard, stiff	Bentonite 4.0 - 6.0'; Sand 6.0 - 18.0	134.6
8	8.0								132.6
9, 10		D-3	4.0 100%		69SB27-05 (9-11')	100 to 300	some white clay throughout, hard, strong odor	Top of PVC Screen @ 8.0'	

DRILLING CO.:	JFA	BAKER REP.:	Joe Burawa
DRILLER:	Domingo Gonzalez	BORING NO.:	69SB27 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico - SWMU 69

SO NO.: 111626 BORING NO.: 69SB27

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11		D-3	4.0 100%			100-300	continued Sandy clay mixed with white clay		
12	12.0								
13		D-4	4.0 100%			300 +	Sand with some clay, more gray in color, strong odor, damp to moist, clay is more plastic	2" PVC Screen	
14									
15								Sand	
16	16.0								
17		A	NA						
18	18.0						Bottom of well 18.0		122.6
19									
20									
21									
22									
23									
24									
25									

DRILLING CO.: JFA BAKER REP.: Joe Burawa

DRILLER: Domingo Gonzalez BORING NO.: 69SB27 SHEET 2 OF 2

SOIL BORING LOGS AND WELL CONSTRUCTION RECORDS
2010 DISTURBED SOIL SAMPLING INVESTIGATION

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB101

COORDINATES: EAST: 772871.19 NORTH: 153083.43

ELEVATION: SURFACE: 157.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	3.0 100%		69SB101-00 & Duplicate 69SB101-01 69SB101-02	BKG	0.0-0.8 Light grey sandy gravel. Moist. (0.8)	156.3
2							0.8-3.0 Reddish brown sandy clay. Moist	
3	3.0						(3.0)	154.1
4							End of Boring at 3.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Darrin Hupe

DRILLER: William Rodrigez BORING NO.: 69SB101 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB102

COORDINATES: EAST: 772910.83 NORTH: 153072.52

ELEVATION: SURFACE: 155.8

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1					69SB102-00		TOPSOIL (organics) 0.1	155.7
							0.1-0.4 Grey coarse sand with some rounded gravel. Damp 0.4	155.4
		D-1	4.0 100%		69SB102-01	BKG		
2							0.4-4.0 Orange/red interbedded clay. Dry	
					69SB102-02			
3								
4	4.0						4.0	151.8
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB102 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB103

COORDINATES: EAST: 772964.08 NORTH: 153052.42

ELEVATION: SURFACE: 153.8

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB103-00		TOPSOIL (organics) 0.1	153.7
1							0.1-0.8 Tank-light grey sand with sparse gravel and 0.8	153.0
		D-1	4.0		69SB103-01	BKG	cobble fragments. Dry	
2			100%				0.8-4.0 Orange/red clay. Dry	
					69SB103-02			
3								
4	4.0						4.0	149.8
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB103 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB104

COORDINATES: EAST: 773013.69 NORTH: 153064.95

ELEVATION: SURFACE: 152.9

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB104-00		TOPSOIL (organics) 0.2	152.7
1							0.2-1.1 Light tan medium sand, gets finer with 1.1	151.8
		D-1	4.0		69SB104-01	BKG	depth, sparse gravel. Dry.	
2			100%		& Duplicate		1.1-4.0 Red/orange clay	
					69SB104-02			
3								
4	4.0						4.0	148.9
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB104 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB105

COORDINATES: EAST: 773061.10 NORTH: 153039.27

ELEVATION: SURFACE: 151.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB105-00		TOPSOIL (organics) 0.2	151.1
1							0.2-1.1 Grey gravel (21A) and sand. Dry 1.1	150.2
		D-1	4.0 100%		69SB105-01	BKG	1.1-4.0 Orange/Red Clay. Dry	
2								
					69SB105-02			
3								
4	4.0						4.0	147.3
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB105 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB106

COORDINATES: EAST: 773089.71 NORTH: 153030.85

ELEVATION: SURFACE: 150.7

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB106-00		TOPSOIL (organics) 0.2	150.5
1		D-1	4.0 100%		69SB106-01	BKG	0.2-2.5 Orange-red interbedded clay with some sand. Dry	
2					69SB106-02		2.5	148.2
3							2.5-4.0 Light tan clay, some red clay interbedded. Dry	
4	4.0						4.0	146.7
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB106 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB107

COORDINATES: EAST: 773157.85 NORTH: 153036.73

ELEVATION: SURFACE: 149.7

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB107-00	BKG	TOPSOIL (organics) 0.2	149.5
2					69SB107-01		0.2-3.2 Light grey coarse sand. Damp	
3					69SB107-02 & Duplicate		3.2	
4	4.0						3.2-4.0 Red/orange clay. Dry 4.0	145.7
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB107 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB108

COORDINATES: EAST: 773201.42 NORTH: 153001.37

ELEVATION: SURFACE: 148.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB108-00		TOPSOIL (organics) 0.2	148.3
1		D-1	4.0 100%		69SB108-01	BKG	0.2-2.4 Light grey coarse sand with some shelly material, gravel, and coral fragments. Dry	
2					69SB108-02		2.4	146.1
3							2.4-4.0 Orange/red clay. Dry	
4	4.0						4.0	144.5
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB108 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB109

COORDINATES: EAST: 773262.82 NORTH: 153013.10

ELEVATION: SURFACE: 147.4

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB109-00		TOPSOIL (organics) 0.3	147.1
1							0.3-0.6 Light grey coarse sand, some shelly 0.6	146.8
		D-1	4.0		69SB109-01	BKG	material. Dry	
2			100%				0.6- 3.5 Brown/dark orange interbedded clays. Dry	
					69SB109-02			
3								
							3.5	
4	4.0						3.5-4.0 Dark red sandy clay. Dry 4.0	143.4
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB109 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB110

COORDINATES: EAST: 773303.96 NORTH: 152976.50

ELEVATION: SURFACE: 146.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB110-00		TOPSOIL (organics) 0.2	146.3
1							0.2-1.1 Brown-light tan coarse sand, some 1.1	145.4
		D-1	4.0		69SB110-01	BKG	shelly material and silt, sparse gravel. Dry	
2			100%				1.1-4.0 Red/ orange clay. Dry	
					69SB110-02			
3								
4	4.0						4.0	142.5
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB110 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB111

COORDINATES: EAST: 773352.99 NORTH: 152988.60

ELEVATION: SURFACE: 146.0

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB111-00 & Duplicate 69SB111-01	BKG	TOPSOIL (organics) 0.2	145.8
							0.2-0.7 Light tan med-coarse sand with some silt, gravel, and shell material present. Dry 0.7	145.3
2					69SB111-02		0.7-2.6 Dark brown silty clay, transitioning to orangish-red towards bottom. Dry 2.6	143.4
3							2.6-4.0 Orange-red clay. Dry	
4	4.0						4.0	142.0
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB111 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB112

COORDINATES: EAST: 773410.89 NORTH: 152951.53

ELEVATION: SURFACE: 144.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description		Elevation (Ft. MSL)
					69SB112-00		TOPSOIL (organics)	0.1	144.4
1							0.1-1.0 Tan silty sand, getting finer with depth, some	1.0	143.5
		D-1	4.0		69SB112-01	BKG	silt/ gravel present, sparse shell material. Dry		
2			100%				1.0-2.0 Brown silty clay	2.0	142.5
					69SB112-02		2.0-4.0 Orange-red clay, some silt beds		
3									
4	4.0							4.0	140.5
							End of Boring at 4.0'		
5									
6									
7									
8									
9									
10									

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB112 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB113

COORDINATES: EAST: 773456.36 NORTH: 152963.91

ELEVATION: SURFACE: 144.2

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
		D-1	4.0 100%		69SB113-00	BKG	0.0-2.0 Light tan medium sand with gravel/ shell fragments, sparse coarse gravel and some silt	
2					69SB113-01		2.0	142.2
					69SB113-02		2.0-4.0 Light orange silty clay	
3								
4	4.0						4.0	140.2
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB113 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB114

COORDINATES: EAST: 773496.48 NORTH: 152931.12

ELEVATION: SURFACE: 143.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB114-00 69SB114-01 & Duplicate 69SB114-02	BKG	TOPSOIL (organics) 0.3 0.2-0.5 brown sandy silt. Damp 0.5-1.5 Tan silty sand, gets finer with depth, some sparse gravel and shell fragments. Dry 1.5 1.5-3.0 Brown silty clay with some red-orange clay nodules Dry 3.0 3.0-4.0 Red/orange clay with some silt. Dry 4.0	142.8 141.6 139.1
2								
3								
4	4.0							
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB114 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB115

COORDINATES: EAST: 773536.30 NORTH: 152933.85

ELEVATION: SURFACE: 143.0

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB115-00		TOPSOIL (organics) 0.3	142.7
1							0.2-1.0 Brownish tan silty sand with some gravel and 1.0	142.0
		D-1	4.0		69SB115-01	BKG	coral fragments. Dry 1.7	141.3
2			100%				1.0-1.7 Tan medium sand, gets finer with depth	
					69SB115-02		some gravel present. Dry	
3							1.7-4.0 Brown-orange silty clay. Dry	
4	4.0						4.0	139.0
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB115 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB116

COORDINATES: EAST: 773593.64 NORTH: 152934.26

ELEVATION: SURFACE: 141.7

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB116-00		TOPSOIL (organics) 0.2	141.5
1							0.2-1.0 Brownish tan silty sand with some gravel 1.0	140.7
		D-1	4.0 100%		69SB116-01	BKG	and coral fragments. Dry 1.7	140.0
2							1.0-1.7 Light tan sand with coral and shell	
					69SB116-02		fragments. Dry	
3							1.7- 4.0 Dark orange silty clay with some light	
							grey and red nodules/bedding. Dry	
4	4.0						4.0	137.7
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB116 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB117

COORDINATES: EAST: 773639.41 NORTH: 152906.05

ELEVATION: SURFACE: 140.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB117-00		TOPSOIL (organics) 0.2	140.3
1							0.2-1.2 Tan sand with some silt and shell fragments 1.2	139.3
		D-1	4.0		69SB117-01	BKG	coarse sand lens at depth with some gravel. Dry	
2			100%				1.2- 4.0 Dark brown silty clay- some orange	
					69SB117-02		transitioning in with depth. Dry	
3					& Duplicate			
4	4.0						4.0	136.5
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB117 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB118

COORDINATES: EAST: 773681.22 NORTH: 152887.22

ELEVATION: SURFACE: 140.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB118-00		TOPSOIL (organics) 0.1	140.0
1							0.1-1.1 Tan sand, medium to coarse, with gravel 1.1	139.0
		D-1	4.0		69SB118-01	BKG	some coarse gravel interdispersed. Dry	
2			100%				1.1- 4.0 Brown- dark orange silty clay. Dry	
					69SB118-02			
3								
4	4.0						4.0	136.1
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB118 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB119

COORDINATES: EAST: 773740.31 NORTH: 152892.17

ELEVATION: SURFACE: 139.4

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB119-00	BKG	TOPSOIL (organics) 0.3	139.1
2					69SB119-01		0.2-2.8 Tan silty sand with some gravel and concrete/cobble fragments. Dry	
3					69SB119-02		2.8	136.6
4	4.0						2.8-4.0 Dark orange silty clay. Dry	135.4
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB119 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB120

COORDINATES: EAST: 773774.97 NORTH: 152862.04

ELEVATION: SURFACE: 138.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description		Elevation (Ft. MSL)
					69SB120-00		TOPSOIL (organics)	0.3	137.8
1							0.3-0.7 Brown silt with angular bluish-grey gravel	0.7	137.4
		D-1	4.0		69SB120-01	BKG	(21A). Dry	1.2	136.9
2			100%				0.7-1.2 Tan silty sand with some shell fragments.	2.0	136.1
					69SB120-02		1.2-2.0 Brown silty clay. Dry		
3							2.0-4.0 Orange red clay. Dry		
4	4.0							4.0	134.1
							End of Boring at 4.0'		
5									
6									
7									
8									
9									
10									

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB120 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB121

COORDINATES: EAST: 773829.76 NORTH: 152856.80

ELEVATION: SURFACE: 137.6

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB121-00 & Duplicate 69SB121-01 69SB121-02	BKG	TOPSOIL (organics) 0.3 0.3-0.9 Light tan medium sand with some shell fragments and sparse gravel. Dry 0.9 0.9-4.0 Brown silty clay, color transition to orangish-brown with depth. Dry	137.3 136.7
2								
3								
4	4.0						4.0	133.6
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB121 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB122

COORDINATES: EAST: 773878.10 NORTH: 152833.77

ELEVATION: SURFACE: 136.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB122-00		TOPSOIL (organics) 0.2	136.1
1							0.2-0.7 Brown silty sand, some clay 0.7	135.6
		D-1	4.0 100%		69SB122-01	BKG	0.7-4.0 Orange/red clay with some silt	
2								
					69SB122-02			
3								
4	4.0						4.0	132.3
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB122 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB123

COORDINATES: EAST: 773933.12 NORTH: 152845.45

ELEVATION: SURFACE: 136.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB123-00	BKG	TOPSOIL (organics) 0.3	135.8
2					69SB123-01		FILL - clay to coarse sand, trace fine gravel, tan, dry to damp, non plastic, loose	
3					69SB123-02			
4	4.0							132.1
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB123 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB124

COORDINATES: EAST: 773978.23 NORTH: 152812.21

ELEVATION: SURFACE: 134.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB124-00 69SB124-01 & Duplicate 69SB124-02	BKG	TOPSOIL (organics) 0.3 FILL - clay to coarse sand, trace fine gravel, tan, dry to damp, non plastic, loose	133.8
2								
3								
4	4.0							130.1
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB124 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB125

COORDINATES: EAST: 774027.69 NORTH: 152832.88

ELEVATION: SURFACE: 134.9

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB125-00		TOPSOIL (organics) 0.2	134.7
1							0.2-1.2 Dark orange silty clay with some gravel 1.2	133.7
		D-1	4.0 100%		69SB125-01	BKG	1.2-2.4 Black and white sand with shell and coral fragments. Damp	
2								
					69SB125-02		2.4	132.5
3							2.4-4.0 Dark orange silty clay	
4	4.0						4.0	130.9
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB125 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB126

COORDINATES: EAST: 774074.58 NORTH: 152819.22

ELEVATION: SURFACE: 133.9

Rig:	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)			2.5"		8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length								
Type			SS					
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB126-00		TOPSOIL (organics) 0.2	133.7
1							0.3-2.0 Brown silty clay with shelly material	
		A-1	4.0		69SB126-01	BKG	and some grey clay nodules with depth. Damp	
2			100%				2.0	131.9
					69SB126-02		2.0-2.5 Brown silty sand w/ brown clay nodules. 2.5	131.4
3							2.5-4.0 Dark orange silty clay with brown clay nodules. Damp	
4	4.0						4.0	129.9
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB126 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB127

COORDINATES: EAST: 774056.12 NORTH: 152767.71

ELEVATION: SURFACE: 131.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB127-00	BKG	0.0-1.1 Dark brown silty clay. Wet	130.2
2					69SB127-01		1.1-1.5 Light tan coarse sand with shell fragments. Wet	129.8
3					60SB127-02 & Duplicate		1.5-4.0 grey silty clay with some red silty nodules interdispersed, clay content increasing with depth. Damp	
4	4.0							127.3
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB127 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB128

COORDINATES: EAST: 774029.16 NORTH: 152774.28

ELEVATION: SURFACE: 131.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB128-00		TOPSOIL (organics) 0.2	131.3
1		D-1	4.0 100%		69SB128-01	BKG	0.2-2.0 Orange silty clay with grey nodules and red silty lenses sparsely dispersed. Dry	
2							2.0	129.5
					69SB128-02		2.0-4.0 Grey clay with red silty clay nodules. Dry	
3								
4	4.0						4.0	127.5
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB128 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB129

COORDINATES: EAST: 773970.62 NORTH: 152777.31

ELEVATION: SURFACE: 132.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB129-00	BKG	TOPSOIL (organics) 0.3	132.0
2					69SB129-01		FILL - clay to coarse sand, trace fine gravel, tan, dry to damp, non plastic, loose	
3					69SB129-02			
4	4.0							128.3
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB129 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB130

COORDINATES: EAST: 773924.62 NORTH: 152792.75

ELEVATION: SURFACE: 134.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB130-00	BKG	TOPSOIL (organics) 0.3	133.8
2					69SB130-01		FILL - clay to coarse sand, trace fine gravel, tan, dry to damp, non plastic, loose	
3					69SB130-02			
4	4.0							130.1
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB130 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB131

COORDINATES: EAST: 773877.25 NORTH: 152811.58

ELEVATION: SURFACE: 135.1

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/5/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB131-00 & Duplicate 69SB131-01 69SB131-02	BKG	TOPSOIL (organics) 0.3 FILL - clay to coarse sand, trace fine gravel, tan, dry to damp, non plastic, loose	134.8
2								
3								
4	4.0							131.1
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB131 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB132

COORDINATES: EAST: 773830.20 NORTH: 152801.52

ELEVATION: SURFACE: 134.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB132-00		TOPSOIL (organics) 0.2	134.3
1							0.2-1.7 Tan and orange silty clay. Dry	
		D-1	4.0 100%		69SB132-01	BKG	1.7	132.8
2							1.7-4.0 Grey silty clay with some red nodules and sparse gravel. Dry	
					60SB132-02			
3								
4	4.0						4.0	130.5
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB132 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB133

COORDINATES: EAST: 773784.63 NORTH: 152815.47

ELEVATION: SURFACE: 135.6

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1					69SB133-00		TOPSOIL (organics) 0.2	135.4
		D-1	4.0 100%		69SB133-01	BKG	0.2-4.0 Orange and light grey silty clay. Silt content decreasing with depth. Dry	
2					69SB133-02			
3								
4	4.0						4.0	131.6
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB133 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB134

COORDINATES: EAST: 773736.40 NORTH: 152827.50

ELEVATION: SURFACE: 136.4

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB134-00 69SB134-01 & Duplicate 69SB134-02	BKG	TOPSOIL (organics) 0.2 0.2-4.0 Orange-brown silty clay. Dry	136.2
2								
3								
4	4.0						4.0	132.4
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB134 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB135

COORDINATES: EAST: 773676.47 NORTH: 152843.99

ELEVATION: SURFACE: 138.0

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB135-00		TOPSOIL (organics) 0.3	137.7
1							0.2-1.0 Dark grey-blue and orange interbedded clay. Dry 1.0	137.0
		D-1	4.0 100%		69SB135-01	BKG		
2							1.0-4.0 Orange silty clay. Dry	
					69SB135-02			
3								
4	4.0						4.0	134.0
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB135 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB136

COORDINATES: EAST: 773623.38 NORTH: 152850.85

ELEVATION: SURFACE: 138.8

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB136-00	BKG	0.0-0.5 Brown clayey silt (0.5)	138.3
2					69SB136-01		0.5-1.5 Brown silty clay with some black nodules. Dry (1.5)	137.3
3					69SB136-02		1.5-3.0 Brown and grey interbedded clay with some red nodules. Dry (3.0)	135.8
4	4.0						3.0-4.0 Orange and grey interbedded clay. Dry (4.0)	134.8
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB136 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB137

COORDINATES: EAST: 773581.10 NORTH: 152859.63

ELEVATION: SURFACE: 140.4

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly sunny, breezy, low 90's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB137-00	BKG	0.0-0.5 Dark brown clayey silt with some sand. Dry (0.5)	139.9
2					69SB137-01		0.5- 4.0 Orange silty clay with some light grey and red clay nodules and bedding. Dry	
3					69SB137-02 & Duplicate			
4	4.0						(4.0)	136.4
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB137 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB138

COORDINATES: EAST: 773529.36 NORTH: 152866.98

ELEVATION: SURFACE: 142.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB138-00		TOPSOIL (organics) 0.3	142.0
1							0.3-2.0 Brown silty clay transitioning to orange with depth	
		D-1	4.0		69SB138-01	BKG	Dry	
2			100%				2.0	140.3
					69SB138-02		2.0-4.0 Orange/ red silty clay. Dry	
3								
4	4.0							138.3
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB138 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB139

COORDINATES: EAST: 773491.42 NORTH: 152886.38

ELEVATION: SURFACE: 142.7

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB139-00		TOPSOIL (organics) 0.2	142.5
1		D-1	4.0 100%		69SB139-01	BKG	0.2-1.5 tan medium sand with some shell fragments and sparse gravel. Dry 1.5	141.2
2					69SB139-02		1.5-4.0 Orange red clay with some silt. Dry	
3								
4	4.0						4.0	138.7
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB139 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB140

COORDINATES: EAST: 773428.33 NORTH: 152889.62

ELEVATION: SURFACE: 142.2

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB140-00		TOPSOIL (organics) 0.2	142.0
1							0.2-1.2 Brown silty clay with sparse gravel, some sand. Dry 1.2	141.0
		D-1	4.0 100%		69SB140-01	BKG		
2							1.2-4.0 Light orange silty clay. Dry	
					69SB140-02			
3								
4	4.0						4.0	138.2
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB140 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB141

COORDINATES: EAST: 773389.41 NORTH: 152919.92

ELEVATION: SURFACE: 143.9

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB141-00 & Duplicate		TOPSOIL (organics) 0.2	143.7
1							0.2-0.4 Dark brown silty sand. Dry 1.0	142.9
		D-1	4.0 100%		69SB141-01	BKG	0.4-1.0 Light orange medium sand with some gravel and shell fragments. Dry 1.5	142.4
2								
					69SB141-02		1.0-1.5 Brown silty clay. Dry	
3							1.5-4.0 Orange-red clay with some silt. Dry	
4	4.0						4.0	139.9
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB141 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB142

COORDINATES: EAST: 773347.60 NORTH: 152918.85

ELEVATION: SURFACE: 144.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/4/2010	0.0 - 4.0	Mostly cloudy, breezy, mid 80's	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB142-00		TOPSOIL (organics) 0.2	144.1
1							0.2-1.0 Light brown and black gravelly sand. Dry 1.0	143.3
		D-1	4.0 100%		69SB142-01	BKG		
2							1.0-4.0 Orange-red clay. Dry	
					69SB142-02			
3								
4	4.0						4.0	140.3
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB142 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB143

COORDINATES: EAST: 773302.49 NORTH: 152942.53

ELEVATION: SURFACE: 145.7

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB143-00		TOPSOIL (organics) 0.2	145.5
1							0.2-0.5 Brown tan silty sand with some gravel. 0.5	145.2
		D-1	4.0		69SB143-01	BKG	Dry	
2			100%				0.5-4.0 Orange/red clay. Dry	
					69SB143-02			
3								
4	4.0						4.0	141.7
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB143 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB144

COORDINATES: EAST: 773241.81 NORTH: 152942.16

ELEVATION: SURFACE: 146.0

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB144-00 69SB144-01 & Duplicate 69SB144-02	BKG	TOPSOIL (organics) 0.2 0.2-0.4 Grey sand with gravel and shell fragments. Dry 0.4 0.4-0.8 Black and orange interbedded clay. Dry 0.8 0.8-2.0 Red/orange clay 2.0 2.0-4.0 Light grey clay with some red/orange interbeds. Dry	145.8 145.6 145.2
2								
3								
4	4.0						4.0	142.0
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB144 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB145

COORDINATES: EAST: 773198.25 NORTH: 152965.66

ELEVATION: SURFACE: 147.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB145-00		TOPSOIL (organics) 0.2	147.1
1							0.2-0.7 Black and white sand, some shell 0.7	146.6
		D-1	4.0		69SB145-01	BKG	fragments. Dry 1.4	145.9
2			100%				0.7-1.4 red/orange clay with some black clay	
					69SB145-02		nodules. Dry	
3							1.4-4.0 Red/orange clay with some light grey	
							lenses. Dry	
4	4.0						4.0	143.3
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB145 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB146

COORDINATES: EAST: 773145.19 NORTH: 152962.38

ELEVATION: SURFACE: 147.0

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB146-00		TOPSOIL (organics) 0.2	146.8
1							0.2-0.4 Orange/red intermingled clay. Dry 0.4	146.6
		D-1	4.0 100%		69SB146-01	BKG	0.4-1.4 Light grey clay with some silt. Dry 1.4	145.6
2							1.4-2.8 Orange silty clay with sparse sand. Dry	
					69SB146-02		2.8	144.2
3							2.8-4.0 Light grey clay with some red clay interbeds. Dry,	
4	4.0							143.0
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB146 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB147

COORDINATES: EAST: 773086.37 NORTH: 152976.47

ELEVATION: SURFACE: 148.6

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB147-00		TOPSOIL (organics) 0.2	148.4
1							0.2-2.5 Orange/red intermingled clays, some sand.	
		D-1	4.0 100%		69SB147-01	BKG	Dry	
2								
					69SB147-02 & Duplicate		2.5	146.1
3							2.5-4.0 Light tan clay, some red clay interbeds. Dry	
4	4.0						4.0	144.6
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB147 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB148

COORDINATES: EAST: 773053.51 NORTH: 152999.00

ELEVATION: SURFACE: 150.4

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1					69SB148-00		TOPSOIL (organics) 0.2	150.2
		D-1	4.0 100%		69SB148-01	BKG	0.2-4.0 Red/orange interbedded clays. Dry	
2					69SB148-02			
3								
4	4.0						4.0	146.4
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB148 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB149

COORDINATES: EAST: 773001.32 NORTH: 153011.89

ELEVATION: SURFACE: 151.9

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB149-00		TOPSOIL (organics) 0.1	151.8
1							0.1-0.9 Orange clayey silt with some sand. Dry 0.9	151.0
		D-1	4.0		69SB149-01	BKG	0.9-4.0 Orange/red clay	
2			100%					
					69SB149-02			
3								
4	4.0						4.0	147.9
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB149 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB150

COORDINATES: EAST: 772960.16 NORTH: 153012.95

ELEVATION: SURFACE: 152.3

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
					69SB150-00		TOPSOIL (organics) 0.2	152.1
1							0.2-0.6 Orange-red silt with clay, sparse gravel 0.6	151.7
		D-1	4.0 100%		69SB150-01	BKG	0.6-4.0 Orange/red clay. Dry	
2								
					69SB150-02			
3								
4	4.0						4.0	148.3
							End of Boring at 4.0'	
5								
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB150 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB151

COORDINATES: EAST: 772907.95 NORTH: 153040.69

ELEVATION: SURFACE: 155.9

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB151-00 & Duplicate 69SB151-01	BKG	0.0-0.6 Brown silty sand with some clay. Dry (0.6)	155.3
2					69SB151-02		0.6-1.1 Dark brown silty sand with some clay, some white gravel and asphalt chunks present. (1.1)	154.8
3							1.1-4.0 Orange/red mottled clay. Dry	
4	4.0						(4.0)	151.9
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB151 SHEET 1 OF 1

Baker

Michael Baker Jr., Inc.

TEST BORING RECORD

PROJECT: Naval Activity Puerto Rico SWMU 69

PROJ. NO.: 119197, 11.2 BORING NO.: 69SB152

COORDINATES: EAST: 772859.37 NORTH: 153037.10

ELEVATION: SURFACE: 156.5

Rig:	Geoprobe Track Rig 6610 DT							
	Macro Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1-5/8"				8/3/2010	0.0 - 4.0	sunny, breezy, mid-80s	
Length	4'							
Type	Acetate							
Hammer Wt.								
Fall								

Remarks: PID background (BKG) is 0.4.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BKG/PS = Background/Point Source
ppm = parts per million

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Elevation (Ft. MSL)
1		D-1	4.0 100%		69SB152-00	BKG	0.0-0.9 Dark brown silty sand with some bluish angular gravel (#57). Dry (0.9)	155.6
2					69SB152-01		0.9-1.7 Light tan shelly coarse sand with some sparse gravel. Moist (1.7)	
3					69SB152-02		1.7-4.0 Red/orange mottled clay. Dry	
4	4.0						(4.0)	152.5
5							End of Boring at 4.0'	
6								
7								
8								
9								
10								

DRILLING CO.: GeoEnviro Tech, Inc. BAKER REP.: Jason Oliver

DRILLER: William Rodrigez BORING NO.: 69SB152 SHEET 1 OF 1

CHAIN-OF-CUSTODY FORMS
2008 CMS INVESTIGATION

Serial Number 004541

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8480 2694 7400

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165 69-001

( ) Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
NAPR 7 Site Investigation	111626	PR

TAL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.
Kathy E. Smith		

CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX
Mark Kimes	412.337.7465	

CLIENT NAME	CLIENT E-MAIL
Michael Baker Jr., Inc.	mkimes@mbakercorp.com

CLIENT ADDRESS: 100 Airside Dr., Moon Township, PA 15108

COMPANY CONTRACTING THIS WORK (if applicable): Michael Baker Jr., Inc.

PAGE 1 OF 2

STANDARD REPORT DELIVERY (X)
DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App IX VOCs	App IX SVOCs	LL PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	App IX Pesticides	App IX PCBs	TOC	REMARKS
			MATRIX TYPE					REQUIRED ANALYSIS										
								PRESERVATIVE										
								NUMBER OF CONTAINERS SUBMITTED										
4/29/08	0830	69SB07-00	G		X			3	1		1							
	0840	69SB07-01	G		X			3	1		1							
	0855	69SB07-05	G		X			3	1		1							
	0915	69SB08-00	G		X			3	1		1							
	0925	69SB08-01	G		X			3	1		1							
	0945	69SB08-05	G		X			3	1		1							
	0945	69SB08-05D	G		X			3	1		1							
	0945	69SB08-05MS/MSD	G		X			3	1		1							
	1010	69SB11-00	G		X			3	1		1							
	1010	69SB11-00D	G		X			3	1		1							
	1025	69SB11-01	G		X			3	1		1							
	1035	69SB11-03	G		X			3	1		1							

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. K	4/29/08	1800			

RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
	4/28/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
	4/30/08 ~~4/28/08~~	0908 ~~0700~~	YES ( ) NO ( )		680-36289	Temp(°C): 0.4, 1.4, 1.8, 2.2, 3.6, 3.8

MEK 4/29/08

TAL8240-680 (1207)

Serial Number 004542

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8480 2994 7400

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

69-001

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
NAPR 7 Site Investigation	111626	PR

TAL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.
Kathy E. Smith		

CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX
Mark Kimes	412.337.7465	

CLIENT NAME	CLIENT E-MAIL
Michael Baker Jr., Inc.	mkimes@mbakercorp.com

CLIENT ADDRESS: 100 Airside Dr., Moon Township, PA 15108

COMPANY CONTRACTING THIS WORK (if applicable): Michael Baker Jr., Inc.

PAGE 2 OF 2

STANDARD REPORT DELIVERY ☒

DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App IX VOCs	App IX SVOCs	LL PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	App IX Pesticides	App IX PCBs	TOC	REMARKS
								NUMBER OF CONTAINERS SUBMITTED										
4/29/08	1050	695B12-00	G		X			3	1		1							
↓	1055	695B12-01	G		X			3	1		1							
	1105	695B12-05	G		X			3	1		1							
4/29/08		69TB01	G	X				3										

PRESERVATIVE

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Michael E. K	4/29/08	1800			
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
[signature]	4/28/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	4/30/08	0908	YES ○ NO ○		L80-36789	Temp (°C): 0.4, 1.4, 1.8, 2.2, 3.6, 3.8

TAL8240-680 (1207)

Serial Number 004543

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 7535

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

69-002

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: NAPR 7 Site Investigation	PROJECT NO.: 111626	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy E. Smith	P.O. NUMBER:	CONTRACT NO.:
CLIENT (SITE) PM: Mark Kimes	CLIENT PHONE: 412.337.7465	CLIENT FAX:
CLIENT NAME: Michael Baker Jr., Inc.	CLIENT E-MAIL: mkimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr., Moon Township, PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable): Michael Baker Jr., Inc.		

PAGE 1 OF 3

STANDARD REPORT DELIVERY (X)
DATE DUE 28 Day TAT
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App IX VOCs	App IX SVOCs	LL PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	App IX Pesticides	App IX PCBs	TOC	REMARKS
								PRESERVATIVE										
								NUMBER OF CONTAINERS SUBMITTED										
4/29/08	0850	69SB01-00	G		X			3	1		1							
	0855	69SB01-00D	G		X			3	1		1							
	0850	69SB01-00MS	G		X			3										
	0850	69SB01-00MSD	G		X			3										
	0850	69SB01-00MS/MSD	G		X				1		1							
	0940	69SB02-00	G		X			3	1		1							
	0950	69SB03-00	G		X			3	1		1							
	1035	69SB04-00	G		X			3	1		1							
	1110	69SB05-00	G		X			3	1		1							
	1120	69SB06-00	G		X			3	1		1							
	1135	69SB09-00	G		X			3	1		1							
4/29/08	1345	69SB10-00	G		X			3	1		1							

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]			[signature]	5/1/08	1500			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
[signature]	4/29/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	5/2/08	0914	YES ( ) NO ( )		680-36360	

TAL8240-680 (1207)

Serial Number 004544

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 7535

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165 69-002

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: NAPR 7 Site Investigation	PROJECT NO.: 111626	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy E. Smith	P.O. NUMBER:	CONTRACT NO.:
CLIENT (SITE) PM: Mark Kimes	CLIENT PHONE: 412.337.7465	CLIENT FAX:
CLIENT NAME: Michael Baker Jr., Inc.	CLIENT E-MAIL: mkimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr., Moon Township, PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable): Michael Baker Jr., Inc.		

PAGE 2 OF 3

STANDARD REPORT DELIVERY (X)

DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ( )

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

PRESERVATIVE

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App IX VOCs	App IX SVOCs	LL PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	App IX Pesticides	App IX PCBs	TOC	REMARKS
4/29/08	1400	69SB 13-00	G		✓			3	1		1							
	1415	69SB 14-00	G		✓			3	1		1							
	1425	69SB 15-00	G		✓			3	1		1							
	1430	69SB 16-00	G		/			3	1		1							
	1445	69SB 17-00	G		/			3	1		1							
	1450	69SB 18-00	G		/			3	1		1							
	1500	69SB 19-00	G		/			3	1		1							
	1500	69SB 20-00	G		/			3	1		1							
	1520	69SB 21-00	G		/			3	1		1							
	1520	69SB 21-00D	G		/			3	1		1							
	1520	69SB 21-00MS/MSD	G		/			3	1		1							
4/29/08	1530	69SB 22-00	G		/			3	1		1							

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	5/1/08	1500			
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
[illegible]	4/28/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[illegible]	5/2/08	0914	YES ( ) NO ( )		680-36360	

TAL8240-680 (1207)

Serial Number 004545

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 7535

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165 69-002

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
NAPR 7 Site Investigation	111626	PR

TAL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.
Kathy E. Smith		

CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX
Mark Kimes	412.337.7465	

CLIENT NAME	CLIENT E-MAIL
Michael Baker Jr., Inc.	mkimes@mbakercorp.com

CLIENT ADDRESS: 100 Airside Dr., Moon Township, PA 15108

COMPANY CONTRACTING THIS WORK (if applicable): Michael Baker Jr., Inc.

PAGE 3 OF 3

STANDARD REPORT DELIVERY ☒

DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App IX VOCs	App IX SVOCs	LL PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	App IX Pesticides	App IX PCBs	TOC	REMARKS
								PRESERVATIVE										
								NUMBER OF CONTAINERS SUBMITTED										
4/29/08	1535	69SB23-00	G		✓			3	1		1							
4/29/08	1550	69SB24-00	G		✓			3	1		1							
4/30/08		69TB02	G	X				3										
5/1/08	1215	69GW11	G	✓				3	2		1	1						
	1215	69GW11MS	G	✓				3	2		1	1						
	1215	69GW11MSD	G	✓				3	2		1	1						
	1220	69GW11D	G	✓				3	2		1	1						
	1125	69GW08	G	✓				3	2		1	1						
5/1/08	1020	69GW07	G	✓				3	2		1	1						
	1210	69SB27-00	G		✓			3	1		1							
	1215	69SB27-01	G		✓			3	1		1							
5/1/08	1220	69SB27-05	G		✓			3	1		1							

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	5/1/08	1500			

RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
	4/29/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
	5/2/08	0914	YES ○ NO ●		680-36360	

TAL8240-680 (1207)

Serial Number 005109

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.:

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

69-003

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
NAPR 7 Site Investigation	111626	PR

TAL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.
Kathy E. Smith		

CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX
Mark Kimes	412.337.7465	

CLIENT NAME	CLIENT E-MAIL
Michael Baker Jr., Inc.	mkimes@mbakercorp.com

CLIENT ADDRESS: 100 Airside Dr., Moon Township, PA 15108

COMPANY CONTRACTING THIS WORK (if applicable): Michael Baker Jr., Inc.

PAGE 1 OF 1

STANDARD REPORT DELIVERY (X)
DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App IX VOCs	App IX SVOCs	LL PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	App IX Pesticides	App IX PCBs	TOC	REMARKS
								PRESERVATIVE										
5/1/08	1520	69GW25	G	✓				3	2		1	1						
5/1/08	1420	69GW12	G	✓				3	2		1	1						

NUMBER OF CONTAINERS SUBMITTED

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	5/2/08	1500			

RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
[signature]	4/28/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
KH	5/5/08	0909	YES ( ) NO ( )		680-36419	

TAL8240-680 (1207)

CHAIN-OF-CUSTODY FORMS
2010 DISTURBED SOIL SAMPLING INVESTIGATION

Serial Number 006328

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 1 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	NUMBER OF CONTAINERS SUBMITTED	REMARKS
8/3/10	0925	69SB101-00	G		X			1	
	"	69SB101-00D						1	
	"	69SB101-00MS/MSD						1	
	0944	69SB101-01						1	
	0945	69SB101-02						1	
	0957	69SB102-00						1	
	0959	69SB102-01						1	
	1002	69SB102-02						1	
	1033 ~~1033~~	69SB103-00						1	
	1035 ~~1035~~	69SB103-01						1	
	1036 ~~1036~~	69SB103-02						1	
	1015	69SB104-00						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	4.5/4.4/5.1/3.8/4.2

TAL8240-680 (1207)

Serial Number 006281

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 2 OF 16

STANDARD REPORT DELIVERY ( )

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ( )

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals										REMARKS
								PRESERVATIVE										
								None										
8/3/10	1020	69SB104-01	G		X			1										
	1020	69SB104-01D						1										
	1023	69SB104-02						1										
	1046	69SB105-00						1										
	1047	69SB105-01						1										
	1048	69SB105-02						1										
	1101	69SB106-00						1										
	1102	69SB106-01						1										
	1103	69SB106-02						1										
	1130	69SB107-00						1										
	1131	69SB107-01						1										
	1133	69SB107-02						1										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006280

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 3 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals	REMARKS
8/3/10	1133	69SB107-02D	G		X			1	
	1133	69SB107-02MS/MSD						1	
	1248	69SB108-00						1	
	1249	69SB108-01						1	
	1250	69SB108-02						1	
	1306	69SB109-00						1	
	1307	69SB109-01						1	
	1308	69SB109-02						1	
	1320	69SB110-00						1	
	1321	69SB110-01						1	
	1322	69SB110-02						1	
8/4/10	0827	69SB111-00						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-6989	

TAL8240-680 (1207)

Serial Number 006282

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 4 OF 16

STANDARD REPORT DELIVERY ◯
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ◯
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals	REMARKS
8/4/10	0827	69SB111-00D	G		X			1	
	0829	69SB111-01						1	
	0830	69SB111-02						1	
	0841	69SB112-00						1	
	0842	69SB112-01						1	
	0843	69SB112-02						1	
	0855	69SB113-00						1	
	0856	69SB113-01						1	
	0857	69SB113-02						1	
	0915	69SB114-00						1	
	0916	69SB114-01						1	
	0916	69SB114-01D						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ◯ NO ◯		680-60189	

TAL8240-680 (1207)

Serial Number 006283

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
119197 11.2 On Island		PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 5 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS / NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals									REMARKS
								NaNO	PRESERVATIVE								
8/4/10	0916	69SB114-01MS/MSD	G		X			1									
	0918	69SB114-02						1									
	0930	69SB115-00						1									
	0931	69SB115-01						1									
	0932	69SB115-02						1									
	0955	69SB116-00						1									
	0956	69SB116-01						1									
	0957	69SB116-02						1									
	1013	69SB117-00						1									
	1014	69SB117-01						1									
	1015	69SB117-02						1									
	1015	69SB117-02D						1									

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		[signature]	

TAL8240-680 (1207)

Serial Number 006284

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 6 OF 16

STANDARD REPORT DELIVERY ◯

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ◯

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals	REMARKS
8/4/10	1052	69SB118-00	G		X			1	
	1053	69SB118-01						1	
	1054	69SB118-02						1	
	1127	69SB119-00						1	
	1128	69SB119-01						1	
	1130	69SB119-02						1	
	1313	69SB120-00						1	
	1314	69SB120-01						1	
	1315	69SB120-02						1	
	1342	69SB121-00						1	
	1342	69SB121-00D						1	
	1342	69SB121-00MS/MSD						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ◯ NO ◯		680-60189	

TAL8240-680 (1207)

Serial Number 006285

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 7 OF 16

STANDARD REPORT DELIVERY ◯

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ◯

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals									REMARKS
								None	PRESERVATIVE								
								NUMBER OF CONTAINERS SUBMITTED									
8/4/10	1345	69SB121-01	G		X			1									
"	1347	69SB121-02						1									
8/5/10	0850	69SB122-00						1									
	0851	69SB122-01						1									
	0852	69SB122-02						1									
	0900	69SB123-00						1									
	0901	69SB123-01						1									
	0902	69SB123-02						1									
	0909	69SB124-00						1									
	0910	69SB124-01						1									
	0910	69SB124-01D						1									
	0912	69SB124-02						1									

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ◯ NO ◯		680-60189	

TAL8240-680 (1207)

Serial Number 006286

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
119197 11.2 On Island		PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 8 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals										REMARKS
								None										
								PRESERVATIVE										
								NUMBER OF CONTAINERS SUBMITTED										
8/5/10	0924	69SB125-00	G		X			1										
	0925	69SB125-01						1										
	0926	69SB125-02						1										
	1010	69SB126-00						1										
	1012	69SB126-01						1										
	1014	69SB126-02						1										
	0935	69SB127-00						1										
	0936	69SB127-01						1										
	0937	69SB127-02						1										
	0937	69SB127-02D						1										
	0937	69SB127-02MS/MSD						1										
	0930	69SB128-00						1										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006287

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)
119197 11.2 On Island		PR

TAL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.
Kathy Smith		

CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX
Darrin Hupe	724.622.5907	

CLIENT NAME	CLIENT E-MAIL
Baker Environmental	MKimes@mbakercorp.com

CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108

COMPANY CONTRACTING THIS WORK (if applicable):

PAGE 9 OF 16

STANDARD REPORT DELIVERY ( )

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ( )

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	NUMBER OF CONTAINERS SUBMITTED (App. IX Metals)	REMARKS
8/5/10	0931	69SB128-01	G		X			1	
	0932	69SB128-02						1	
	0915	69SB129-00						1	
	0916	69SB129-01						1	
	0917	69SB129-02						1	
	0904	69SB130-00						1	
	0905	69SB130-01						1	
	0906	69SB130-02						1	
	0855	69SB131-00						1	
	0855	69SB131-00D						1	
	0857	69SB131-01						1	
	0858	69SB131-02						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						

RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006288

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 10 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS / NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals										REMARKS
								HNO3	PRESERVATIVE									
8/4/10	1355	69SB132-00	G		X			1										
	1356	69SB132-01						1										
	1357	69SB132-02						1										
	1327	69SB133-00						1										
	1328	69SB133-01						1										
	1330	69SB133-02						1										
	1300	69SB134-00						1										
	1301	69SB134-01						1										
	1301	69SB134-01D						1										
	1301	69SB134-01MS/MSD						1										
	1305	69SB134-02						1										
	1103	69SB135-00						1										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006289

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 11 OF 16

STANDARD REPORT DELIVERY ◯

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ◯

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals (NUMBER OF CONTAINERS SUBMITTED)	REMARKS
8/4/10	1104	69SB135-01	G		X			1	
	1105	69SB135-02						1	
	1022	69SB136-00						1	
	1023	69SB136-01						1	
	1024	69SB136-02						1	
	1005	69SB137-00						1	
	1006	69SB137-01						1	
	1007	69SB137-02						1	
	1007	69SB137-02D						1	
	0935	69SB138-00						1	
	0936	69SB138-01						1	
	0937	69SB138-02						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1032	YES ◯ NO ◯		680-60189	

TAL8240-680 (1207)

Serial Number 006320

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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5102 LaRoche Avenue
Savannah, GA 31404

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Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 12 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals	REMARKS
8/4/10	0924	69SB139-00	G		X			1	
	0925	69SB139-01						1	
	0926	69SB139-02						1	
	0907	69SB140-00						1	
	0908	69SB140-01						1	
	0909	69SB140-02						1	
	0849	69SB141-00						1	
	0849	69SB141-00D						1	
	0849	69SB141-00MS/MSD						1	
	0854	69SB141-01						1	
	0855	69SB141-02						1	
	0836	69SB142-00						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						

RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006321

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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5102 LaRoche Avenue
Savannah, GA 31404

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Phone: (912) 354-7858
Fax: (912) 352-0165

○ Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 13 OF 16

STANDARD REPORT DELIVERY ○
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ○
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals	REMARKS
8/4/10	0837	69SB142-01	G		X			1	
"	0838	69SB142-02						1	
8/3/10	1325	69SB143-00						1	
	1326	69SB143-01						1	
	1327	69SB143-02						1	
	1313	69SB144-00						1	
	1314	69SB144-01						1	
	1314	69SB144-01D						1	
	1316	69SB144-02						1	
	1254	69SB145-00						1	
	1255	69SB145-01						1	
	1256	69SB145-02						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ○ NO ○		680-60189	

TAL8240-680 (1207)

Serial Number 006322

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 14 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals	REMARKS
8/3/10	1136	69SB146-00	G		X			1	
	1137	69SB146-01						1	
	1138	69SB146-02						1	
	1117	69SB147-00						1	
	1118	69SB147-01						1	
	1120	69SB147-02						1	
	1120	69SB147-02D						1	
	1120	69SB147-02MS/MSD						1	
	1050	69SB148-00						1	
	1051	69SB148-01						1	
	1052	69SB148-02						1	
	1041	69SB149-00						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006323

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

(X) TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 15 OF 16

STANDARD REPORT DELIVERY ( )
DATE DUE _____
EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE _____
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: App. IX Metals

PRESERVATIVE: None

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	NUMBER OF CONTAINERS SUBMITTED	REMARKS
8/3/10	1042	69SB149-01	G		X			1	
	1044	69SB149-02						1	
	1037	69SB150-00						1	
	1038	69SB150-01						1	
	1039	69SB150-02						1	
	1024	69SB151-00						1	
	1024	69SB151-00D						1	
	1025	69SB151-01						1	
	1026	69SB151-02						1	
	1010	69SB152-00						1	
	1012	69SB152-01						1	
	1014	69SB152-02						1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ( ) NO ( )		680-60189	

TAL8240-680 (1207)

Serial Number 006327

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

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TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

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Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: 119197 11.2 On Island	PROJECT NO.	PROJECT LOCATION (STATE) PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Darrin Hupe	CLIENT PHONE: 724.622.5907	CLIENT FAX
CLIENT NAME: Baker Environmental	CLIENT E-MAIL: MKimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Dr. Moon Twp. PA 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 16 OF 16

STANDARD REPORT DELIVERY ◯

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ◯

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	App. IX Metals (HNO3 PRESERVATIVE)										REMARKS
8/3/10	1105	69ER01		X				1										
8/4/10	0755	69ER02		X				1										
8/5/10	1130	69ER03		X				1										
8/5/10	1140	69FB01		X				1										

NUMBER OF CONTAINERS SUBMITTED

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	8/6/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	8/7/10	1052	YES ◯ NO ◯		680-60189	

TAL8240-680 (1207)

Serial Number 032201

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FEDEX Airbill No. 8611 3412 4119

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: SWMU 69	PROJECT NO.	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.
CLIENT (SITE) PM: Adam Gairey	CLIENT PHONE: 412-874-4035	CLIENT FAX
CLIENT NAME: Mark Kimes	CLIENT E-MAIL: mkimes@mbakercorp.com	
CLIENT ADDRESS: 100 Airside Drive, Moon TWP., PA. 15108		
COMPANY CONTRACTING THIS WORK (if applicable)		

PAGE 1 OF 2

STANDARD REPORT DELIVERY ●

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: Metals 6020/7471A

PRESERVATIVE

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	NUMBER OF CONTAINERS SUBMITTED	REMARKS
11/5/10	0956	69SD01	G		X			1	
	0956	69SD01 D						1	
	0947	69 SD 02						1	
	0947	69 SD 02 D						1	
	0947	69 SD 02 MS/MSD						1	
	0940	69 SD 03						1	
	0935	69 SD 04						1	
	0926	69 SD05						1	
	0901	69 SD06						1	
	0852	69 SD07						1	
	0835	69 SD 09						1	
11/5/10	0820	69 SD 10	G		X			1	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	11/5/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
Beth A Daughtry	11/6/10	1034	YES ○ NO ○		680-62912	Temp 2.6

TAL8240-680 (1207)

Serial Number 032204

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

FEDEX Airbill No. 8611 3412 4119

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE: SWMU 69	PROJECT NO.	PROJECT LOCATION (STATE): PR	PAGE 2 OF 2
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER	CONTRACT NO.	STANDARD REPORT DELIVERY ●
CLIENT (SITE) PM: Adam Cairel	CLIENT PHONE: 412-874-4035	CLIENT FAX	DATE DUE _____
CLIENT NAME: Mark Kimes	CLIENT E-MAIL: mkimes@mbakercorp.com		EXPEDITED REPORT DELIVERY (SURCHARGE) ○
CLIENT ADDRESS: 100 Airside Drive, Moon Twp. PA 15108			DATE DUE _____
COMPANY CONTRACTING THIS WORK (if applicable)			NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: Metals 6020/7471B

PRESERVATIVE

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT, ...)	NUMBER OF CONTAINERS SUBMITTED	REMARKS
	0755	69 SD 11	G		X			1	
	0746	69 SD 12	G		X			1	
	0812	69 SD 13	G		X			1	
	0805	69 SD 14	G		X			1	
	1005	69 FB-SD	G	X				1	
	1015	69 ER-SD	G	X				1	
	0842	69 SD08	G		X			1	

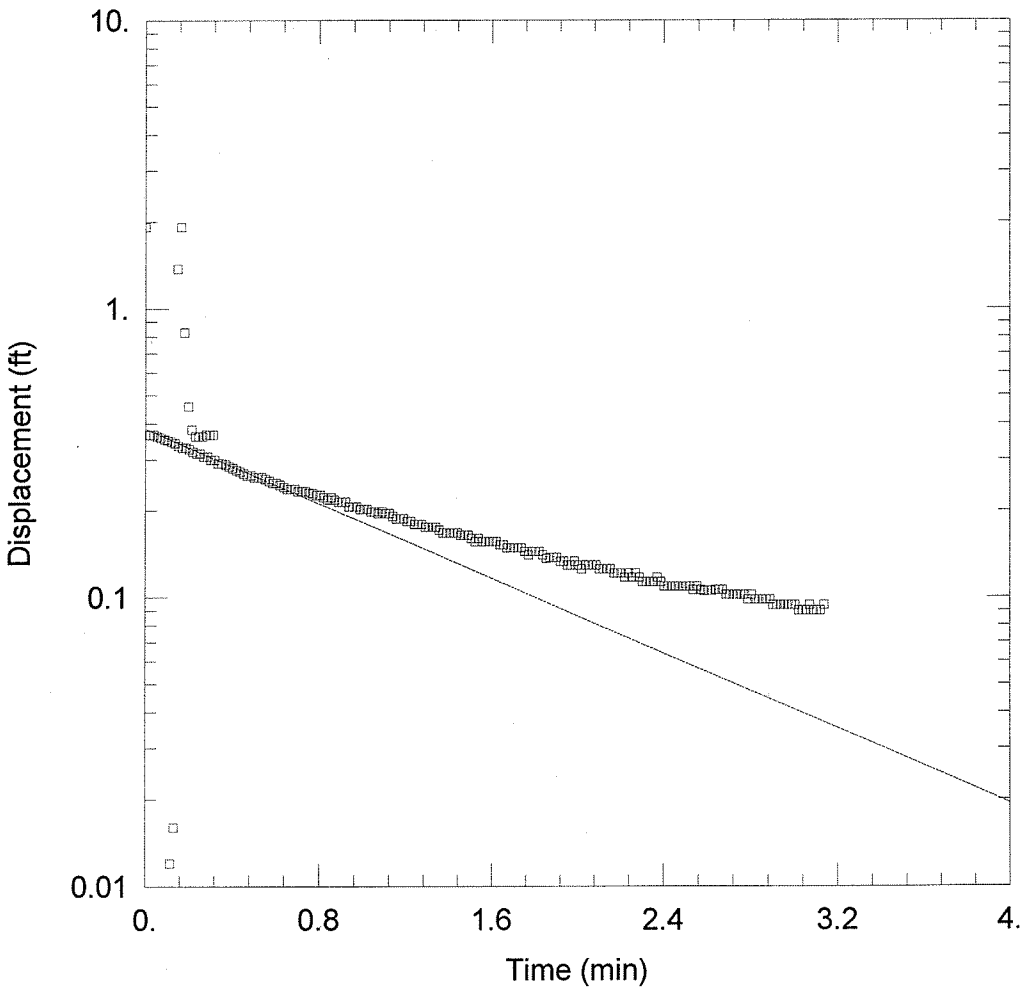
RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	11/5/10	1500						
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
Ruth a Daughtry	11/6/10	1034	YES ○ NO ○		680-62912	Temp 2-6

TAL8240-680 (1207)

SLUG TEST RESULTS



WELL TEST ANALYSIS

Data Set: K:\...\69gw07f.aqt
Date: 07/15/08 Time: 14:38:11

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW07f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW07F)

Initial Displacement: 1.92 ft
Total Well Penetration Depth: 14.08 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.08 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0005958 ft/min
y0 = 0.3832 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:18

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW07f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW07F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.92 ft
Static Water Column Height: 14.08 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.08 ft

No. of Observations: 207

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.004	1.439	0.167
0.022	0.365	1.455	0.164
0.033	0.	1.472	0.164
0.039	0.365	1.489	0.164
0.05	-0.003	1.505	0.16
0.055	0.361	1.522	0.156
0.067	-0.003	1.539	0.16
0.072	0.357	1.555	0.156
0.083	-0.003	1.572	0.156
0.089	0.353	1.589	0.156
0.1	0.	1.605	0.156
0.105	0.35	1.622	0.156
0.117	0.012	1.639	0.152
0.122	0.346	1.655	0.152
0.133	0.016	1.672	0.148
0.139	0.342	1.689	0.148
0.15	1.37	1.705	0.148
0.155	0.334	1.722	0.148
0.167	1.92	1.739	0.148
0.172	0.33	1.755	0.144
0.183	0.827	1.772	0.14
0.189	0.33	1.789	0.144
0.2	0.458	1.805	0.144
0.205	0.326	1.822	0.144
0.217	0.381	1.839	0.14
0.222	0.319	1.855	0.136
0.233	0.361	1.872	0.137
0.239	0.315	1.889	0.137

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.361	1.905	0.137
0.255	0.315	1.922	0.133
0.267	0.361	1.939	0.133
0.272	0.307	1.955	0.129
0.283	0.365	1.972	0.129
0.289	0.307	1.989	0.133
0.3	0.365	2.005	0.129
0.305	0.299	2.022	0.125
0.317	0.365	2.039	0.129
0.322	0.299	2.055	0.129
0.339	0.291	2.072	0.129
0.355	0.291	2.089	0.129
0.372	0.288	2.105	0.125
0.389	0.284	2.122	0.125
0.405	0.28	2.139	0.125
0.422	0.276	2.155	0.125
0.439	0.272	2.172	0.121
0.455	0.268	2.189	0.121
0.472	0.264	2.205	0.121
0.489	0.264	2.222	0.117
0.505	0.26	2.239	0.121
0.522	0.26	2.255	0.117
0.539	0.26	2.272	0.121
0.555	0.257	2.289	0.117
0.572	0.253	2.305	0.113
0.589	0.249	2.322	0.113
0.605	0.249	2.339	0.113
0.622	0.245	2.355	0.113
0.639	0.241	2.372	0.117
0.655	0.237	2.389	0.113
0.672	0.237	2.405	0.109
0.689	0.237	2.422	0.109
0.705	0.233	2.439	0.109
0.722	0.233	2.455	0.109
0.739	0.233	2.472	0.109
0.755	0.23	2.489	0.109
0.772	0.229	2.505	0.109
0.789	0.226	2.522	0.109
0.805	0.226	2.539	0.106
0.822	0.222	2.555	0.109
0.839	0.218	2.572	0.106
0.855	0.222	2.589	0.105
0.872	0.218	2.605	0.105
0.889	0.214	2.622	0.105
0.905	0.214	2.639	0.106
0.922	0.214	2.655	0.106
0.939	0.206	2.672	0.106
0.955	0.206	2.689	0.102
0.972	0.206	2.705	0.102
0.989	0.202	2.722	0.102
1.005	0.202	2.739	0.102
1.022	0.202	2.755	0.102
1.039	0.198	2.772	0.102
1.055	0.198	2.789	0.098
1.072	0.195	2.805	0.102
1.089	0.198	2.822	0.098
1.105	0.195	2.839	0.098
1.122	0.195	2.855	0.098
1.139	0.191	2.872	0.098
1.155	0.187	2.889	0.098
1.172	0.187	2.905	0.094
1.189	0.187	2.922	0.094
1.205	0.183	2.939	0.094

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	0.183	2.955	0.094
1.239	0.179	2.972	0.094
1.255	0.179	2.989	0.094
1.272	0.179	3.005	0.094
1.289	0.175	3.022	0.09
1.305	0.175	3.039	0.09
1.322	0.175	3.055	0.09
1.339	0.175	3.072	0.094
1.355	0.171	3.089	0.09
1.372	0.167	3.105	0.09
1.389	0.167	3.122	0.09
1.405	0.167	3.139	0.094
1.422	0.167		

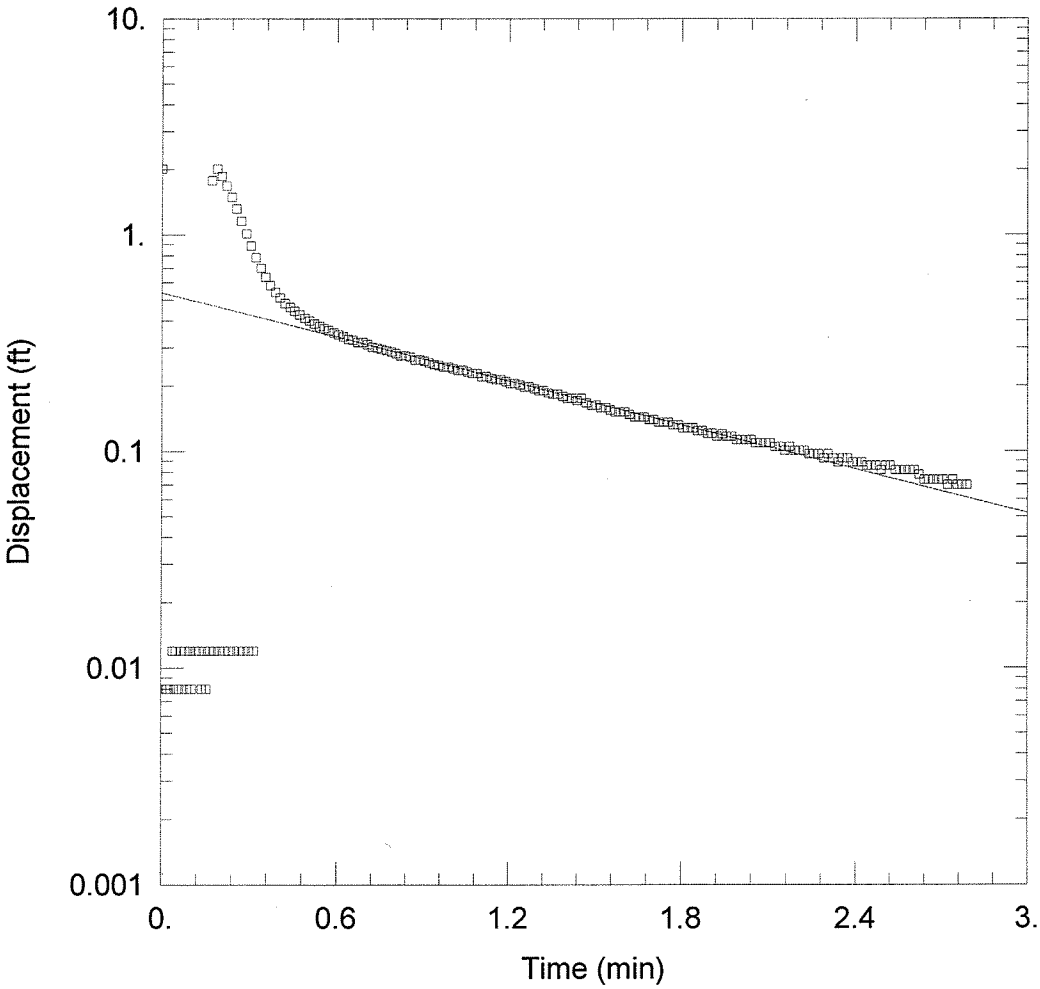
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.319

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0005958	ft/min
y0	0.3832	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw07r.aqt
Date: 07/15/08 Time: 14:38:01

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW07r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW07R)

Initial Displacement: 2.014 ft
Total Well Penetration Depth: 16.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.49 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0006448 ft/min
y0 = 0.5382 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:11

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW07r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW07R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.014 ft
Static Water Column Height: 14.49 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 16.5 ft

No. of Observations: 186

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.008	1.255	0.198
0.022	0.008	1.272	0.198
0.033	0.008	1.289	0.194
0.039	0.012	1.305	0.19
0.05	0.012	1.322	0.19
0.055	0.008	1.339	0.186
0.067	0.012	1.355	0.183
0.072	0.008	1.372	0.183
0.083	0.012	1.389	0.179
0.089	0.008	1.405	0.175
0.1	0.012	1.422	0.175
0.105	0.008	1.439	0.171
0.117	0.012	1.455	0.175
0.122	0.012	1.472	0.167
0.133	0.012	1.489	0.163
0.139	0.008	1.505	0.163
0.15	0.012	1.522	0.159
0.155	0.008	1.539	0.159
0.167	0.012	1.555	0.155
0.172	1.781	1.572	0.152
0.183	0.012	1.589	0.152
0.189	2.014	1.605	0.152
0.2	0.012	1.622	0.148
0.205	1.866	1.639	0.144
0.217	0.012	1.655	0.144
0.222	1.684	1.672	0.144
0.233	0.012	1.689	0.14
0.239	1.494	1.705	0.14

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.012	1.722	0.136
0.255	1.319	1.739	0.136
0.267	0.012	1.755	0.136
0.272	1.156	1.772	0.132
0.283	0.012	1.789	0.132
0.289	1.013	1.805	0.128
0.3	0.012	1.822	0.128
0.305	0.889	1.839	0.128
0.317	0.012	1.855	0.124
0.322	0.784	1.872	0.124
0.339	0.699	1.889	0.121
0.355	0.636	1.905	0.121
0.372	0.582	1.922	0.117
0.389	0.543	1.939	0.12
0.405	0.512	1.955	0.117
0.422	0.481	1.972	0.117
0.439	0.462	1.989	0.113
0.455	0.443	2.005	0.113
0.472	0.427	2.022	0.113
0.489	0.411	2.039	0.113
0.505	0.4	2.055	0.109
0.522	0.388	2.072	0.109
0.539	0.377	2.089	0.109
0.555	0.369	2.105	0.109
0.572	0.361	2.122	0.105
0.589	0.353	2.139	0.105
0.605	0.346	2.155	0.101
0.622	0.338	2.172	0.105
0.639	0.33	2.189	0.101
0.655	0.326	2.205	0.101
0.672	0.318	2.222	0.101
0.689	0.318	2.239	0.097
0.705	0.311	2.255	0.097
0.722	0.303	2.272	0.097
0.739	0.299	2.289	0.093
0.755	0.295	2.305	0.097
0.772	0.291	2.322	0.093
0.789	0.287	2.339	0.089
0.805	0.283	2.355	0.093
0.822	0.276	2.372	0.093
0.839	0.276	2.389	0.089
0.855	0.272	2.405	0.089
0.872	0.264	2.422	0.089
0.889	0.264	2.439	0.086
0.905	0.26	2.455	0.086
0.922	0.256	2.472	0.086
0.939	0.252	2.489	0.082
0.955	0.249	2.505	0.086
0.972	0.245	2.522	0.086
0.989	0.245	2.539	0.082
1.005	0.241	2.555	0.082
1.022	0.237	2.572	0.082
1.039	0.237	2.589	0.082
1.055	0.233	2.605	0.082
1.072	0.229	2.622	0.078
1.089	0.229	2.639	0.074
1.105	0.221	2.655	0.074
1.122	0.221	2.672	0.074
1.139	0.217	2.689	0.074
1.155	0.214	2.705	0.074
1.172	0.214	2.722	0.07
1.189	0.21	2.739	0.074
1.205	0.206	2.755	0.07

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	0.206	2.772	0.07
1.239	0.202	2.789	0.07

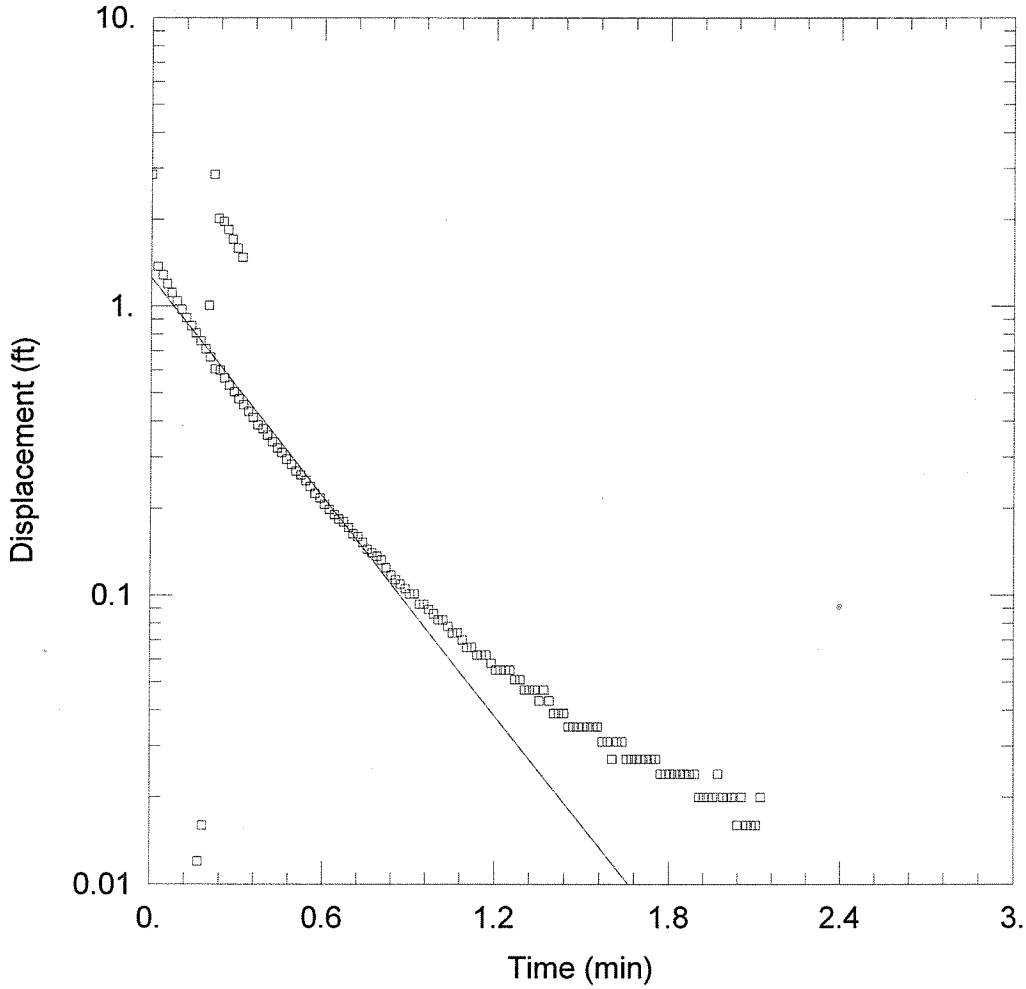
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.399

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0006448	ft/min
y0	0.5382	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw08f.aqt
Date: 07/15/08 Time: 14:38:50

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW08f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW08F)

Initial Displacement: 2.859 ft
Total Well Penetration Depth: 13.14 ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.14 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00229 ft/min
y0 = 1.252 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:20:04

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW08f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW08F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.859 ft
Static Water Column Height: 13.14 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 13.14 ft

No. of Observations: 146

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.	0.922	0.101
0.022	1.373	0.939	0.093
0.033	0.	0.955	0.093
0.039	1.28	0.972	0.089
0.05	0.	0.989	0.086
0.055	1.191	1.005	0.082
0.067	-0.004	1.022	0.082
0.072	1.113	1.039	0.078
0.083	0.	1.055	0.074
0.089	1.04	1.072	0.074
0.1	0.	1.089	0.07
0.105	0.974	1.105	0.066
0.117	-0.004	1.122	0.066
0.122	0.912	1.139	0.062
0.133	0.	1.155	0.062
0.139	0.854	1.172	0.062
0.15	0.008	1.189	0.058
0.155	0.807	1.205	0.055
0.167	0.012	1.222	0.055
0.172	0.757	1.239	0.055
0.183	0.016	1.255	0.055
0.189	0.71	1.272	0.051
0.2	1.005	1.289	0.051
0.205	0.667	1.305	0.047
0.217	2.859	1.322	0.047
0.222	0.605	1.339	0.047
0.233	2.013	1.355	0.043
0.239	0.598	1.372	0.047

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	1.967	1.389	0.043
0.255	0.563	1.405	0.039
0.267	1.839	1.422	0.039
0.272	0.532	1.439	0.039
0.283	1.703	1.455	0.035
0.289	0.504	1.472	0.035
0.3	1.587	1.489	0.035
0.305	0.477	1.505	0.035
0.317	1.474	1.522	0.035
0.322	0.454	1.539	0.035
0.339	0.431	1.555	0.035
0.355	0.411	1.572	0.031
0.372	0.388	1.589	0.031
0.389	0.376	1.605	0.027
0.405	0.357	1.622	0.031
0.422	0.338	1.639	0.031
0.439	0.322	1.655	0.027
0.455	0.311	1.672	0.027
0.472	0.295	1.689	0.027
0.489	0.283	1.705	0.027
0.505	0.268	1.722	0.027
0.522	0.26	1.739	0.027
0.539	0.249	1.755	0.027
0.555	0.237	1.772	0.024
0.572	0.225	1.789	0.024
0.589	0.217	1.805	0.024
0.605	0.206	1.822	0.024
0.622	0.198	1.839	0.024
0.639	0.19	1.855	0.024
0.655	0.183	1.872	0.024
0.672	0.179	1.889	0.024
0.689	0.171	1.905	0.02
0.705	0.163	1.922	0.02
0.722	0.159	1.939	0.02
0.739	0.152	1.955	0.02
0.755	0.144	1.972	0.024
0.772	0.14	1.989	0.02
0.789	0.136	2.005	0.02
0.805	0.132	2.022	0.02
0.822	0.124	2.039	0.016
0.839	0.117	2.055	0.02
0.855	0.113	2.072	0.016
0.872	0.109	2.089	0.016
0.889	0.105	2.105	0.016
0.905	0.101	2.122	0.02

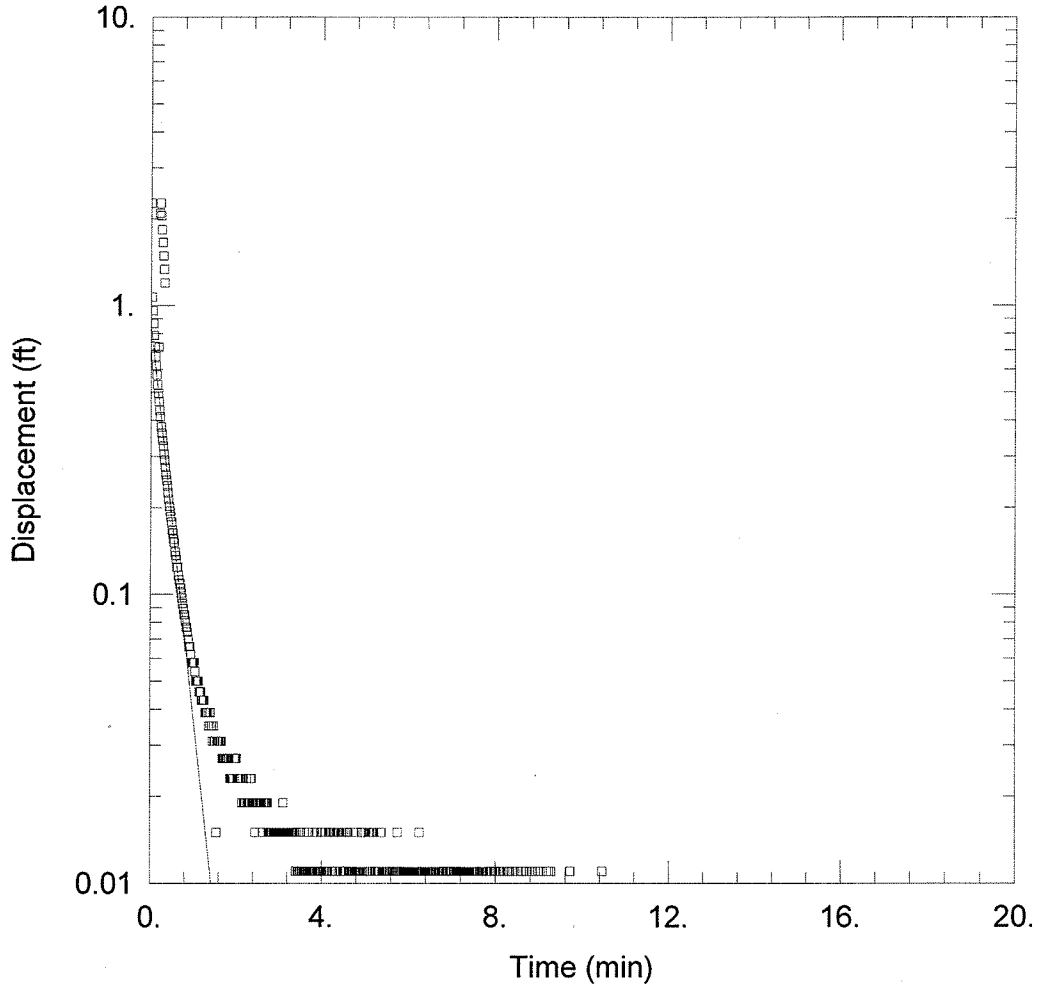
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.285

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00229	ft/min
y0	1.252	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw08r.aqt
Date: 07/15/08 Time: 14:38:46

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW08r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW08R)

Initial Displacement: 2.265 ft
Static Water Column Height: 13.73 ft
Total Well Penetration Depth: 13.73 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.002459 ft/min
y0 = 0.8521 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:57

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW08r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW08R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.265 ft
Static Water Column Height: 13.73 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 13.73 ft

No. of Observations: 659

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.004	5.205	0.015
0.022	1.067	5.222	0.015
0.033	0.008	5.239	0.011
0.039	0.958	5.255	0.011
0.05	0.004	5.272	0.011
0.055	0.865	5.289	0.011
0.067	0.004	5.305	0.011
0.072	0.787	5.322	0.011
0.083	0.008	5.339	0.011
0.089	0.721	5.355	0.011
0.1	0.004	5.372	0.015
0.105	0.667	5.389	0.015
0.117	0.004	5.405	0.011
0.122	0.617	5.422	0.011
0.133	0.004	5.439	0.011
0.139	0.574	5.455	0.011
0.15	0.004	5.472	0.011
0.155	0.531	5.489	0.011
0.167	0.008	5.505	0.011
0.172	0.496	5.522	0.011
0.183	0.717	5.539	0.011
0.189	0.465	5.555	0.011
0.2	2.09	5.572	0.011
0.205	0.434	5.589	0.011
0.217	2.265	5.605	0.008
0.222	0.411	5.622	0.008
0.233	2.052	5.639	0.008
0.239	0.38	5.655	0.011

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	1.831	5.672	0.008
0.255	0.361	5.689	0.011
0.267	1.652	5.705	0.008
0.272	0.341	5.722	0.008
0.283	1.485	5.739	0.011
0.289	0.326	5.755	0.015
0.3	1.334	5.772	0.011
0.305	0.306	5.789	0.008
0.317	1.195	5.805	0.011
0.322	0.291	5.822	0.011
0.339	0.275	5.839	0.011
0.355	0.26	5.855	0.011
0.372	0.248	5.872	0.008
0.389	0.237	5.889	0.011
0.405	0.225	5.905	0.011
0.422	0.213	5.922	0.011
0.439	0.202	5.939	0.011
0.455	0.194	5.955	0.011
0.472	0.186	5.972	0.011
0.489	0.178	5.989	0.011
0.505	0.167	6.005	0.011
0.522	0.163	6.022	0.011
0.539	0.155	6.039	0.011
0.555	0.151	6.055	0.011
0.572	0.14	6.072	0.011
0.589	0.136	6.089	0.011
0.605	0.132	6.105	0.011
0.622	0.124	6.122	0.011
0.639	0.124	6.139	0.011
0.655	0.116	6.155	0.011
0.672	0.112	6.172	0.011
0.689	0.109	6.189	0.011
0.705	0.105	6.205	0.011
0.722	0.101	6.222	0.011
0.739	0.097	6.239	0.011
0.755	0.093	6.255	0.015
0.772	0.089	6.272	0.011
0.789	0.085	6.289	0.011
0.805	0.085	6.305	0.011
0.822	0.081	6.322	0.011
0.839	0.077	6.339	0.011
0.855	0.077	6.355	0.008
0.872	0.074	6.372	0.011
0.889	0.07	6.389	0.011
0.905	0.066	6.405	0.011
0.922	0.066	6.422	0.011
0.939	0.066	6.439	0.011
0.955	0.062	6.455	0.011
0.972	0.058	6.472	0.011
0.989	0.058	6.489	0.011
1.005	0.058	6.505	0.011
1.022	0.058	6.522	0.011
1.039	0.058	6.539	0.011
1.055	0.054	6.555	0.011
1.072	0.05	6.572	0.011
1.089	0.05	6.589	0.011
1.105	0.05	6.605	0.011
1.122	0.05	6.622	0.008
1.139	0.05	6.639	0.011
1.155	0.046	6.655	0.011
1.172	0.046	6.672	0.008
1.189	0.046	6.689	0.011
1.205	0.043	6.705	0.011

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	0.043	6.722	0.011
1.239	0.043	6.739	0.011
1.255	0.043	6.755	0.008
1.272	0.043	6.772	0.011
1.289	0.039	6.789	0.011
1.305	0.039	6.805	0.011
1.322	0.039	6.822	0.011
1.339	0.039	6.839	0.008
1.355	0.039	6.855	0.008
1.372	0.035	6.872	0.011
1.389	0.039	6.889	0.008
1.405	0.035	6.905	0.008
1.422	0.039	6.922	0.008
1.439	0.035	6.939	0.008
1.455	0.035	6.955	0.011
1.472	0.031	6.972	0.011
1.489	0.035	6.989	0.008
1.505	0.031	7.005	0.008
1.522	0.031	7.022	0.008
1.539	-0.035	7.039	0.011
1.555	0.015	7.055	0.011
1.572	0.031	7.072	0.011
1.589	0.031	7.089	0.011
1.605	0.031	7.105	0.011
1.622	0.031	7.122	0.011
1.639	0.031	7.139	0.011
1.655	0.031	7.155	0.011
1.672	0.031	7.172	0.011
1.689	0.027	7.189	0.011
1.705	0.027	7.205	0.011
1.722	0.027	7.222	0.011
1.739	0.027	7.239	0.011
1.755	0.027	7.255	0.011
1.772	0.027	7.272	0.011
1.789	0.027	7.289	0.011
1.805	0.027	7.305	0.011
1.822	0.027	7.322	0.011
1.839	0.027	7.339	0.011
1.855	0.027	7.355	0.011
1.872	0.023	7.372	0.011
1.889	0.023	7.389	0.011
1.905	0.023	7.405	0.011
1.922	0.023	7.422	0.011
1.939	0.023	7.439	0.008
1.955	0.023	7.455	0.011
1.972	0.027	7.472	0.011
1.989	0.027	7.489	0.011
2.005	0.027	7.505	0.011
2.022	0.027	7.522	0.011
2.039	0.023	7.539	0.011
2.055	0.023	7.555	0.011
2.072	0.023	7.572	0.011
2.089	0.023	7.589	0.011
2.105	0.023	7.605	0.011
2.122	0.023	7.622	0.008
2.139	0.023	7.639	0.011
2.155	0.019	7.655	0.011
2.172	0.023	7.672	0.008
2.189	0.019	7.689	0.011
2.205	0.019	7.705	0.011
2.222	0.019	7.722	0.011
2.239	0.019	7.739	0.011
2.255	0.023	7.755	0.008

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.272	0.019	7.772	0.011
2.289	0.019	7.789	0.011
2.305	0.019	7.805	0.011
2.322	0.019	7.822	0.011
2.339	0.019	7.839	0.008
2.355	0.023	7.855	0.008
2.372	0.023	7.872	0.011
2.389	0.019	7.889	0.008
2.405	0.019	7.905	0.008
2.422	0.019	7.922	0.008
2.439	0.019	7.939	0.008
2.455	0.015	7.955	0.008
2.472	0.019	7.972	0.008
2.489	0.019	7.989	0.011
2.505	0.019	8.005	0.011
2.522	0.019	8.022	0.011
2.539	0.019	8.039	0.011
2.555	0.019	8.055	0.008
2.572	0.019	8.072	0.008
2.589	0.019	8.089	0.011
2.605	0.019	8.105	0.008
2.622	0.019	8.122	0.011
2.639	0.015	8.139	0.011
2.655	0.019	8.155	0.008
2.672	0.019	8.172	0.011
2.689	0.019	8.189	0.008
2.705	0.019	8.205	0.008
2.722	0.019	8.222	0.008
2.739	0.019	8.239	0.008
2.755	0.019	8.255	0.008
2.772	0.015	8.272	0.011
2.789	0.015	8.289	0.011
2.805	0.015	8.305	0.008
2.822	0.015	8.322	0.008
2.839	0.015	8.339	0.008
2.855	0.015	8.355	0.008
2.872	0.015	8.372	0.008
2.889	0.015	8.389	0.011
2.905	0.015	8.405	0.008
2.922	0.015	8.422	0.011
2.939	0.015	8.439	0.008
2.955	0.015	8.455	0.008
2.972	0.015	8.472	0.008
2.989	0.015	8.489	0.008
3.005	0.015	8.505	0.011
3.022	0.015	8.522	0.011
3.039	0.015	8.539	0.008
3.055	0.015	8.555	0.008
3.072	0.015	8.572	0.008
3.089	0.015	8.589	0.008
3.105	0.019	8.605	0.011
3.122	0.015	8.622	0.008
3.139	0.015	8.639	0.011
3.155	0.015	8.655	0.008
3.172	0.015	8.672	0.008
3.189	0.015	8.689	0.008
3.205	0.015	8.705	0.011
3.222	0.015	8.722	0.011
3.239	0.015	8.739	0.008
3.255	0.015	8.755	0.008
3.272	0.015	8.772	0.008
3.289	0.015	8.789	0.011
3.305	0.015	8.805	0.008

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.322	0.015	8.822	0.008
3.339	0.015	8.839	0.011
3.355	0.015	8.855	0.011
3.372	0.015	8.872	0.008
3.389	0.015	8.889	0.008
3.405	0.011	8.905	0.008
3.422	0.015	8.922	0.011
3.439	0.011	8.939	0.008
3.455	0.011	8.955	0.008
3.472	0.011	8.972	0.008
3.489	0.011	8.989	0.011
3.505	0.011	9.005	0.008
3.522	0.015	9.022	0.008
3.539	0.011	9.039	0.008
3.555	0.011	9.055	0.008
3.572	0.011	9.072	0.008
3.589	0.011	9.089	0.008
3.605	0.011	9.105	0.008
3.622	0.011	9.122	0.008
3.639	0.011	9.139	0.008
3.655	0.011	9.155	0.008
3.672	0.015	9.172	0.011
3.689	0.011	9.189	0.008
3.705	0.015	9.205	0.008
3.722	0.011	9.222	0.011
3.739	0.011	9.239	0.008
3.755	0.011	9.255	0.008
3.772	0.011	9.272	0.011
3.789	0.011	9.289	0.008
3.805	0.015	9.305	0.008
3.822	0.011	9.322	0.008
3.839	0.011	9.339	0.008
3.855	0.011	9.355	0.008
3.872	0.011	9.372	0.008
3.889	0.015	9.389	0.008
3.905	0.011	9.405	0.008
3.922	0.011	9.422	0.008
3.939	0.011	9.439	0.008
3.955	0.011	9.455	0.008
3.972	0.011	9.472	0.008
3.989	0.011	9.489	0.008
4.005	0.011	9.505	0.008
4.022	0.015	9.522	0.008
4.039	0.015	9.539	0.008
4.055	0.011	9.555	0.008
4.072	0.011	9.572	0.008
4.089	0.011	9.589	0.008
4.105	0.015	9.605	0.008
4.122	0.011	9.622	0.008
4.139	0.011	9.639	0.008
4.155	0.011	9.655	0.008
4.172	0.015	9.672	0.008
4.189	0.015	9.689	0.008
4.205	0.011	9.705	0.011
4.222	0.015	9.722	0.011
4.239	0.011	9.739	0.008
4.255	0.011	9.755	0.004
4.272	0.015	9.772	0.008
4.289	0.015	9.789	0.008
4.305	0.011	9.805	0.008
4.322	0.015	9.822	0.008
4.339	0.011	9.839	0.008
4.355	0.015	9.855	0.008

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
4.372	0.015	9.872	0.008
4.389	0.015	9.889	0.008
4.405	0.015	9.905	0.008
4.422	0.015	9.922	0.008
4.439	0.011	9.939	0.008
4.455	0.015	9.955	0.008
4.472	0.015	9.972	0.008
4.489	0.015	9.989	0.008
4.505	0.011	10.01	0.008
4.522	0.015	10.02	0.008
4.539	0.011	10.04	0.008
4.555	0.011	10.06	0.008
4.572	0.011	10.07	0.008
4.589	0.015	10.09	0.008
4.605	0.015	10.11	0.008
4.622	0.015	10.12	0.008
4.639	0.011	10.14	0.008
4.655	0.011	10.15	0.008
4.672	0.011	10.17	0.008
4.689	0.011	10.19	0.008
4.705	0.011	10.21	0.008
4.722	0.011	10.22	0.008
4.739	0.011	10.24	0.008
4.755	0.015	10.26	0.008
4.772	0.011	10.27	0.008
4.789	0.011	10.29	0.008
4.805	0.011	10.31	0.008
4.822	0.011	10.32	0.008
4.839	0.011	10.34	0.008
4.855	0.011	10.36	0.008
4.872	0.011	10.37	0.008
4.889	0.011	10.39	0.008
4.905	0.011	10.4	0.008
4.922	0.011	10.42	0.008
4.939	0.015	10.44	0.008
4.955	0.011	10.46	0.011
4.972	0.015	10.47	0.008
4.989	0.011	10.49	0.008
5.005	0.011	10.51	0.008
5.022	0.015	10.52	0.008
5.039	0.011	10.54	0.008
5.055	0.011	10.56	0.008
5.072	0.011	10.57	0.008
5.089	0.015	10.59	0.008
5.105	0.015	10.61	0.008
5.122	0.015	10.62	0.008
5.139	0.011	10.64	0.008
5.155	0.015	10.65	0.008
5.172	0.015	10.67	0.008
5.189	0.015		

SOLUTION

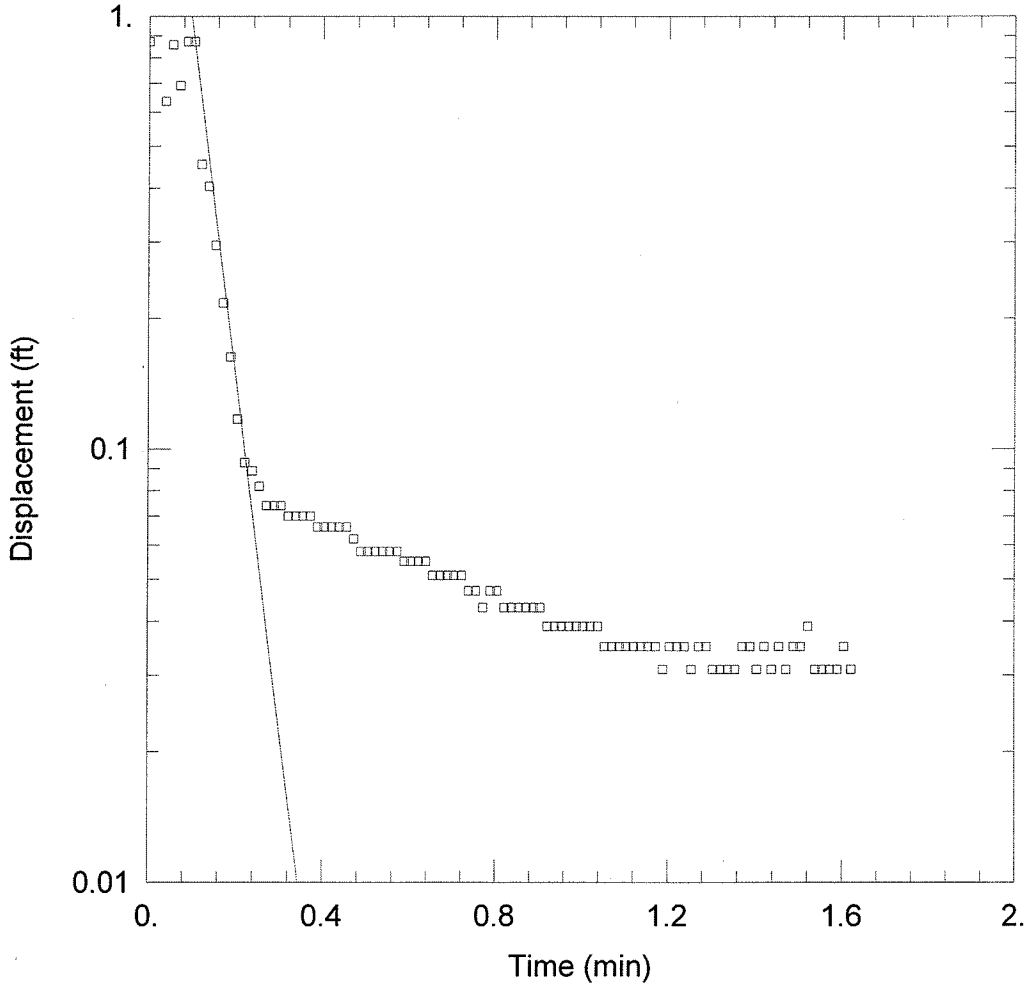
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.307

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.002459	ft/min

y0	0.8521	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw11f.aqt
Date: 07/15/08 Time: 14:38:40

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW11f

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW11F)

Initial Displacement: 0.873 ft Static Water Column Height: 15.13 ft
Total Well Penetration Depth: 15.13 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.01518 ft/min y0 = 6.272 ft

Data Set: K:\ SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:52

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW11f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW11F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.873 ft
Static Water Column Height: 15.13 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.13 ft

No. of Observations: 116

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.004	0.672	0.051
0.022	0.004	0.689	0.051
0.033	0.	0.705	0.051
0.039	0.636	0.722	0.051
0.05	0.	0.739	0.047
0.055	0.858	0.755	0.047
0.067	0.	0.772	0.043
0.072	0.691	0.789	0.047
0.083	0.	0.805	0.047
0.089	0.873	0.822	0.043
0.1	-0.004	0.839	0.043
0.105	0.873	0.855	0.043
0.117	0.	0.872	0.043
0.122	0.454	0.889	0.043
0.133	0.	0.905	0.043
0.139	0.404	0.922	0.039
0.15	0.	0.939	0.039
0.155	0.295	0.955	0.039
0.167	0.	0.972	0.039
0.172	0.217	0.989	0.039
0.183	0.	1.005	0.039
0.189	0.163	1.022	0.039
0.2	0.	1.039	0.039
0.205	0.117	1.055	0.035
0.217	0.	1.072	0.035
0.222	0.093	1.089	0.035
0.233	0.	1.105	0.035
0.239	0.089	1.122	0.035

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.004	1.139	0.035
0.255	0.082	1.155	0.035
0.267	0.008	1.172	0.035
0.272	0.074	1.189	0.031
0.283	0.008	1.205	0.035
0.289	0.074	1.222	0.035
0.3	0.008	1.239	0.035
0.305	0.074	1.255	0.031
0.317	0.004	1.272	0.035
0.322	0.07	1.289	0.035
0.339	0.07	1.305	0.031
0.355	0.07	1.322	0.031
0.372	0.07	1.339	0.031
0.389	0.066	1.355	0.031
0.405	0.066	1.372	0.035
0.422	0.066	1.389	0.035
0.439	0.066	1.405	0.031
0.455	0.066	1.422	0.035
0.472	0.062	1.439	0.031
0.489	0.058	1.455	0.035
0.505	0.058	1.472	0.031
0.522	0.058	1.489	0.035
0.539	0.058	1.505	0.035
0.555	0.058	1.522	0.039
0.572	0.058	1.539	0.031
0.589	0.055	1.555	0.031
0.605	0.055	1.572	0.031
0.622	0.055	1.589	0.031
0.639	0.055	1.605	0.035
0.655	0.051	1.622	0.031

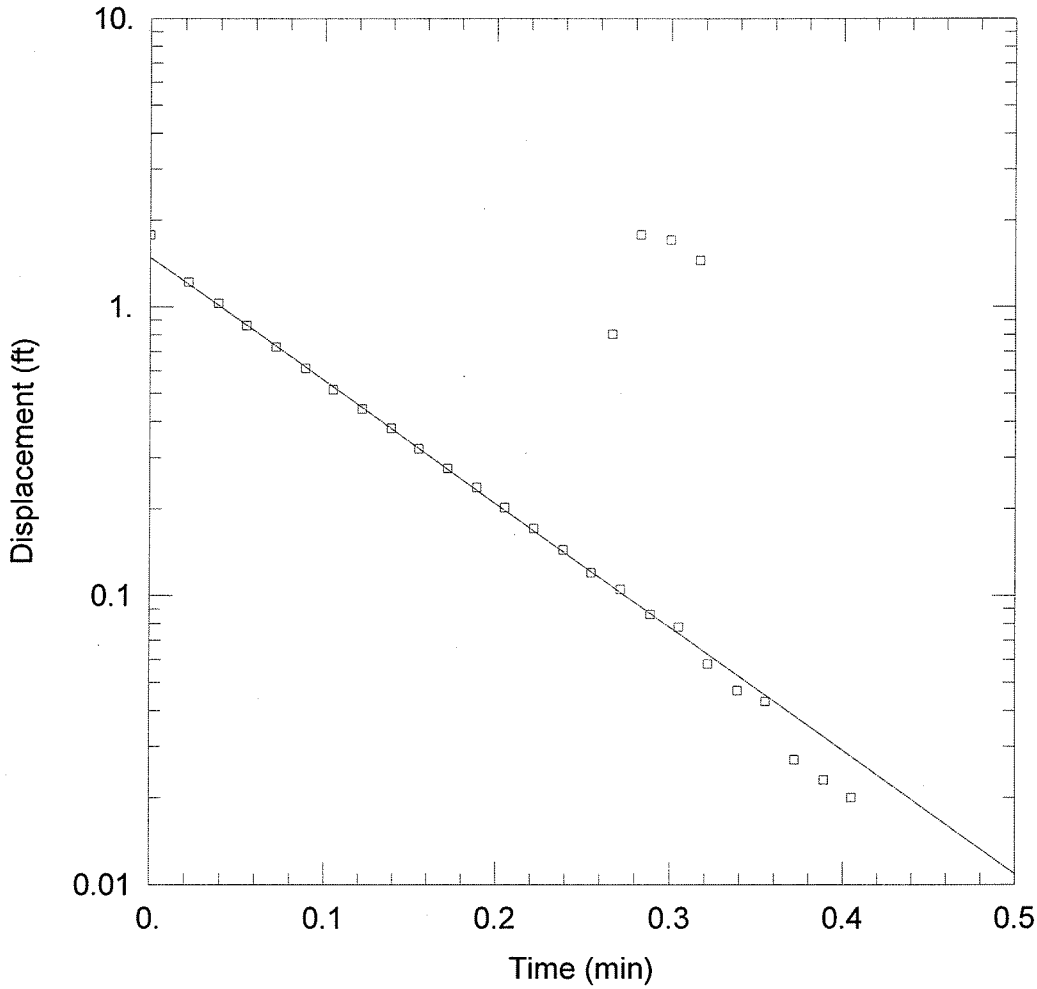
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.355

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.01518	ft/min
y0	6.272	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw11r.aqt
Date: 07/15/08 Time: 14:38:35

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW11r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW11R)

Initial Displacement: 1.777 ft
Total Well Penetration Depth: 14.22 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.22 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.007866 ft/min
y0 = 1.482 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:44

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW11r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW11R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.777 ft
Static Water Column Height: 14.22 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.22 ft

No. of Observations: 47

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.	0.217	0.
0.022	1.215	0.222	0.171
0.033	0.	0.233	0.
0.039	1.028	0.239	0.144
0.05	0.	0.25	-0.004
0.055	0.862	0.255	0.12
0.067	0.	0.267	0.803
0.072	0.726	0.272	0.105
0.083	0.	0.283	1.777
0.089	0.613	0.289	0.086
0.1	0.	0.3	1.704
0.105	0.516	0.305	0.078
0.117	-0.004	0.317	1.448
0.122	0.443	0.322	0.058
0.133	-0.004	0.339	0.047
0.139	0.38	0.355	0.043
0.15	-0.004	0.372	0.027
0.155	0.322	0.389	0.023
0.167	-0.004	0.405	0.02
0.172	0.276	0.422	0.008
0.183	0.	0.439	0.004
0.189	0.237	0.455	0.004
0.2	0.	0.472	0.
0.205	0.202		

SOLUTION

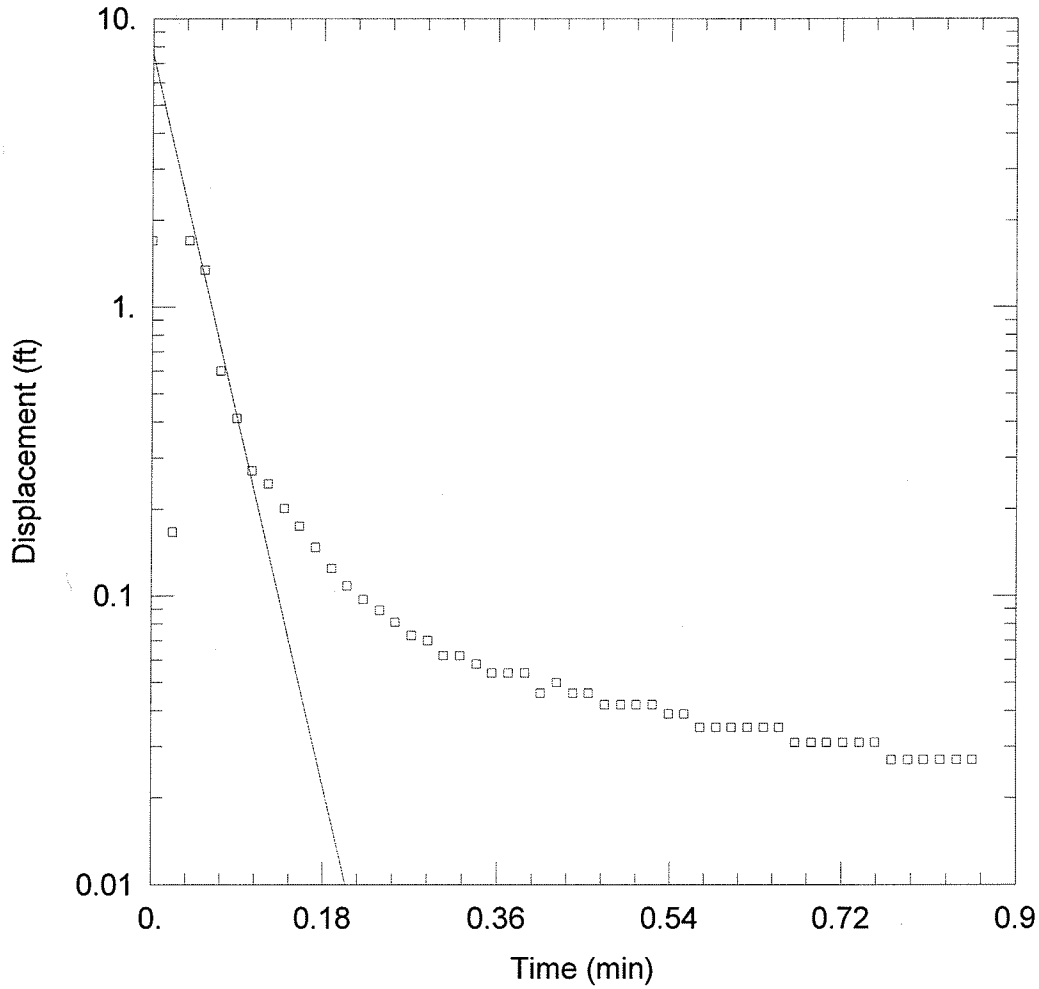
Aquifer Model: Unconfined

Solution Method: Bouwer-Rice
Shape Factor: 2.324

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.007866	ft/min
y0	1.482	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw12f.aqt
Date: 07/15/08 Time: 14:38:29

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW12f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW12F)

Initial Displacement: 1.695 ft
Total Well Penetration Depth: 13.31 ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.31 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02563 ft/min
y0 = 7.582 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:38

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW12f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW12F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.695 ft
Static Water Column Height: 13.31 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 13.31 ft

No. of Observations: 70

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.	0.305	0.062
0.022	0.166	0.317	0.007
0.033	0.	0.322	0.062
0.039	1.695	0.339	0.058
0.05	0.	0.355	0.054
0.055	1.342	0.372	0.054
0.067	0.	0.389	0.054
0.072	0.601	0.405	0.046
0.083	-0.004	0.422	0.05
0.089	0.411	0.439	0.046
0.1	0.	0.455	0.046
0.105	0.271	0.472	0.042
0.117	-0.004	0.489	0.042
0.122	0.244	0.505	0.042
0.133	0.	0.522	0.042
0.139	0.201	0.539	0.039
0.15	-0.004	0.555	0.039
0.155	0.174	0.572	0.035
0.167	0.	0.589	0.035
0.172	0.147	0.605	0.035
0.183	-0.004	0.622	0.035
0.189	0.124	0.639	0.035
0.2	0.	0.655	0.035
0.205	0.108	0.672	0.031
0.217	0.004	0.689	0.031
0.222	0.097	0.705	0.031
0.233	0.	0.722	0.031
0.239	0.089	0.739	0.031

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.	0.755	0.031
0.255	0.081	0.772	0.027
0.267	0.004	0.789	0.027
0.272	0.073	0.805	0.027
0.283	0.007	0.822	0.027
0.289	0.07	0.839	0.027
0.3	0.007	0.855	0.027

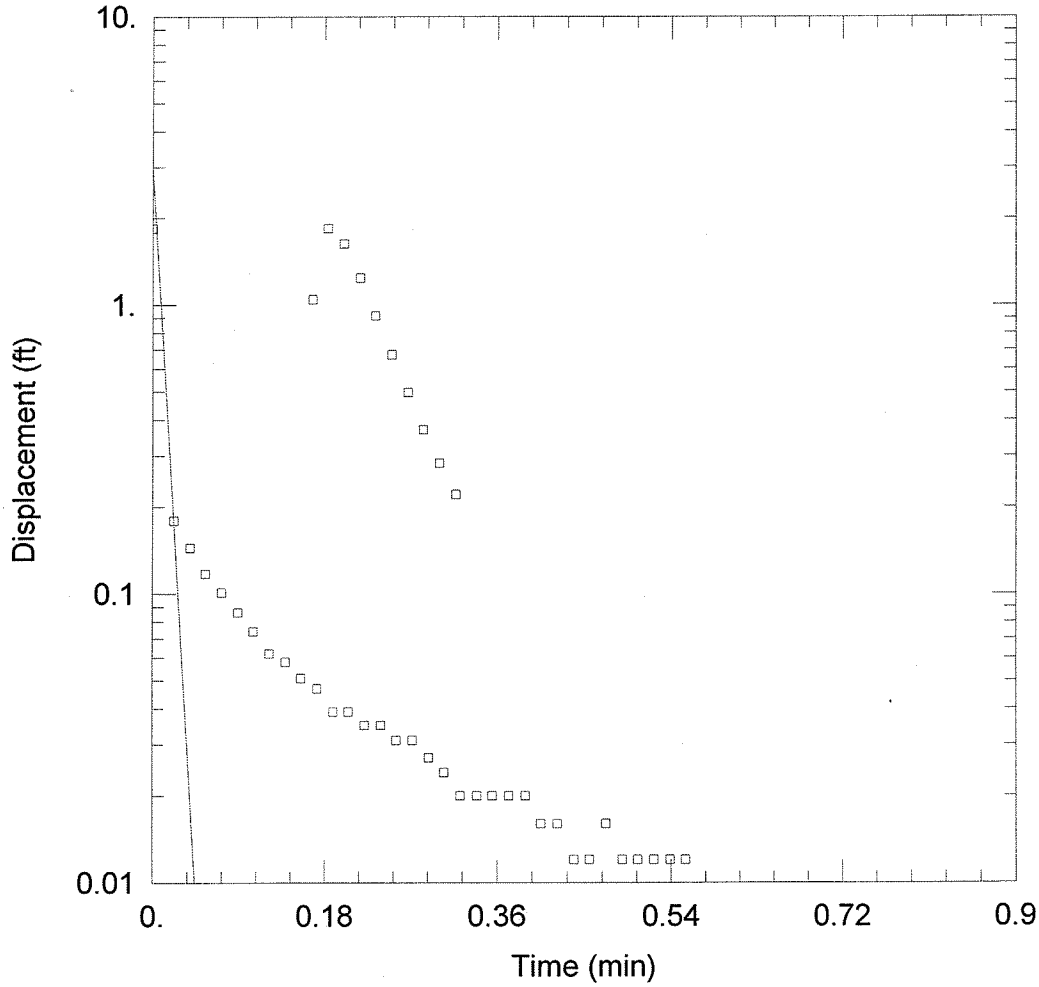
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.291

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.02563	ft/min
y0	7.582	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw12r.aqt
Date: 07/15/08 Time: 14:38:21

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW12r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW12R)

Initial Displacement: 1.843 ft
Total Well Penetration Depth: 13.16 ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.16 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.1011 ft/min
y0 = 2.962 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:32

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW12r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW12R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.843 ft
Static Water Column Height: 13.16 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 13.16 ft

No. of Observations: 70

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.004	0.305	0.024
0.022	0.179	0.317	0.221
0.033	-0.004	0.322	0.02
0.039	0.144	0.339	0.02
0.05	-0.004	0.355	0.02
0.055	0.117	0.372	0.02
0.067	-0.004	0.389	0.02
0.072	0.101	0.405	0.016
0.083	-0.004	0.422	0.016
0.089	0.086	0.439	0.012
0.1	-0.004	0.455	0.012
0.105	0.074	0.472	0.016
0.117	-0.007	0.489	0.012
0.122	0.062	0.505	0.012
0.133	-0.004	0.522	0.012
0.139	0.058	0.539	0.012
0.15	-0.004	0.555	0.012
0.155	0.051	0.572	0.008
0.167	1.044	0.589	0.008
0.172	0.047	0.605	0.008
0.183	1.843	0.622	0.008
0.189	0.039	0.639	0.008
0.2	1.626	0.655	0.008
0.205	0.039	0.672	0.004
0.217	1.238	0.689	0.008
0.222	0.035	0.705	0.004
0.233	0.916	0.722	0.004
0.239	0.035	0.739	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.671	0.755	0.004
0.255	0.031	0.772	0.004
0.267	0.497	0.789	0.004
0.272	0.031	0.805	0.004
0.283	0.369	0.822	0.004
0.289	0.027	0.839	0.
0.3	0.283	0.855	0.

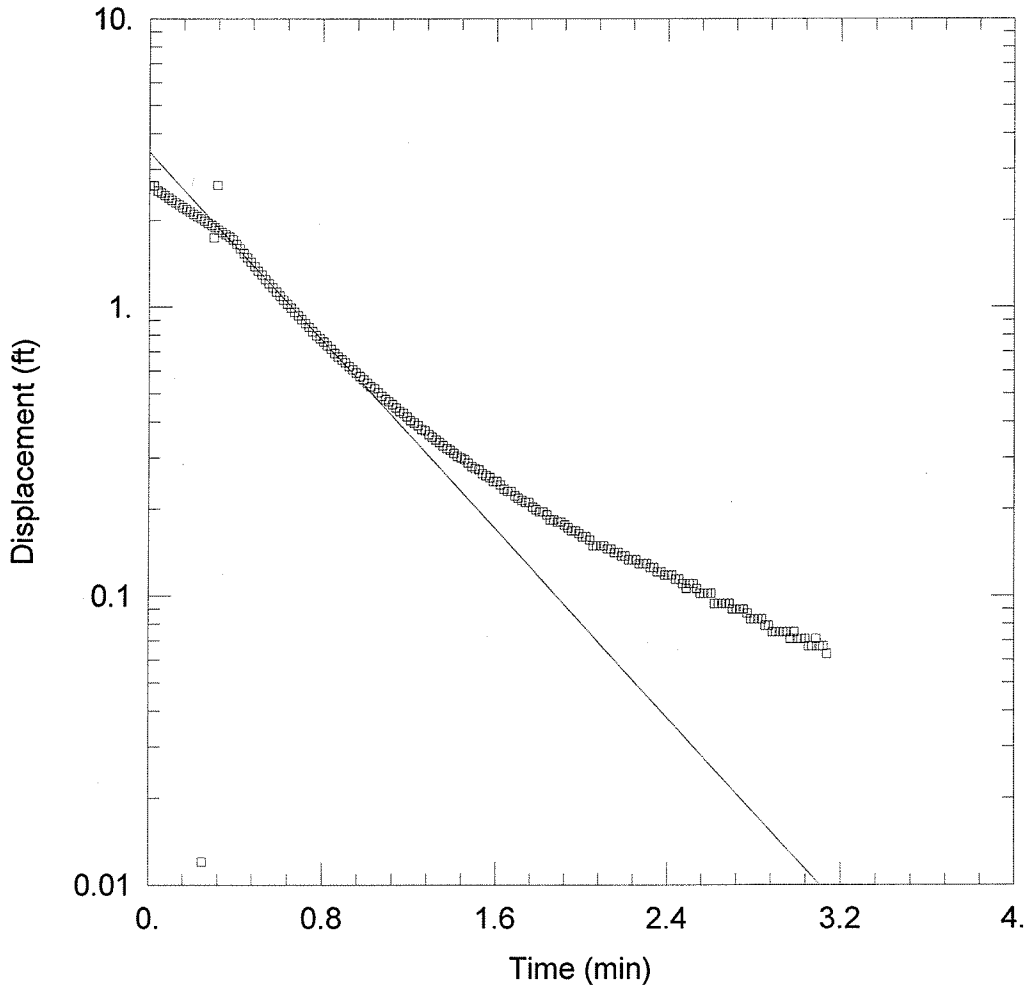
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.286

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.1011	ft/min
y0	2.962	ft



WELL TEST ANALYSIS

Data Set: K:\...\69gw25f.aqt
Date: 07/15/08 Time: 14:38:16

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW25f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (69GW25F)

Initial Displacement: 2.642 ft
Total Well Penetration Depth: 15.36 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.36 ft
Screen Length: 10. ft
Wellbore Radius: 0.344 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00153 ft/min
y0 = 3.442 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\69 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 15:19:26

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 69
Test Well: 69GW25f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 69GW25F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.642 ft
Static Water Column Height: 15.36 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.344 ft
Well Skin Radius: 0.344 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.36 ft

No. of Observations: 207

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.003	1.439	0.3
0.022	2.634	1.455	0.296
0.033	-0.007	1.472	0.288
0.039	2.529	1.489	0.28
0.05	-0.007	1.505	0.276
0.055	2.491	1.522	0.273
0.067	-0.007	1.539	0.265
0.072	2.44	1.555	0.261
0.083	-0.007	1.572	0.257
0.089	2.39	1.589	0.249
0.1	-0.007	1.605	0.249
0.105	2.347	1.622	0.242
0.117	-0.007	1.639	0.234
0.122	2.301	1.655	0.23
0.133	-0.007	1.672	0.23
0.139	2.262	1.689	0.222
0.15	-0.007	1.705	0.218
0.155	2.215	1.722	0.214
0.167	-0.011	1.739	0.211
0.172	2.177	1.755	0.211
0.183	-0.011	1.772	0.203
0.189	2.138	1.789	0.199
0.2	-0.007	1.805	0.195
0.205	2.099	1.822	0.195
0.217	0.008	1.839	0.191
0.222	2.06	1.855	0.183
0.233	0.008	1.872	0.183
0.239	2.025	1.889	0.18

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.012	1.905	0.18
0.255	1.987	1.922	0.176
0.267	0.004	1.939	0.172
0.272	1.952	1.955	0.168
0.283	0.001	1.972	0.168
0.289	1.917	1.989	0.164
0.3	1.734	2.005	0.16
0.305	1.882	2.022	0.16
0.317	2.642	2.039	0.156
0.322	1.847	2.055	0.149
0.339	1.812	2.072	0.149
0.355	1.781	2.089	0.149
0.372	1.75	2.105	0.149
0.389	1.711	2.122	0.145
0.405	1.649	2.139	0.145
0.422	1.591	2.155	0.141
0.439	1.533	2.172	0.141
0.455	1.482	2.189	0.137
0.472	1.428	2.205	0.137
0.489	1.378	2.222	0.133
0.505	1.331	2.239	0.133
0.522	1.289	2.255	0.133
0.539	1.246	2.272	0.129
0.555	1.203	2.289	0.129
0.572	1.164	2.305	0.129
0.589	1.126	2.322	0.125
0.605	1.091	2.339	0.125
0.622	1.056	2.355	0.121
0.639	1.021	2.372	0.121
0.655	0.99	2.389	0.118
0.672	0.959	2.405	0.118
0.689	0.932	2.422	0.118
0.705	0.905	2.439	0.114
0.722	0.877	2.455	0.114
0.739	0.85	2.472	0.11
0.755	0.823	2.489	0.106
0.772	0.796	2.505	0.11
0.789	0.777	2.522	0.11
0.805	0.757	2.539	0.106
0.822	0.734	2.555	0.102
0.839	0.715	2.572	0.102
0.855	0.691	2.589	0.102
0.872	0.672	2.605	0.102
0.889	0.656	2.622	0.094
0.905	0.641	2.639	0.094
0.922	0.622	2.655	0.094
0.939	0.606	2.672	0.094
0.955	0.591	2.689	0.094
0.972	0.575	2.705	0.09
0.989	0.56	2.722	0.09
1.005	0.544	2.739	0.09
1.022	0.529	2.755	0.09
1.039	0.521	2.772	0.087
1.055	0.505	2.789	0.083
1.072	0.49	2.805	0.083
1.089	0.478	2.822	0.083
1.105	0.47	2.839	0.083
1.122	0.459	2.855	0.079
1.139	0.447	2.872	0.079
1.155	0.435	2.889	0.075
1.172	0.428	2.905	0.075
1.189	0.416	2.922	0.075
1.205	0.404	2.939	0.075

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	0.397	2.955	0.075
1.239	0.389	2.972	0.071
1.255	0.377	2.989	0.075
1.272	0.373	3.005	0.071
1.289	0.362	3.022	0.071
1.305	0.354	3.039	0.071
1.322	0.346	3.055	0.067
1.339	0.339	3.072	0.067
1.355	0.331	3.089	0.071
1.372	0.323	3.105	0.067
1.389	0.319	3.122	0.067
1.405	0.311	3.139	0.063
1.422	0.304		

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.363

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00153	ft/min
y0	3.442	ft

APPENDIX B
2008 AND 2010 LABORATORY ANALYTICAL RESULTS

APPENDIX B

2008 SURFACE AND SHALLOW SUBSURFACE SOIL DATA NARRATIVE

As discussed in Section 1.0, the conversion of the airfield to a commercial facility by the PRPA resulted in significant disturbances to soil at SWMU 69 (which occurred after the 2008 CMS investigation). Therefore, analytical results for surface and shallow subsurface soil collected during the 2008 CMS investigation are no longer representative of the current site conditions. These activities resulted in a significant alteration of the physical conditions at the SWMU, as well as a potential redistribution of the chemicals of concern (COCs) identified within the 2008 Draft CMS Report (Baker, 2008a). A Disturbed Soil Sampling Investigation was conducted in 2010 to re-characterize the site. Although the analytical results for the 2008 surface and shallow subsurface soil were not discussed in Section 6.0, given their lack of representation; they have been incorporated into this appendix for reference.

Note that subsurface soil samples collected from depths greater than 3 feet bgs during the 2008 CMS field investigation, as well as groundwater is still considered representative of SWMU conditions and were used in the ecological and human health risk assessments presented in Sections 7.0 and 8.0, respectively.

Surface Soils

2008 CMS Investigation

Twenty-five surface soil samples (69SB01-00 through 69SB24-00 and 69SB27-00) and three duplicate samples (69SB01-00D, 69SB11-00D, and 69SB21-00D) were collected and analyzed during the 2008 CMS investigation at SWMU 69. All of the surface soil samples were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs) and metals. The detected analytical results and the complete data set for the 2008 surface soil data are each provided in Appendix B.

Eight VOCs were detected in the surface soil data set including 2-hexanone, 4-methyl-2-pentanone, acetone, benzene, ethylbenzene, toluene, trans-1,4-dichloro-2-butene and total xylenes. Acetone was detected in 16 of the 25 samples with concentrations ranging from 9.1 J ug/kg in sample 69SB07-00 to 260 ug/kg in sample 69SB05-00. Acetone results from two samples, 69SB04-00 and 69SB12-00 (and the duplicate 69SB11-00D) were rejected because the initial and continuing calibration exhibited low relative response factors; non-detected values were rejected. Total xylenes were detected in five of the 25 surface soil samples at concentrations ranging from 4.9 J in sample 69SB13-00 to 28 J ug/kg in sample 69SB09-00. Toluene was detected in three of the 25 samples at low concentrations (near the detection limits); similarly, ethylbenzene was detected in two of 25 samples at concentrations near the detection limit. Each of the remaining VOCs were detected in only one of the 25 surface soil samples. These results are similar to the ECP Phase II results in that only two VOCs were detected and their corresponding concentrations were below the screening criteria used in the ECP Phase II investigation. Table 6-5 provides a summary of the constituents detected in surface soil during the ECP Phase II Investigation.

Twenty-two SVOCs were detected in the surface soil, as shown in Appendix B. In general, the highest concentrations of SVOCs were encountered in sample 69SB05-00 and to a lesser extent in samples 69SB09-00, 69SB15-00, 69SB18-00 and 69SB23-00. SVOC detections in the remaining samples were all at relatively low concentrations (i.e., near detection limits). As indicated previously, quantitative comparison of these results to screening criteria is provided in Sections 7.0 and 8.0. The CMS Investigation results are similar to the ECP Phase II results in that 15 SVOCs were detected and only two of the detections exceeded the residential RBCs; none of the detections exceeded the industrial RBCs for soil used in the ECP Phase II investigation.

Sixteen metals were detected in the surface soil samples including:

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Tin
- Vanadium
- Zinc

Of these sixteen metals, eleven were detected in one or more samples at concentrations in excess of the NAPR basewide background screening value, as shown in Appendix B. Arsenic exceeded the NAPR basewide background screening value in 18 of 25 samples. Cadmium and lead exceeded the basewide background screening value in 10 of 25 samples. Chromium and zinc exceeded the background value in 4 of 25 samples. Mercury exceeded the background screening value in three samples and nickel exceeded in two samples. Barium, selenium, tin and vanadium each exceeded the basewide background screening value in one sample. Sample 69SB05-00 had the highest number of metals exceeding the background screening values as well as the highest detected concentrations of numerous metals (e.g., arsenic at 5.4 mg/kg, barium at 800 mg/kg, cadmium at 36 J mg/kg, chromium at 89 J mg/kg, lead at 520 mg/kg, nickel at 34 mg/kg, tin at 9 J mg/kg and zinc at 650 mg/kg). Lead concentrations elevated above the background screening value also were noted in samples collected immediately adjacent to the southern and eastern edges of the expanded concrete apron area. With the exception of 69SB17 (which was collected in the vicinity of the former UST 974), the surface soil samples collected from the vicinity of the drainage ditch did not exhibit lead concentrations in excess of the background screening value. This indicates that surficial soil contamination is limited to the area immediately adjacent to the expanded concrete apron area and has not migrated to the drainage ditch.

As shown on Table 6-5, fourteen metals were detected in the ECP Phase II investigation. Seven of these metals (arsenic, barium, cadmium, nickel, lead, vanadium and zinc) were detected at concentrations exceeding the background screening value used at that time; six (arsenic, barium, cadmium, chromium, lead and vanadium) were in excess of residential soil RBCs and only one (arsenic at locations 15E-01, 15E-02, 15E-03 and 15E-04) was in excess of industrial RBCs.

Subsurface Soil

2008 CMS Investigation

Five subsurface soil samples (1.0 to 3.0 feet bgs) were collected and analyzed during the 2008 CMS investigation at SWMU 69. All of the subsurface soil samples were analyzed for Appendix IX VOCs,

SVOCs (including LLPAHs), and metals. The detected results (including the complete data set) for the 2008 subsurface soil data (1.0 to 3.0 feet bgs) are provided in Appendix B.

Five VOCs were detected in the subsurface soil data set including 2-chloro-1,3-butadiene, 2-hexanone, 4-methyl-2-pentanone, acetone and carbon disulfide. Acetone was detected in all five samples with concentrations ranging from 9 J ug/kg in sample 69SB07-01 to 47 J ug/kg in sample 69SB27-01. There were no other VOC detections in the shallow subsurface soil samples.

There were no SVOC detections in the shallow subsurface soil samples.

Fourteen metals were detected in the subsurface soil samples collected during the 2008 CMS investigation, including:

- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Vanadium
- Zinc

Of these fourteen metals, five were detected in one or more samples at concentrations in excess of the NAPR basewide background screening value. Arsenic exceeded the NAPR basewide background screening value in sample 69SB08-01; cobalt in sample 69SB12-01; and mercury in sample 69SB07-01.

2008 LABORATORY ANALYTICAL RESULTS

SOIL DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB01	69SB02	69SB03	69SB04	69SB05
Sample ID	69SB01-00	69SB01-00D	69SB02-00	69SB03-00	69SB04-00	69SB05-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.57 U	0.36 U	2.7 UJ	1.6 U	0.88 U	0.51 U
1,1,1-Trichloroethane	0.52 U	0.33 U	2.4 UJ	1.4 U	0.8 U	0.46 U
1,1,2,2-Tetrachloroethane	1.2 U	0.8 U	5.8 UJ	3.4 U	1.9 U	1.1 U
1,1,2-Trichloroethane	1.1 U	0.68 U	5 UJ	3 U	1.7 U	0.96 U
1,1-Dichloroethane	0.44 U	0.29 U	2.1 UJ	1.2 U	0.69 U	0.4 U
1,1-Dichloroethene	0.48 U	0.31 U	2.2 UJ	1.3 U	0.74 U	0.43 U
1,2,3-Trichloropropane	1.2 U	0.8 U	5.8 UJ	3.4 U	1.9 U	1.1 U
1,2-Dibromo-3-Chloropropane	2.5 U	1.6 U	12 UJ	6.9 U	3.9 U	2.2 U
1,2-Dichloroethane	0.89 U	0.57 U	4.1 UJ	2.5 U	1.4 U	0.8 U
1,2-Dichloropropane	0.98 U	0.63 U	4.6 UJ	2.7 U	1.5 U	0.88 U
2-Butanone (MEK)	19 U	20 U	11 UJ	6.6 U	3.7 U	28 U
2-Chloro-1,3-butadiene	0.51 U	0.32 U	2.4 UJ	1.4 U	0.78 U	0.46 U
2-Hexanone	1.9 UJ	1.2 U	8.7 UJ	5.2 U	2.9 U	1.7 U
3-Chloro-1-propene	1.3 U	0.86 UJ	6.2 UJ	3.7 UJ	2.1 UJ	1.2 UJ
4-Methyl-2-pentanone (MIBK)	2.6 U	1.7 U	12 UJ	7.1 U	4 U	2.3 U
Acetone	140	190	18 UJ	11 U	6.1 R	260
Acetonitrile	40 R	26 U	190 UJ	110 U	62 UJ	36 U
Acrolein	17 R	11 R	79 R	47 R	26 R	15 R
Acrylonitrile	20 U	13 U	95 UJ	57 UJ	32 UJ	18 U
Benzene	0.7 U	0.45 U	3.3 UJ	1.9 U	1.1 U	0.63 U
Bromoform	0.98 U	0.63 U	4.6 UJ	2.7 U	1.5 U	0.88 U
Bromomethane	1.4 UJ	0.91 U	6.6 UJ	3.9 U	2.2 UJ	1.3 U
Carbon disulfide	0.45 U	0.29 U	2.1 UJ	1.3 U	0.7 U	0.41 U
Carbon tetrachloride	0.89 U	0.57 U	4.1 UJ	2.5 U	1.4 U	0.8 U
Chlorobenzene	0.65 U	0.42 U	3 UJ	1.8 U	1 U	0.58 U
Chlorodibromomethane	0.44 U	0.29 U	2.1 UJ	1.2 U	0.69 U	0.4 U
Chloroethane	1.1 U	0.68 U	5 UJ	3 U	1.7 U	0.96 U
Chloroform	0.44 U	0.29 U	2.1 UJ	1.2 U	0.69 U	0.4 U
Chloromethane	0.63 U	0.4 U	2.9 UJ	1.7 U	0.98 UJ	0.57 U
cis-1,3-Dichloropropene	0.77 U	0.5 U	3.6 UJ	2.1 U	1.2 U	0.69 U
Dibromomethane	1.1 U	0.68 U	5 UJ	3 U	1.7 U	0.96 U
Dichlorobromomethane	0.74 U	0.47 U	3.4 UJ	2 U	1.1 U	0.66 U
Dichlorodifluoromethane	0.79 U	0.51 U	3.7 UJ	2.2 U	1.2 U	0.71 U
Ethyl methacrylate	2 UJ	1.3 U	9.1 UJ	5.4 U	3 U	1.8 U
Ethylbenzene	0.67 U	0.43 U	3.1 UJ	1.8 U	1 U	0.6 U
Ethylene Dibromide	1.3 U	0.86 U	6.2 UJ	3.7 U	2.1 U	1.2 U
Iodomethane	0.89 U	0.57 UJ	4.1 UJ	2.5 U	1.4 U	0.8 UJ
Isobutyl alcohol	61 R	39 R	290 R	170 R	95 R	55 R
Methacrylonitrile	21 UJ	14 UJ	99 UJ	59 U	33 U	19 UJ
Methyl methacrylate	3.3 UJ	2.1 UJ	15 UJ	9.1 U	5.1 U	3 UJ
Methylene Chloride	0.89 U	0.57 U	4.1 UJ	2.5 U	1.4 U	0.8 U
Pentachloroethane	2 U	1.3 UJ	9.1 UJ	5.4 UJ	3 UJ	1.8 UJ
Propionitrile	19 R	12 U	87 UJ	52 U	29 U	17 U
Styrene	0.59 U	0.38 U	2.7 UJ	1.6 U	0.91 U	0.53 U
Tetrachloroethene	0.65 U	0.42 U	3 UJ	1.8 U	1 U	0.58 U
Toluene	0.7 U	0.45 U	3.3 J	1.9 U	1.1 U	0.63 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB01	69SB02	69SB03	69SB04	69SB05
Sample ID	69SB01-00	69SB01-00D	69SB02-00	69SB03-00	69SB04-00	69SB05-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	0.86 U	0.55 U	4 UJ	2.4 U	1.3 U	0.77 U
trans-1,3-Dichloropropene	0.77 U	0.5 U	3.6 UJ	2.1 U	1.2 U	0.69 U
trans-1,4-Dichloro-2-butene	2.8 UJ	1.8 UJ	13 UJ	7.6 U	4.3 U	2.5 UJ
Trichloroethene	0.89 U	0.57 U	4.1 UJ	2.5 U	1.4 U	0.8 U
Trichlorofluoromethane	1.3 U	0.86 U	6.2 UJ	3.7 U	2.1 U	1.2 U
Vinyl acetate	1.3 U	0.86 U	6.2 UJ	3.7 U	2.1 U	1.2 U
Vinyl chloride	0.52 U	0.33 U	2.4 UJ	1.4 U	0.8 U	0.46 U
Xylenes, Total	2 U	1.3 U	9.5 UJ	6.1 J	3.2 U	1.8 U
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	11 U	10 U	15 UJ	12 UJ	10 UJ	15 UJ
1,2,4,5-Tetrachlorobenzene	9.5 U	8.6 U	13 UJ	9.9 UJ	8.6 UJ	26 J
1,2,4-Trichlorobenzene	11 U	10 U	15 UJ	12 UJ	10 UJ	15 UJ
1,2-Dichlorobenzene	11 U	9.6 U	14 UJ	11 UJ	9.6 UJ	14 UJ
1,3,5-Trinitrobenzene	26 U	23 U	35 UJ	27 UJ	23 UJ	33 UJ
1,3-Dichlorobenzene	9.1 U	8.2 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ
1,3-Dinitrobenzene	5.9 U	5.3 U	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ
1,4-Dichlorobenzene	9.4 U	8.5 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ
1,4-Dioxane	12 U	11 U	17 UJ	13 UJ	11 UJ	16 UJ
1,4-Naphthoquinone	5.9 UJ	5.3 UJ	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ
2,2'-oxybis[1-chloropropane]	9.5 U	8.6 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ
2,3,4,6-Tetrachlorophenol	6.4 UJ	5.7 U	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ
2,4,5-Trichlorophenol	10 UJ	9.3 U	14 UJ	11 UJ	9.3 UJ	13 UJ
2,4,6-Trichlorophenol	12 UJ	11 U	16 UJ	12 UJ	11 UJ	16 UJ
2,4-Dichlorophenol	12 UJ	11 U	17 UJ	13 UJ	11 UJ	16 UJ
2,4-Dimethylphenol	26 UJ	23 U	35 UJ	27 UJ	23 UJ	33 UJ
2,4-Dinitrophenol	130 UJ	110 UJ	170 UJ	130 UJ	110 UJ	160 UJ
2,4-Dinitrotoluene	8.9 U	8.1 U	12 UJ	9.3 UJ	8.1 UJ	12 UJ
2,6-Dichlorophenol	9.7 UJ	8.7 U	13 UJ	10 UJ	8.8 UJ	13 UJ
2,6-Dinitrotoluene	9.4 U	8.5 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ
2-Acetylaminofluorene	7.7 U	7 U	11 UJ	8 UJ	7 UJ	10 UJ
2-Chloronaphthalene	9.4 U	8.5 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ
2-Chlorophenol	10 UJ	9 U	14 UJ	10 UJ	9 UJ	13 UJ
2-Methylnaphthalene	2.6 U	2.3 U	3.5 UJ	2.7 UJ	2.3 UJ	9.2 J
2-Methylphenol	12 UJ	11 U	17 UJ	13 UJ	11 UJ	16 UJ
2-Naphthylamine	30 U	27 U	41 UJ	31 UJ	27 UJ	39 UJ
2-Nitroaniline	9.8 U	8.9 U	13 UJ	10 UJ	8.9 UJ	13 UJ
2-Nitrophenol	11 UJ	10 U	15 UJ	11 UJ	10 UJ	14 UJ
2-Picoline	18 U	16 U	25 UJ	19 UJ	16 UJ	24 UJ
2-Toluidine	14 U	13 U	19 UJ	15 UJ	13 UJ	18 UJ
3 & 4 Methylphenol	11 UJ	10 U	15 UJ	11 UJ	10 UJ	14 UJ
3,3'-Dichlorobenzidine	14 UJ	13 UJ	19 UJ	14 UJ	13 UJ	18 UJ
3,3'-Dimethylbenzidine	270 U	250 U	370 UJ	280 UJ	250 UJ	350 UJ
3-Methylcholanthrene	9.2 U	8.3 U	13 UJ	9.6 UJ	8.4 UJ	12 UJ
3-Nitroaniline	6.8 U	6.1 U	9.3 UJ	7.1 UJ	6.2 UJ	8.9 UJ
4,6-Dinitro-2-methylphenol	8.8 UJ	7.9 UJ	12 UJ	9.1 UJ	8 UJ	11 UJ
4-Aminobiphenyl	20 U	18 U	27 UJ	20 UJ	18 UJ	26 UJ

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB01	69SB02	69SB03	69SB04	69SB05
Sample ID	69SB01-00	69SB01-00D	69SB02-00	69SB03-00	69SB04-00	69SB05-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	11 U	9.7 U	15 UJ	11 UJ	9.7 UJ	14 UJ
4-Chloro-3-methylphenol	11 UJ	10 U	16 UJ	12 UJ	10 UJ	15 UJ
4-Chloroaniline	9.1 U	8.2 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ
4-Chlorophenyl phenyl ether	9.4 U	8.5 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ
4-Nitroaniline	12 U	11 U	16 UJ	12 UJ	11 UJ	15 UJ
4-Nitrophenol	50 UJ	45 U	68 UJ	52 UJ	45 UJ	65 UJ
4-Nitroquinoline-1-oxide	17 R	15 R	23 R	17 R	15 R	22 R
7,12-Dimethylbenz(a)anthracene	14 UJ	13 UJ	19 UJ	15 UJ	13 UJ	18 UJ
Acenaphthene	0.86 U	0.78 U	1.2 UJ	0.9 UJ	0.78 UJ	10 J
Acenaphthylene	2.6 U	2.3 U	3.5 UJ	2.7 UJ	2.3 UJ	11 J
Acetophenone	13 U	12 U	18 UJ	14 UJ	12 UJ	17 UJ
alpha,alpha-Dimethyl phenethylamine	89 U	81 U	120 UJ	93 UJ	81 UJ	120 UJ
Aniline	9.5 U	8.6 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ
Anthracene	2.6 U	2.3 U	3.5 UJ	2.7 UJ	2.3 UJ	34 J
Aramite, Total	17 UJ	15 UJ	23 UJ	17 UJ	15 UJ	22 UJ
Benzo[a]anthracene	6.9 J	73 J	10 J	2.7 UJ	8.3 J	460 J
Benzo[a]pyrene	16 J	69 J	22 J	1 UJ	13 J	530 J
Benzo[b]fluoranthene	35 J	160 J	50 J	1.2 UJ	20 J	1300 J
Benzo[g,h,i]perylene	33 J	57 J	38 J	2.7 UJ	30 J	1400 J
Benzo[k]fluoranthene	1.5 U	1.4 U	2.1 UJ	1.6 UJ	14 J	2 UJ
Benzyl alcohol	12 UJ	11 U	17 UJ	13 UJ	11 UJ	16 UJ
Bis(2-chloroethoxy)methane	10 U	9.3 U	14 UJ	11 UJ	9.3 UJ	13 UJ
Bis(2-chloroethyl)ether	8.6 U	7.8 U	12 UJ	9 UJ	7.8 UJ	11 UJ
Bis(2-ethylhexyl) phthalate	110	58 U	230 J	64 UJ	170 J	1000 J
Butyl benzyl phthalate	11 U	9.8 U	15 UJ	11 UJ	86 J	300 J
Chrysene	18 J	170 J	30 J	9 J	30 J	1000 J
Diallate	15 U	13 U	20 UJ	15 UJ	13 UJ	19 UJ
Dibenz(a,h)anthracene	7.8 J	19	6.3 J	0.93 UJ	8.1 J	220 J
Dibenzofuran	6.4 U	5.7 U	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ
Diethyl phthalate	17 U	15 U	23 UJ	17 UJ	15 UJ	22 UJ
Dimethyl phthalate	9.7 U	8.7 U	13 UJ	10 UJ	8.8 UJ	13 UJ
Di-n-butyl phthalate	38 U	34 U	52 UJ	39 UJ	34 UJ	49 UJ
Di-n-octyl phthalate	5 U	4.5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ
Dinoseb	26 U	23 U	35 UJ	27 UJ	23 UJ	33 UJ
Ethyl methanesulfonate	17 U	15 U	23 UJ	17 UJ	15 UJ	22 UJ
Fluoranthene	17 J	300 J	27 J	3.1 J	21 J	1100 J
Fluorene	1.2 U	6.4 J	1.6 UJ	1.2 UJ	1.1 UJ	14 J
Hexachlorobenzene	10 U	9.3 U	14 UJ	11 UJ	9.3 UJ	13 UJ
Hexachlorobutadiene	14 U	12 U	19 UJ	14 UJ	12 UJ	18 UJ
Hexachlorocyclopentadiene	21 U	19 U	29 UJ	22 UJ	19 UJ	28 UJ
Hexachloroethane	11 U	10 U	15 UJ	12 UJ	10 UJ	15 UJ
Hexachlorophene	1300 R	1100 R	1700 R	1300 R	1100 R	1600 R
Hexachloropropene	11 UJ	9.8 UJ	15 UJ	11 UJ	9.9 UJ	14 UJ
Indeno[1,2,3-cd]pyrene	17	37	21 J	1.9 UJ	22 J	1400 J
Isophorone	9.4 U	8.5 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ
Isosafrole	11 U	9.7 U	15 UJ	11 UJ	9.7 UJ	14 UJ

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB01	69SB02	69SB03	69SB04	69SB05
Sample ID	69SB01-00	69SB01-00D	69SB02-00	69SB03-00	69SB04-00	69SB05-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
Methapyrilene	14 UJ	13 UJ	19 UJ	15 UJ	13 UJ	18 UJ
Methyl methanesulfonate	14 U	13 U	19 UJ	15 UJ	13 UJ	18 UJ
Naphthalene	0.91 U	0.82 U	1.2 UJ	0.94 UJ	0.82 UJ	3.4 J
Nitrobenzene	10 U	9.4 U	14 UJ	11 UJ	9.5 UJ	14 UJ
N-Nitro-o-toluidine	9.1 U	8.2 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ
N-Nitrosodiethylamine	18 U	16 U	25 UJ	19 UJ	16 UJ	24 UJ
N-Nitrosodimethylamine	15 U	13 U	20 UJ	15 UJ	13 UJ	19 UJ
N-Nitrosodi-n-butylamine	14 UJ	12 UJ	19 UJ	14 UJ	12 UJ	18 UJ
N-Nitrosodi-n-propylamine	9.8 U	8.9 U	13 UJ	10 UJ	8.9 UJ	13 UJ
N-Nitrosodiphenylamine	11 U	9.7 U	15 UJ	11 UJ	9.7 UJ	14 UJ
N-Nitrosomethylethylamine	8.6 U	7.8 U	12 UJ	9 UJ	7.8 UJ	11 UJ
N-Nitrosomorpholine	10 UJ	9 UJ	14 UJ	10 UJ	9 UJ	13 UJ
N-Nitrosopiperidine	13 UJ	12 UJ	18 UJ	13 UJ	12 UJ	17 UJ
N-Nitrosopyrrolidine	13 U	12 U	18 UJ	14 UJ	12 UJ	18 UJ
p-Dimethylamino azobenzene	11 U	9.7 U	15 UJ	11 UJ	9.7 UJ	14 UJ
Pentachlorobenzene	9.4 U	8.5 U	13 UJ	9.8 UJ	8.5 UJ	13 J
Pentachloronitrobenzene	8.9 UJ	8.1 UJ	12 UJ	9.3 UJ	8.1 UJ	12 UJ
Pentachlorophenol	13 UJ	11 U	17 UJ	13 UJ	11 UJ	16 UJ
Phenacetin	7.1 U	6.4 U	9.7 UJ	7.4 UJ	6.4 UJ	9.3 UJ
Phenanthrene	5.2 J	170 J	4.9 J	2.7 UJ	8.6 J	270 J
Phenol	7.3 U	6.6 U	9.9 UJ	7.5 UJ	6.6 UJ	9.5 UJ
p-Phenylene diamine	240 U	220 U	330 UJ	250 UJ	220 UJ	320 UJ
Pronamide	14 U	12 U	19 UJ	14 UJ	12 UJ	18 UJ
Pyrene	19 J	290 J	30 J	4 J	22 J	1200 J
Pyridine	17 U	15 U	23 UJ	17 UJ	15 UJ	22 UJ
Safrole, Total	13 U	11 U	17 UJ	13 UJ	11 UJ	16 UJ

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB01	69SB02	69SB03	69SB04	69SB05
Sample ID	69SB01-00	69SB01-00D	69SB02-00	69SB03-00	69SB04-00	69SB05-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)						
Antimony	0.24 UJ	0.19 UJ	0.3 UJ	0.18 UJ	0.15 UJ	2 J
Arsenic	2	2.1	3 J	4.6	1.6	5.4
Barium	29	28	38 J	21	18	800
Beryllium	0.092 J	0.098 J	0.12 J	0.066 J	0.099 J	0.35
Cadmium	1.3 J	0.89 J	3.5 J	0.68 J	0.61 J	36 J
Chromium	58 J	45 J	42 J	33 J	15 J	89 J
Cobalt	14	13	13 J	9.5	12	17
Copper	50	46	47 J	28	36	130
Lead	59 J	21 J	41 J	20	7.7	520
Mercury	0.026 J	0.025	0.022 J	0.011 J	0.16	0.12
Nickel	17	14	13 J	8.7	4	34
Selenium	0.34 J	0.29 J	0.36 J	0.18 U	1.8	0.72 J
Silver	0.056 J	0.045 J	0.08 J	0.024 U	0.19 J	0.54
Thallium	0.17 U	0.15 U	0.23 UJ	0.18 U	0.15 U	0.22 U
Tin	5.5 U	5 U	7.6 UJ	6.1 U	5.1 U	9 J
Vanadium	140 J	130 J	140 J	110 J	170 J	100 J
Zinc	51	43	83 J	23	34	650

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB06	69SB07	69SB08	69SB09	69SB10	69SB11
Sample ID	69SB06-00	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00D
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	1.9 U	0.42 U	0.5 U	4.8 UJ	0.85 U	0.78 U
1,1,1-Trichloroethane	1.7 U	0.38 U	0.46 U	4.3 UJ	0.77 U	0.71 U
1,1,2,2-Tetrachloroethane	4.1 U	0.93 U	1.1 U	10 UJ	1.9 U	1.7 U
1,1,2-Trichloroethane	3.5 U	0.79 U	0.95 U	8.9 UJ	1.6 U	1.5 U
1,1-Dichloroethane	1.5 U	0.33 U	0.39 U	3.7 UJ	0.66 U	0.61 U
1,1-Dichloroethene	1.6 U	0.36 U	0.43 U	4 UJ	0.72 U	0.66 U
1,2,3-Trichloropropane	4.1 U	0.93 U	1.1 U	10 UJ	1.9 U	1.7 U
1,2-Dibromo-3-Chloropropane	8.2 U	1.9 U	2.2 U	21 UJ	3.7 U	3.4 UJ
1,2-Dichloroethane	2.9 U	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U
1,2-Dichloropropane	3.2 U	0.73 U	0.87 U	8.2 UJ	1.5 U	1.3 U
2-Butanone (MEK)	7.9 U	1.8 U	2.1 U	20 UJ	3.6 U	3.3 U
2-Chloro-1,3-butadiene	1.7 U	0.38 UJ	0.45 UJ	4.2 UJ	0.76 U	0.69 U
2-Hexanone	6.1 U	1.4 U	1.7 U	16 UJ	2.8 U	2.6 U
3-Chloro-1-propene	4.4 UJ	0.99 R	1.2 R	11 UJ	2 U	1.8 UJ
4-Methyl-2-pentanone (MIBK)	8.5 U	1.9 U	2.3 U	22 UJ	3.8 U	3.5 U
Acetone	33 U	9.1 J	29 J	33 UJ	5.8 U	32 R
Acetonitrile	130 U	30 UJ	36 UJ	330 UJ	60 UJ	55 U
Acrolein	56 R	13 R	15 R	140 R	25 U	23 R
Acrylonitrile	67 UJ	15 UJ	18 UJ	170 UJ	31 U	28 U
Benzene	2.3 U	0.52 U	0.62 U	5.9 UJ	1 U	0.96 U
Bromoform	3.2 U	0.73 U	0.87 U	8.2 UJ	1.5 U	1.3 U
Bromomethane	4.7 U	1.1 UJ	1.3 UJ	12 UJ	2.1 U	2 UJ
Carbon disulfide	1.5 U	0.34 U	0.4 U	3.8 UJ	0.68 U	0.62 U
Carbon tetrachloride	2.9 U	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U
Chlorobenzene	2.1 U	0.48 U	0.58 U	5.4 UJ	0.97 U	0.89 U
Chlorodibromomethane	1.5 U	0.33 U	0.39 U	3.7 UJ	0.66 U	0.61 U
Chloroethane	3.5 U	0.79 U	0.95 U	8.9 UJ	1.6 U	1.5 U
Chloroform	1.5 U	0.33 U	0.39 U	3.7 UJ	0.66 U	0.61 U
Chloromethane	2.1 U	0.47 U	0.56 U	5.3 UJ	0.94 U	0.87 U
cis-1,3-Dichloropropene	2.5 U	0.57 U	0.69 U	6.5 UJ	1.2 U	1.1 U
Dibromomethane	3.5 U	0.79 U	0.95 U	8.9 UJ	1.6 U	1.5 U
Dichlorobromomethane	2.4 U	0.55 U	0.65 U	6.2 UJ	1.1 U	1 U
Dichlorodifluoromethane	2.6 U	0.59 U	0.7 U	6.6 UJ	1.2 U	1.1 U
Ethyl methacrylate	6.4 U	1.5 U	1.7 U	16 UJ	2.9 U	2.7 U
Ethylbenzene	2.2 J	0.5 U	0.59 U	6.2 J	1 U	0.91 U
Ethylene Dibromide	4.4 U	0.99 U	1.2 U	11 UJ	2 U	1.8 U
Iodomethane	2.9 U	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U
Isobutyl alcohol	200 R	46 R	54 R	510 R	92 R	84 R
Methacrylonitrile	70 U	16 U	19 U	180 UJ	32 U	29 UJ
Methyl methacrylate	11 U	2.4 U	2.9 U	27 UJ	4.9 U	4.5 UJ
Methylene Chloride	2.9 U	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U
Pentachloroethane	6.4 UJ	1.5 U	1.7 U	16 UJ	2.9 UJ	2.7 U
Propionitrile	61 U	14 UJ	17 UJ	160 UJ	28 U	26 U
Styrene	1.9 U	0.44 U	0.52 U	4.9 UJ	0.88 U	0.8 U
Tetrachloroethene	2.1 U	0.48 U	0.58 U	5.4 UJ	0.97 U	0.89 U
Toluene	2.5 J	0.52 U	0.62 U	5.9 UJ	1 U	0.96 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB06	69SB07	69SB08	69SB09	69SB10	69SB11
Sample ID	69SB06-00	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00D
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	2.8 U	0.64 U	0.77 U	7.2 UJ	1.3 U	1.2 U
trans-1,3-Dichloropropene	2.5 U	0.57 U	0.69 U	6.5 UJ	1.2 U	1.1 U
trans-1,4-Dichloro-2-butene	9.1 U	2 U	2.4 U	23 UJ	4.1 U	3.8 UJ
Trichloroethene	2.9 U	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U
Trichlorofluoromethane	4.4 U	0.99 U	1.2 U	11 UJ	2 U	1.8 U
Vinyl acetate	4.4 U	0.99 UJ	1.2 UJ	11 UJ	2 U	1.8 UJ
Vinyl chloride	1.7 U	0.38 U	0.46 U	4.3 UJ	0.77 U	0.71 U
Xylenes, Total	14 J	1.5 U	1.8 U	28 J	12 J	2.8 U
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	11 UJ	8.2 U	9.5 U	27 UJ	9.8 U	8.7 U
1,2,4,5-Tetrachlorobenzene	9.2 UJ	7 U	8.1 U	23 UJ	8.3 U	8.2 U
1,2,4-Trichlorobenzene	11 UJ	8.2 U	9.5 U	27 UJ	9.8 U	8.7 U
1,2-Dichlorobenzene	10 UJ	7.8 U	9 U	26 UJ	9.2 U	8.3 U
1,3,5-Trinitrobenzene	25 UJ	19 U	22 U	62 UJ	22 U	20 U
1,3-Dichlorobenzene	8.8 UJ	6.6 U	7.7 U	22 UJ	7.9 U	7.1 U
1,3-Dinitrobenzene	5.7 UJ	4.3 U	5 U	14 UJ	5.2 U	4.6 U
1,4-Dichlorobenzene	9 UJ	6.9 U	8 U	23 UJ	8.2 U	7.3 U
1,4-Dioxane	12 UJ	8.9 U	10 U	29 UJ	11 U	9.5 U
1,4-Naphthoquinone	5.7 UJ	4.3 U	5 U	14 UJ	5.2 UJ	4.6 U
2,2'-oxybis[1-chloropropane]	9.2 UJ	7 U	8.1 U	23 UJ	8.3 U	7.4 U
2,3,4,6-Tetrachlorophenol	6.1 UJ	4.7 U	5.4 U	15 UJ	5.5 U	5 U
2,4,5-Trichlorophenol	9.9 UJ	7.5 U	8.7 U	25 UJ	9 U	8 U
2,4,6-Trichlorophenol	12 UJ	8.8 U	10 U	29 UJ	10 U	9.3 U
2,4-Dichlorophenol	12 UJ	9 U	10 U	30 UJ	11 U	9.6 U
2,4-Dimethylphenol	25 UJ	19 U	22 U	62 UJ	22 U	20 U
2,4-Dinitrophenol	120 UJ	92 UJ	110 UJ	300 UJ	110 UJ	98 UJ
2,4-Dinitrotoluene	8.6 UJ	6.5 UJ	7.6 U	22 UJ	7.8 U	7 U
2,6-Dichlorophenol	9.3 UJ	7.1 U	8.2 U	23 UJ	8.5 U	7.6 U
2,6-Dinitrotoluene	9 UJ	6.9 U	8 U	23 UJ	8.2 U	7.3 U
2-Acetylaminofluorene	7.4 UJ	5.7 U	6.5 U	19 UJ	6.7 U	6 U
2-Chloronaphthalene	9 UJ	6.9 U	8 U	23 UJ	8.2 U	7.3 U
2-Chlorophenol	9.6 UJ	7.3 U	8.5 U	24 UJ	8.7 U	7.8 U
2-Methylnaphthalene	2.5 UJ	1.9 U	2.2 U	6.2 UJ	2.2 U	2.3 J
2-Methylphenol	12 UJ	9 U	10 U	30 UJ	11 U	9.6 U
2-Naphthylamine	29 UJ	22 U	26 UJ	73 UJ	26 U	24 UJ
2-Nitroaniline	9.5 UJ	7.2 U	8.3 U	24 UJ	8.6 U	7.7 U
2-Nitrophenol	11 UJ	8.1 U	9.4 U	27 UJ	9.6 U	8.6 U
2-Picoline	18 UJ	13 U	15 U	44 UJ	16 U	14 U
2-Toluidine	14 UJ	10 U	12 U	34 UJ	12 U	11 U
3 & 4 Methylphenol	11 UJ	8.1 U	9.4 U	27 UJ	9.6 U	8.6 U
3,3'-Dichlorobenzidine	13 UJ	10 U	12 U	34 UJ	12 UJ	11 UJ
3,3'-Dimethylbenzidine	260 UJ	200 U	230 UJ	660 UJ	240 U	210 UJ
3-Methylcholanthrene	8.9 UJ	6.8 U	7.8 U	22 UJ	8.1 U	7.2 U
3-Nitroaniline	6.6 UJ	5 U	5.8 U	16 UJ	5.9 U	5.3 U
4,6-Dinitro-2-methylphenol	8.5 UJ	6.4 UJ	7.4 UJ	21 UJ	7.7 UJ	6.9 UJ
4-Aminobiphenyl	19 UJ	14 U	17 U	48 UJ	17 U	15 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB06	69SB07	69SB08	69SB09	69SB10	69SB11
Sample ID	69SB06-00	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00D
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	10 UJ	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U
4-Chloro-3-methylphenol	11 UJ	8.3 U	9.6 U	27 UJ	9.9 U	8.9 U
4-Chloroaniline	8.8 UJ	6.6 U	7.7 U	22 UJ	7.9 U	7.1 U
4-Chlorophenyl phenyl ether	9 UJ	6.9 U	8 U	23 UJ	8.2 U	7.3 U
4-Nitroaniline	11 UJ	8.5 UJ	9.9 U	28 UJ	10 U	9.1 U
4-Nitrophenol	48 UJ	37 UJ	42 U	120 UJ	44 U	39 U
4-Nitroquinoline-1-oxide	16 R	12 R	14 R	40 R	15 R	13 R
7,12-Dimethylbenz(a)anthracene	14 UJ	10 U	12 U	34 UJ	12 UJ	11 U
Acenaphthene	0.83 UJ	0.63 U	0.73 U	5.4 J	0.75 U	0.67 U
Acenaphthylene	2.5 UJ	1.9 U	2.2 U	9.8 J	2.2 U	2 U
Acetophenone	13 UJ	9.5 U	11 U	31 UJ	11 U	10 U
alpha,alpha-Dimethyl phenethylamine	86 UJ	65 U	76 U	220 UJ	78 U	70 U
Aniline	9.2 UJ	7 U	8.1 U	23 UJ	8.3 U	7.4 U
Anthracene	2.5 UJ	1.9 U	2.2 U	22 J	2.2 U	3.8 J
Aramite, Total	16 UJ	12 U	14 UJ	40 UJ	15 UJ	13 UJ
Benzo[a]anthracene	5.5 J	1.9 U	2.2 U	200 J	2.2 U	14 J
Benzo[a]pyrene	0.96 UJ	0.73 U	0.85 U	330 J	4.5 J	35 J
Benzo[b]fluoranthene	28 J	0.84 U	0.98 U	900 J	7.8 J	91 J
Benzo[g,h,i]perylene	23 J	1.9 U	2.2 U	340 J	2.2 UJ	140 J
Benzo[k]fluoranthene	1.5 UJ	1.1 U	1.3 U	3.7 UJ	1.3 UJ	1.2 U
Benzyl alcohol	12 UJ	8.9 U	10 U	29 UJ	11 U	9.5 U
Bis(2-chloroethoxy)methane	9.9 UJ	7.5 U	8.7 U	25 UJ	9 U	8 U
Bis(2-chloroethyl)ether	8.3 UJ	6.3 U	7.3 U	21 UJ	7.5 U	6.7 U
Bis(2-ethylhexyl) phthalate	47 UJ	14 J	9.4 J	260 J	18 U	760 J
Butyl benzyl phthalate	11 UJ	8 U	9.2 U	98 J	9.5 U	41 J
Chrysene	16 J	0.68 U	0.78 U	520 J	6.1 J	33
Diallate	14 UJ	11 U	12 U	35 UJ	13 U	11 U
Dibenz(a,h)anthracene	5 UJ	0.65 U	0.76 U	65 J	0.78 UJ	0.7 R
Dibenzofuran	6.1 UJ	4.7 U	5.4 U	15 UJ	5.5 U	5 U
Diethyl phthalate	16 UJ	12 U	14 U	40 UJ	15 U	13 U
Dimethyl phthalate	9.3 UJ	7.1 U	8.2 U	23 UJ	8.5 U	7.6 U
Di-n-butyl phthalate	36 UJ	28 U	32 U	92 UJ	33 U	30 U
Di-n-octyl phthalate	4.8 UJ	3.7 U	4.2 U	12 UJ	4.4 UJ	26 J
Dinoseb	25 UJ	19 U	22 U	62 UJ	22 U	20 U
Ethyl methanesulfonate	16 UJ	12 U	14 U	40 UJ	15 U	13 U
Fluoranthene	14 J	1.9 U	2.2 U	700 J	3.1 J	20
Fluorene	1.1 UJ	0.85 U	0.99 U	6.7 UJ	1 U	0.91 U
Hexachlorobenzene	9.9 UJ	7.5 U	8.7 U	25 UJ	9 U	8 U
Hexachlorobutadiene	13 UJ	10 U	12 U	33 UJ	12 U	11 U
Hexachlorocyclopentadiene	20 UJ	16 U	18 U	51 UJ	18 U	17 U
Hexachloroethane	11 UJ	8.2 U	9.5 U	27 UJ	9.8 U	8.7 U
Hexachlorophene	1200 R	920 R	1100 R	3000 R	1100 R	980 R
Hexachloropropene	11 UJ	8 UJ	9.2 UJ	26 UJ	9.5 UJ	8.5 UJ
Indeno[1,2,3-cd]pyrene	11 J	1.3 UJ	1.5 UJ	170 J	1.6 UJ	56 J
Isophorone	9 UJ	6.9 U	8 U	23 UJ	8.2 U	7.3 U
Isosafrole	10 UJ	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB06	69SB07	69SB08	69SB09	69SB10	69SB11
Sample ID	69SB06-00	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00D
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
Methapyrilene	14 UJ	10 UJ	12 UJ	34 UJ	12 UJ	11 UJ
Methyl methanesulfonate	14 UJ	10 U	12 U	34 UJ	12 U	11 U
Naphthalene	0.88 UJ	0.66 U	0.77 U	2.2 UJ	0.79 U	0.71 U
Nitrobenzene	10 UJ	7.6 U	8.9 U	25 UJ	9.1 U	8.2 U
N-Nitro-o-toluidine	8.8 UJ	6.6 U	7.7 U	22 UJ	7.9 U	7.1 U
N-Nitrosodiethylamine	18 UJ	13 U	15 U	44 UJ	16 U	14 U
N-Nitrosodimethylamine	14 UJ	11 U	13 U	36 UJ	13 U	12 U
N-Nitrosodi-n-butylamine	13 UJ	10 UJ	12 UJ	33 UJ	12 UJ	11 UJ
N-Nitrosodi-n-propylamine	9.5 UJ	7.2 U	8.3 U	24 UJ	8.6 U	7.7 U
N-Nitrosodiphenylamine	10 UJ	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U
N-Nitrosomethylethylamine	8.3 UJ	6.3 U	7.3 U	21 UJ	7.5 U	6.7 U
N-Nitrosomorpholine	9.6 UJ	7.3 UJ	8.5 UJ	24 UJ	8.7 UJ	7.8 UJ
N-Nitrosopiperidine	12 UJ	9.4 U	11 UJ	31 UJ	11 UJ	10 UJ
N-Nitrosopyrrolidine	13 UJ	9.9 U	11 UJ	33 UJ	12 U	11 UJ
p-Dimethylamino azobenzene	10 UJ	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U
Pentachlorobenzene	9 UJ	6.9 U	8 U	23 UJ	8.2 U	7.3 U
Pentachloronitrobenzene	8.6 UJ	6.5 U	7.6 U	22 UJ	7.8 UJ	7 U
Pentachlorophenol	12 UJ	9.2 U	11 U	30 UJ	11 U	9.8 U
Phenacetin	6.9 UJ	5.2 U	6 U	17 UJ	6.2 U	5.6 U
Phenanthrene	5.4 J	1.9 UJ	2.2 U	160 J	2.2 U	20
Phenol	7 UJ	5.3 U	6.2 U	18 UJ	6.3 U	5.7 U
p-Phenylene diamine	230 UJ	180 U	210 U	590 UJ	210 U	190 U
Pronamide	13 UJ	10 U	12 U	33 UJ	12 U	11 U
Pyrene	17 J	1.9 U	2.2 U	690 J	4.2 J	32 J
Pyridine	16 UJ	12 U	14 U	40 UJ	15 U	13 U
Safrole, Total	12 UJ	9.2 U	11 U	30 UJ	11 U	9.8 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB06	69SB07	69SB08	69SB09	69SB10	69SB11
Sample ID	69SB06-00	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00D
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)						
Antimony	0.23 UJ	0.21 U	0.094 U	0.83 UJ	0.18 UJ	0.38 U
Arsenic	2.1	4.6	1.6	3.9 J	4	3.8 J
Barium	42	18	17	61 J	34	21
Beryllium	0.16	0.07 J	0.19	0.17 J	0.099 J	0.045 J
Cadmium	0.87 J	0.65 J	0.039 UJ	18 J	0.41 J	3.9 J
Chromium	24 J	21	24	38 J	25 J	29
Cobalt	9.6	6	5.7	12 J	10	5.8
Copper	73	16	82	130 J	42	23
Lead	15	8.9	2.8	250 J	6.8	160
Mercury	0.13	0.0099 J	0.057	0.077 J	0.044	0.017 J
Nickel	6.1	7.1	5.9	14 J	8	8.7
Selenium	0.81	0.14 J	0.79	0.67 J	0.35 J	0.22 J
Silver	0.065 J	0.022 J	0.037 J	0.25 J	0.037 J	0.07 U
Thallium	0.16 U	0.12 U	0.15 U	0.42 UJ	0.15 U	0.13 U
Tin	5.2 U	4 U	5 U	14 UJ	4.9 U	4.3 U
Vanadium	230 J	58	280	92 J	110 J	47
Zinc	41	16	34	270 J	27	66

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16
Sample ID	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.62 U	0.53 U	1.2 U	1.1 U	1.3 U	0.65 U
1,1,1-Trichloroethane	0.56 U	0.48 U	1.1 U	0.96 U	1.1 U	0.59 U
1,1,2,2-Tetrachloroethane	1.4 U	1.2 U	2.6 U	2.3 U	2.7 U	1.4 U
1,1,2-Trichloroethane	1.2 U	1 U	2.3 U	2 U	2.4 U	1.2 U
1,1-Dichloroethane	0.48 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U
1,1-Dichloroethene	0.52 U	0.45 U	1 U	0.89 U	1.1 U	0.55 U
1,2,3-Trichloropropane	1.4 U	1.2 U	2.6 U	2.3 U	2.7 U	1.4 U
1,2-Dibromo-3-Chloropropane	2.7 UJ	2.3 UJ	5.3 U	4.6 U	5.5 U	2.9 U
1,2-Dichloroethane	0.97 UJ	0.83 U	1.9 U	1.7 U	2 U	1 U
1,2-Dichloropropane	1.1 U	0.91 U	2.1 U	1.8 U	2.2 U	1.1 U
2-Butanone (MEK)	6 UJ	3.7 U	5.1 U	4.5 U	5.3 U	2.8 U
2-Chloro-1,3-butadiene	0.55 UJ	0.47 U	1.1 U	0.94 U	1.1 U	0.58 U
2-Hexanone	2 J	1.7 U	4 U	3.5 U	4.1 U	2.1 U
3-Chloro-1-propene	1.5 U	1.2 UJ	2.8 UJ	2.5 U	2.9 UJ	1.5 U
4-Methyl-2-pentanone (MIBK)	2.8 U	2.4 U	5.5 U	4.8 U	5.7 U	3 U
Acetone	13 J	24 R	8.3 U	170	8.6 U	41 J
Acetonitrile	44 U	37 U	85 U	74 R	88 U	46 R
Acrolein	18 R	16 R	36 R	31 R	37 R	19 R
Acrylonitrile	22 UJ	19 U	43 UJ	38 U	45 UJ	23 U
Benzene	0.77 U	0.66 U	1.5 U	1.3 U	1.6 U	0.81 U
Bromoform	1.1 U	0.91 U	2.1 U	1.8 U	2.2 U	1.1 U
Bromomethane	1.6 UJ	1.3 UJ	3 U	2.6 UJ	3.1 U	1.6 UJ
Carbon disulfide	0.49 U	0.42 U	0.96 U	0.84 U	1 U	0.52 U
Carbon tetrachloride	0.97 U	0.83 U	1.9 U	1.7 U	2 U	1 U
Chlorobenzene	0.71 U	0.61 U	1.4 U	1.2 U	1.4 U	0.75 U
Chlorodibromomethane	0.48 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U
Chloroethane	1.2 U	1 U	2.3 U	2 U	2.4 U	1.2 U
Chloroform	0.48 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U
Chloromethane	0.69 U	0.59 U	1.3 U	1.2 U	1.4 U	0.72 U
cis-1,3-Dichloropropene	0.84 U	0.72 U	1.6 U	1.4 U	1.7 U	0.89 U
Dibromomethane	1.2 U	1 U	2.3 U	2 U	2.4 U	1.2 U
Dichlorobromomethane	0.8 U	0.69 U	1.6 U	1.4 U	1.6 U	0.85 U
Dichlorodifluoromethane	0.86 U	0.74 U	1.7 U	1.5 U	1.7 U	0.91 U
Ethyl methacrylate	2.1 UJ	1.8 U	4.2 U	3.6 UJ	4.3 U	2.2 UJ
Ethylbenzene	0.73 U	0.62 U	1.4 U	1.2 U	1.5 U	0.77 U
Ethylene Dibromide	1.5 U	1.2 U	2.8 U	2.5 U	2.9 U	1.5 U
Iodomethane	0.97 UJ	0.83 U	1.9 U	1.7 U	2 U	1 U
Isobutyl alcohol	67 R	57 R	130 R	110 R	140 R	70 R
Methacrylonitrile	23 UJ	20 UJ	45 U	40 UJ	47 U	25 UJ
Methyl methacrylate	3.6 UJ	3.1 UJ	7 U	6.1 UJ	7.3 U	3.8 UJ
Methylene Chloride	0.97 U	0.83 U	1.9 U	1.7 U	2 U	1 U
Pentachloroethane	2.1 U	1.8 U	4.2 UJ	3.6 U	4.3 UJ	2.2 U
Propionitrile	20 U	17 U	40 U	35 R	41 U	21 R
Styrene	0.64 U	0.55 U	1.2 U	1.1 U	1.3 U	0.67 U
Tetrachloroethene	0.71 U	0.61 U	1.4 U	1.2 U	1.4 U	0.75 U
Toluene	0.77 U	0.66 U	1.5 U	1.3 U	1.6 U	0.81 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16
Sample ID	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	0.94 U	0.8 U	1.8 U	1.6 U	1.9 U	0.99 U
trans-1,3-Dichloropropene	0.84 U	0.72 U	1.6 U	1.4 U	1.7 U	0.89 U
trans-1,4-Dichloro-2-butene	3 U	2.6 UJ	5.9 U	59 J	6.1 U	3.2 UJ
Trichloroethene	0.97 U	0.83 U	1.9 U	1.7 U	2 U	1 U
Trichlorofluoromethane	1.5 U	1.2 U	2.8 U	2.5 U	2.9 U	1.5 U
Vinyl acetate	1.5 UJ	1.2 UJ	2.8 U	2.5 U	2.9 U	1.5 U
Vinyl chloride	0.56 U	0.48 U	1.1 U	0.96 U	1.1 U	0.59 U
Xylenes, Total	2.2 U	1.9 U	4.9 J	3.8 U	4.5 U	2.3 U
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U
1,2,4,5-Tetrachlorobenzene	29 J	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U
1,2,4-Trichlorobenzene	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U
1,2-Dichlorobenzene	8.2 U	8.3 U	8.7 U	11 U	10 U	8.1 U
1,3,5-Trinitrobenzene	20 U	20 U	21 U	26 U	25 U	20 U
1,3-Dichlorobenzene	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U
1,3-Dinitrobenzene	4.6 U	4.6 U	4.9 U	5.9 U	5.7 U	4.5 U
1,4-Dichlorobenzene	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U
1,4-Dioxane	9.4 U	9.5 U	10 U	12 U	12 U	9.3 U
1,4-Naphthoquinone	4.6 U	4.6 U	4.9 UJ	5.9 UJ	5.7 UJ	4.5 UJ
2,2'-oxybis[1-chloropropane]	7.4 U	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U
2,3,4,6-Tetrachlorophenol	4.9 U	5 U	5.2 U	6.4 U	6.1 UJ	4.9 UJ
2,4,5-Trichlorophenol	8 U	8.1 U	8.5 U	10 U	9.9 UJ	7.9 UJ
2,4,6-Trichlorophenol	9.3 U	9.4 U	9.8 U	12 U	11 UJ	9.2 UJ
2,4-Dichlorophenol	9.5 U	9.6 U	10 U	12 U	12 UJ	9.4 UJ
2,4-Dimethylphenol	20 U	20 U	21 U	26 U	25 UJ	20 UJ
2,4-Dinitrophenol	98 U	99 UJ	100 UJ	130 UJ	120 UJ	96 UJ
2,4-Dinitrotoluene	7 U	7 U	7.4 U	9 U	8.5 U	6.8 U
2,6-Dichlorophenol	7.5 U	7.6 U	8 U	9.7 U	9.3 UJ	7.4 UJ
2,6-Dinitrotoluene	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U
2-Acetylaminofluorene	6 U	6.1 U	6.4 U	7.8 U	7.4 U	5.9 U
2-Chloronaphthalene	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U
2-Chlorophenol	7.8 U	7.8 U	8.2 U	10 U	9.6 UJ	7.7 UJ
2-Methylnaphthalene	2 U	2 U	2.1 U	2.6 U	2.5 U	2 U
2-Methylphenol	9.5 U	9.6 U	10 U	12 U	12 UJ	9.4 UJ
2-Naphthylamine	24 UJ	24 UJ	25 U	30 U	29 U	23 U
2-Nitroaniline	7.7 U	7.7 U	8.1 U	9.9 U	9.4 U	7.5 U
2-Nitrophenol	8.6 U	8.7 U	9.1 U	11 U	11 UJ	8.5 UJ
2-Picoline	14 U	14 U	15 U	18 U	17 U	14 U
2-Toluidine	11 U	11 U	12 U	14 U	13 U	11 U
3 & 4 Methylphenol	8.6 U	8.7 U	9.1 U	11 U	11 UJ	8.5 UJ
3,3'-Dichlorobenzidine	11 U	11 U	11 UJ	14 UJ	13 UJ	11 UJ
3,3'-Dimethylbenzidine	210 UJ	210 UJ	220 U	270 U	260 U	210 U
3-Methylcholanthrene	7.2 U	7.2 U	7.6 U	9.3 U	8.8 U	7.1 U
3-Nitroaniline	5.3 U	5.3 U	5.6 U	6.8 U	6.5 U	5.2 U
4,6-Dinitro-2-methylphenol	6.8 UJ	6.9 UJ	7.2 UJ	8.8 UJ	8.4 UJ	6.7 UJ
4-Aminobiphenyl	15 U	15 U	16 U	20 U	19 U	15 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16
Sample ID	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U
4-Chloro-3-methylphenol	8.8 U	8.9 U	9.4 U	11 U	11 UJ	8.7 UJ
4-Chloroaniline	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U
4-Chlorophenyl phenyl ether	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U
4-Nitroaniline	9.1 U	9.2 U	9.6 U	12 U	11 U	8.9 U
4-Nitrophenol	39 UJ	39 U	41 U	50 U	48 UJ	38 UJ
4-Nitroquinoline-1-oxide	13 R	13 R	14 R	17 R	16 R	13 R
7,12-Dimethylbenz(a)anthracene	11 U	11 U	12 UJ	14 UJ	13 UJ	11 UJ
Acenaphthene	0.67 U	0.68 U	0.71 U	0.87 U	3 J	0.66 U
Acenaphthylene	2 U	2 U	2.1 U	2.6 U	2.5 U	2 U
Acetophenone	10 U	10 U	11 U	13 U	12 U	10 U
alpha,alpha-Dimethyl phenethylamine	70 U	70 U	74 U	90 U	85 U	68 U
Aniline	7.4 U	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U
Anthracene	2.9 J	2 U	2.1 U	2.6 U	16	2 U
Aramite, Total	13 UJ	13 UJ	14 UJ	17 UJ	16 UJ	13 UJ
Benzo[a]anthracene	2 UJ	2 U	2.1 U	2.6 U	90	2 U
Benzo[a]pyrene	51 J	0.78 U	28	40	100	0.77 UJ
Benzo[b]fluoranthene	0.9 U	0.9 U	50	60	230	0.88 UJ
Benzo[g,h,i]perylene	190	2 U	39	39	99	2 UJ
Benzo[k]fluoranthene	140	1.2 U	1.2 U	1.5 U	1.4 U	1.2 UJ
Benzyl alcohol	9.4 U	9.5 U	10 U	12 U	12 UJ	9.3 UJ
Bis(2-chloroethoxy)methane	8 U	8.1 U	8.5 U	10 U	9.9 U	7.9 U
Bis(2-chloroethyl)ether	6.7 U	6.8 U	7.1 U	8.7 U	8.3 U	6.6 U
Bis(2-ethylhexyl) phthalate	130 J	28 U	47 U	80 U	52 U	27 U
Butyl benzyl phthalate	180 J	8.6 U	110	11 U	21 J	8.3 U
Chrysene	66	0.72 U	55	38	180	0.71 U
Diallate	11 U	11 U	12 U	15 U	14 U	11 U
Dibenz(a,h)anthracene	28 J	0.7 U	9.9	9 J	39	0.68 U
Dibenzofuran	4.9 U	5 U	5.2 U	6.4 U	6.1 U	4.9 U
Diethyl phthalate	13 U	13 U	14 U	17 U	16 U	13 U
Dimethyl phthalate	7.5 U	7.6 U	8 U	9.7 U	9.3 U	7.4 U
Di-n-butyl phthalate	29 U	30 U	31 U	38 U	36 U	29 U
Di-n-octyl phthalate	3.9 U	3.9 U	4.1 U	5 U	4.8 U	3.8 UJ
Dinoseb	20 U	20 U	21 U	26 U	25 U	20 U
Ethyl methanesulfonate	13 U	13 U	14 U	17 U	16 U	13 U
Fluoranthene	27	2 U	14	24	340	2 U
Fluorene	0.91 U	0.92 U	0.96 U	1.2 U	4.3 J	0.89 U
Hexachlorobenzene	8 U	8.1 U	8.5 U	10 U	9.9 U	7.9 U
Hexachlorobutadiene	11 U	11 U	11 U	14 U	13 U	11 U
Hexachlorocyclopentadiene	16 U	17 U	17 U	21 U	20 U	16 U
Hexachloroethane	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U
Hexachlorophene	980 R	990 R	1000 R	1300 R	1200 R	960 R
Hexachloropropene	8.5 UJ	8.6 UJ	9 UJ	11 UJ	10 UJ	8.3 UJ
Indeno[1,2,3-cd]pyrene	94 J	1.4 UJ	17	21	52	1.4 UJ
Isophorone	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U
Isosafrole	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16
Sample ID	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
Methapyrilene	11 UJ	11 UJ	12 UJ	14 UJ	13 UJ	11 UJ
Methyl methanesulfonate	11 U	11 U	12 U	14 U	13 U	11 U
Naphthalene	1.1 J	0.71 U	0.75 U	0.91 U	0.87 U	0.7 U
Nitrobenzene	8.1 U	8.2 U	8.6 U	10 U	10 U	8 U
N-Nitro-o-toluidine	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U
N-Nitrosodiethylamine	14 U	14 U	15 U	18 U	17 U	14 U
N-Nitrosodimethylamine	12 U	12 U	12 U	15 U	14 U	11 U
N-Nitrosodi-n-butylamine	11 UJ	11 UJ	11 UJ	14 UJ	13 UJ	11 UJ
N-Nitrosodi-n-propylamine	7.7 U	7.7 U	8.1 U	9.9 U	9.4 U	7.5 U
N-Nitrosodiphenylamine	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U
N-Nitrosomethylethylamine	6.7 U	6.8 U	7.1 U	8.7 U	8.3 U	6.6 U
N-Nitrosomorpholine	7.8 UJ	7.8 UJ	8.2 UJ	10 UJ	9.6 UJ	7.7 UJ
N-Nitrosopiperidine	10 UJ	10 UJ	11 UJ	13 UJ	12 UJ	9.9 UJ
N-Nitrosopyrrolidine	10 U	11 UJ	11 U	14 U	13 U	10 U
p-Dimethylamino azobenzene	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U
Pentachlorobenzene	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U
Pentachloronitrobenzene	7 U	7 U	7.4 UJ	9 UJ	8.5 UJ	6.8 UJ
Pentachlorophenol	9.8 U	9.9 U	10 U	13 U	12 UJ	9.6 UJ
Phenacetin	5.5 U	5.6 U	5.9 U	7.1 U	6.8 U	5.5 U
Phenanthrene	6.2 J	2 U	3.8 J	6.1 J	110	2 U
Phenol	5.7 U	5.7 U	6 U	7.3 U	7 U	5.6 UJ
p-Phenylene diamine	190 U	190 U	200 U	240 U	230 U	190 U
Pronamide	11 U	11 U	11 U	14 U	13 U	10 U
Pyrene	41	2 U	24	30	320	2 U
Pyridine	13 U	13 U	14 U	17 U	16 U	13 U
Safrole, Total	9.8 U	9.9 U	10 U	13 U	12 U	9.6 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16
Sample ID	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)						
Antimony	0.48 U	0.18 U	0.19 UJ	0.38 UJ	0.58 UJ	0.23 UJ
Arsenic	4.9 J	4.8	3.7	3.2	3.3	4
Barium	21	14	26	76	30	19
Beryllium	0.044 J	0.05 J	0.065 J	0.18	0.088 J	0.037 J
Cadmium	4.4 J	0.051 J	0.96 J	4.1 J	1.4 J	0.082 J
Chromium	34	39	23 J	26 J	17 J	34 J
Cobalt	6.5	14	8.4	13	6.4	8.2
Copper	20	32	33	68	36	16
Lead	220	0.71	36	73	34	0.93
Mercury	0.013 J	0.0098 J	0.023 J	0.039	0.036	0.0066 J
Nickel	9.3	12	7.8	10	5	10
Selenium	0.2 J	0.14 J	0.25 J	0.3 J	0.34 J	0.13 U
Silver	0.084 U	0.018 U	0.046 J	0.25 J	0.1 J	0.021 J
Thallium	0.13 U	0.13 U	0.14 U	0.17 U	0.16 U	0.13 U
Tin	4.3 U	4.4 U	4.5 U	5.6 U	5.3 U	4.4 U
Vanadium	53	87	78 J	99 J	46 J	96 J
Zinc	67	11	30	130	140	9

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB17	69SB18	69SB19	69SB20	69SB21	69SB21
Sample ID	69SB17-00	69SB18-00	69SB19-00	69SB20-00	69SB21-00D	69SB21-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.41 U	0.74 U	0.46 U	0.35 U	0.79 U	0.64 U
1,1,1-Trichloroethane	0.37 U	0.67 U	0.42 U	0.31 U	0.72 U	0.58 U
1,1,2,2-Tetrachloroethane	0.9 U	1.6 U	1 U	0.76 U	1.7 U	1.4 U
1,1,2-Trichloroethane	0.78 U	1.4 U	0.87 U	0.65 U	1.5 U	1.2 U
1,1-Dichloroethane	0.32 U	0.58 U	0.36 U	0.27 U	0.62 U	0.5 U
1,1-Dichloroethene	0.35 U	0.62 U	0.39 U	0.29 U	0.67 U	0.54 U
1,2,3-Trichloropropane	0.9 U	1.6 U	1 U	0.76 U	1.7 U	1.4 U
1,2-Dibromo-3-Chloropropane	1.8 U	3.2 U	2 U	1.5 U	3.5 U	2.8 U
1,2-Dichloroethane	0.65 U	1.2 U	0.73 U	0.54 U	1.2 U	1 U
1,2-Dichloropropane	0.71 U	1.3 U	0.8 U	0.6 U	1.4 U	1.1 U
2-Butanone (MEK)	22 U	3.1 U	5.5 U	1.5 U	3.4 U	15 U
2-Chloro-1,3-butadiene	0.37 U	0.66 U	0.41 U	0.31 U	0.71 U	0.57 U
2-Hexanone	1.4 U	2.4 U	1.5 U	1.1 U	2.6 U	2.1 U
3-Chloro-1-propene	0.97 U	1.7 U	1.1 U	0.81 U	1.9 U	1.5 U
4-Methyl-2-pentanone (MIBK)	1.9 U	3.3 U	2.1 U	1.6 U	3.6 U	2.9 U
Acetone	110	40 J	41 J	42	97	130
Acetonitrile	29 R	52 R	33 UJ	24 R	56 R	45 R
Acrolein	12 R	22 R	14 U	10 R	24 R	19 R
Acrylonitrile	15 U	27 U	17 U	12 U	29 U	23 U
Benzene	0.51 U	0.91 U	0.57 U	0.43 U	0.98 U	0.79 U
Bromoform	0.71 U	1.3 U	0.8 U	0.6 U	1.4 U	1.1 U
Bromomethane	1 UJ	1.8 UJ	1.2 U	0.87 UJ	2 UJ	1.6 UJ
Carbon disulfide	0.33 U	0.59 U	0.37 U	0.28 U	0.63 U	0.51 U
Carbon tetrachloride	0.65 U	1.2 U	0.73 U	0.54 U	1.2 U	1 U
Chlorobenzene	0.47 U	0.84 U	0.53 U	0.4 U	0.91 U	0.73 U
Chlorodibromomethane	0.32 U	0.58 U	0.36 U	0.27 U	0.62 U	0.5 U
Chloroethane	0.78 U	1.4 U	0.87 U	0.65 U	1.5 U	1.2 U
Chloroform	0.32 U	0.58 U	0.36 U	0.27 U	0.62 U	0.5 U
Chloromethane	0.46 U	0.82 U	0.51 U	0.39 U	0.88 U	0.71 U
cis-1,3-Dichloropropene	0.56 U	1 U	0.63 U	0.47 U	1.1 U	0.87 U
Dibromomethane	0.78 U	1.4 U	0.87 U	0.65 U	1.5 U	1.2 U
Dichlorobromomethane	0.54 U	0.96 U	0.6 U	0.45 U	1 U	0.83 U
Dichlorodifluoromethane	0.58 U	1 U	0.65 U	0.48 U	1.1 U	0.89 U
Ethyl methacrylate	1.4 UJ	2.5 UJ	1.6 U	1.2 UJ	2.7 UJ	2.2 UJ
Ethylbenzene	0.48 U	0.87 U	0.54 U	0.41 U	0.93 U	0.75 U
Ethylene Dibromide	0.97 U	1.7 U	1.1 U	0.81 U	1.9 U	1.5 U
Iodomethane	0.65 U	1.2 U	0.73 U	0.54 U	1.2 U	1 U
Isobutyl alcohol	45 R	80 R	56 R	37 R	86 R	69 R
Methacrylonitrile	16 UJ	28 UJ	17 U	13 UJ	30 UJ	24 UJ
Methyl methacrylate	2.4 UJ	4.3 UJ	2.7 U	2 UJ	4.6 UJ	3.7 UJ
Methylene Chloride	0.65 U	1.2 U	0.73 U	0.54 U	1.2 U	1 U
Pentachloroethane	1.4 U	2.5 U	1.6 UJ	1.2 U	2.7 U	2.2 U
Propionitrile	14 R	24 R	15 U	11 R	26 R	21 R
Styrene	0.43 U	0.76 U	0.48 U	0.36 U	0.82 U	0.66 U
Tetrachloroethene	0.47 U	0.84 U	0.53 U	0.4 U	0.91 U	0.73 U
Toluene	0.51 U	0.91 U	0.57 U	0.53 J	0.98 U	0.79 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB17	69SB18	69SB19	69SB20	69SB21	69SB21
Sample ID	69SB17-00	69SB18-00	69SB19-00	69SB20-00	69SB21-00D	69SB21-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	0.63 U	1.1 U	0.7 U	0.53 U	1.2 U	0.97 U
trans-1,3-Dichloropropene	0.56 U	1 U	0.63 U	0.47 U	1.1 U	0.87 U
trans-1,4-Dichloro-2-butene	2 UJ	3.6 UJ	2.2 U	1.7 UJ	3.8 UJ	3.1 UJ
Trichloroethene	0.65 U	1.2 U	0.73 U	0.54 U	1.2 U	1 U
Trichlorofluoromethane	0.97 U	1.7 U	1.1 U	0.81 U	1.9 U	1.5 U
Vinyl acetate	0.97 U	1.7 U	1.1 U	0.81 U	1.9 U	1.5 U
Vinyl chloride	0.37 U	0.67 U	0.42 U	0.31 U	0.72 U	0.58 U
Xylenes, Total	1.5 U	2.7 U	1.7 U	1.2 U	2.9 U	2.3 U
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	10 UJ	9.9 U	8.5 U	10 UJ	9.4 UJ	8.8 U
1,2,4,5-Tetrachlorobenzene	8.9 UJ	8.5 U	7.3 U	8.8 UJ	8 UJ	7.5 U
1,2,4-Trichlorobenzene	10 UJ	9.9 U	8.5 U	10 UJ	9.4 UJ	8.8 U
1,2-Dichlorobenzene	9.9 UJ	9.4 U	8.1 U	9.8 UJ	8.9 UJ	8.3 U
1,3,5-Trinitrobenzene	24 UJ	23 U	20 U	24 UJ	22 UJ	20 U
1,3-Dichlorobenzene	8.5 UJ	8.1 U	6.9 U	8.4 UJ	7.6 UJ	7.1 U
1,3-Dinitrobenzene	5.5 UJ	5.2 U	4.5 U	5.4 UJ	5 UJ	4.6 U
1,4-Dichlorobenzene	8.8 UJ	8.3 U	7.1 U	8.7 UJ	7.9 UJ	7.4 U
1,4-Dioxane	11 UJ	11 U	9.2 U	11 UJ	10 UJ	9.5 U
1,4-Naphthoquinone	5.5 UJ	5.2 UJ	4.5 UJ	5.4 UJ	5 UJ	4.6 U
2,2'-oxybis[1-chloropropane]	8.9 UJ	8.5 U	7.3 U	8.8 UJ	8 UJ	7.5 U
2,3,4,6-Tetrachlorophenol	5.9 UJ	5.6 UJ	4.8 U	5.9 UJ	5.4 UJ	5 UJ
2,4,5-Trichlorophenol	9.6 UJ	9.1 UJ	7.8 U	9.5 UJ	8.7 UJ	8.1 UJ
2,4,6-Trichlorophenol	11 UJ	11 UJ	9.1 U	11 UJ	10 UJ	9.4 UJ
2,4-Dichlorophenol	11 UJ	11 UJ	9.3 U	11 UJ	10 UJ	9.6 UJ
2,4-Dimethylphenol	24 UJ	23 UJ	20 U	24 UJ	22 UJ	20 UJ
2,4-Dinitrophenol	120 UJ	110 UJ	96 UJ	120 UJ	110 UJ	99 UJ
2,4-Dinitrotoluene	8.4 UJ	7.9 U	6.8 U	8.2 UJ	7.5 UJ	7 U
2,6-Dichlorophenol	9.1 UJ	8.6 UJ	7.4 U	8.9 UJ	8.2 UJ	7.6 UJ
2,6-Dinitrotoluene	8.8 UJ	8.3 U	7.1 U	8.7 UJ	7.9 UJ	7.4 U
2-Acetylaminofluorene	7.2 UJ	6.9 U	5.9 U	7.1 UJ	6.5 UJ	6.1 U
2-Chloronaphthalene	8.8 UJ	8.3 U	7.1 U	8.7 UJ	7.9 UJ	7.4 U
2-Chlorophenol	9.3 UJ	8.9 U	7.6 U	9.2 UJ	8.4 UJ	7.8 UJ
2-Methylnaphthalene	2.4 UJ	2.3 U	2 U	2.4 UJ	2.2 UJ	2 U
2-Methylphenol	11 UJ	11 UJ	9.3 U	11 UJ	10 UJ	9.6 UJ
2-Naphthylamine	28 UJ	27 U	23 U	28 UJ	25 UJ	24 U
2-Nitroaniline	9.2 UJ	8.7 U	7.5 U	9.1 UJ	8.3 UJ	7.7 U
2-Nitrophenol	10 UJ	9.8 UJ	8.4 U	10 UJ	9.3 UJ	8.7 UJ
2-Picoline	17 UJ	16 U	14 U	17 UJ	15 UJ	14 U
2-Toluidine	13 UJ	12 U	11 U	13 UJ	12 UJ	11 U
3 & 4 Methylphenol	10 UJ	9.8 UJ	8.4 U	10 UJ	9.3 UJ	8.7 UJ
3,3'-Dichlorobenzidine	13 UJ	12 UJ	11 UJ	13 UJ	12 UJ	11 UJ
3,3'-Dimethylbenzidine	250 UJ	240 U	210 U	250 UJ	230 UJ	210 U
3-Methylcholanthrene	8.6 UJ	8.2 U	7 U	8.5 UJ	7.8 UJ	7.2 U
3-Nitroaniline	6.4 UJ	6 U	5.2 U	6.3 UJ	5.7 UJ	5.3 U
4,6-Dinitro-2-methylphenol	8.2 UJ	7.8 UJ	6.7 UJ	8.1 UJ	7.4 UJ	6.9 UJ
4-Aminobiphenyl	18 UJ	17 U	15 U	18 UJ	17 UJ	15 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB17	69SB18	69SB19	69SB20	69SB21	69SB21
Sample ID	69SB17-00	69SB18-00	69SB19-00	69SB20-00	69SB21-00D	69SB21-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	10 UJ	9.5 U	8.2 U	9.9 UJ	9.1 UJ	8.4 U
4-Chloro-3-methylphenol	11 UJ	10 UJ	8.6 U	10 UJ	9.6 UJ	8.9 UJ
4-Chloroaniline	8.5 UJ	8.1 U	6.9 U	8.4 UJ	7.6 UJ	7.1 U
4-Chlorophenyl phenyl ether	8.8 UJ	8.3 U	7.1 U	8.7 UJ	7.9 UJ	7.4 U
4-Nitroaniline	11 UJ	10 U	8.9 U	11 UJ	9.8 UJ	9.2 UJ
4-Nitrophenol	47 UJ	44 UJ	38 U	46 UJ	42 UJ	39 UJ
4-Nitroquinoline-1-oxide	16 R	15 R	13 R	15 R	14 R	13 R
7,12-Dimethylbenz(a)anthracene	13 UJ	12 UJ	11 UJ	13 UJ	12 UJ	11 U
Acenaphthene	0.81 UJ	0.79 J	0.66 U	0.8 UJ	0.73 UJ	0.68 U
Acenaphthylene	2.4 UJ	2.3 U	2 U	2.4 UJ	2.2 UJ	2 U
Acetophenone	12 UJ	12 U	9.9 U	12 UJ	11 UJ	10 U
alpha,alpha-Dimethyl phenethylamine	84 UJ	79 U	68 U	82 UJ	75 UJ	70 U
Aniline	8.9 UJ	8.5 U	7.3 U	8.8 UJ	8 UJ	7.5 U
Anthracene	2.4 UJ	7.3 J	2 U	2.4 UJ	2.2 UJ	2 U
Aramite, Total	16 UJ	15 UJ	13 UJ	15 UJ	14 UJ	13 U
Benzo[a]anthracene	11 J	140 J	2 UJ	2.4 UJ	2.2 J	4.8 J
Benzo[a]pyrene	28 J	280 J	2.8 J	3.3 UJ	5.4 J	18 J
Benzo[b]fluoranthene	73 J	570 J	5.6 J	5.5 UJ	9.4 J	29 J
Benzo[g,h,i]perylene	76 J	290 J	7.8 J	14 UJ	15 J	35
Benzo[k]fluoranthene	1.4 UJ	1.3 UJ	1.2 UJ	2.9 J	2.8 UJ	1.2 U
Benzyl alcohol	11 UJ	11 UJ	9.2 U	11 UJ	10 UJ	9.5 UJ
Bis(2-chloroethoxy)methane	9.6 UJ	9.1 U	7.8 U	9.5 UJ	8.7 UJ	8.1 U
Bis(2-chloroethyl)ether	8.1 UJ	7.7 U	6.6 U	8 UJ	7.3 UJ	6.8 U
Bis(2-ethylhexyl) phthalate	57 UJ	110 J	45 UJ	24 UJ	27 UJ	29 U
Butyl benzyl phthalate	16 J	51	8.3 U	10 UJ	9.2 UJ	8.6 U
Chrysene	26 J	290 J	3.9 J	4.2 UJ	4.7 J	15
Diallate	14 UJ	13 U	11 U	13 UJ	12 UJ	11 U
Dibenz(a,h)anthracene	8.6 J	75 J	0.68 UJ	0.82 UJ	1.4 UJ	3.4 J
Dibenzofuran	5.9 UJ	5.6 U	4.8 U	5.9 UJ	5.4 UJ	5 U
Diethyl phthalate	16 UJ	15 U	13 U	15 UJ	14 UJ	13 U
Dimethyl phthalate	9.1 UJ	8.6 U	7.4 U	8.9 UJ	8.2 UJ	7.6 U
Di-n-butyl phthalate	35 UJ	34 U	29 U	35 UJ	32 UJ	30 U
Di-n-octyl phthalate	4.7 UJ	4.4 UJ	3.8 UJ	4.6 UJ	4.2 UJ	3.9 U
Dinoseb	24 UJ	23 U	20 U	24 UJ	22 UJ	20 U
Ethyl methanesulfonate	16 UJ	15 U	13 U	15 UJ	14 UJ	13 U
Fluoranthene	18 J	160	2.1 J	4.3 UJ	4 J	14 J
Fluorene	1.1 UJ	1 U	0.89 U	1.1 UJ	0.98 UJ	0.92 U
Hexachlorobenzene	9.6 UJ	9.1 U	7.8 U	9.5 UJ	8.7 UJ	8.1 U
Hexachlorobutadiene	13 UJ	12 U	10 U	13 UJ	12 UJ	11 U
Hexachlorocyclopentadiene	20 UJ	19 U	16 U	20 UJ	18 UJ	17 UJ
Hexachloroethane	10 UJ	9.9 U	8.5 U	10 UJ	9.4 UJ	8.8 U
Hexachlorophene	1200 R	1100 R	960 R	1200 UJ	1100 UJ	990 U
Hexachloropropene	10 UJ	9.7 UJ	8.3 UJ	10 UJ	9.2 UJ	8.6 U
Indeno[1,2,3-cd]pyrene	23 J	190 J	1.4 UJ	4.2 UJ	2.4 UJ	15 J
Isophorone	8.8 UJ	8.3 U	7.1 U	8.7 UJ	7.9 UJ	7.4 U
Isosafrole	10 UJ	9.5 U	8.2 U	9.9 UJ	9.1 UJ	8.4 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB17	69SB18	69SB19	69SB20	69SB21	69SB21
Sample ID	69SB17-00	69SB18-00	69SB19-00	69SB20-00	69SB21-00D	69SB21-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)						
Methapyrilene	13 UJ	12 UJ	11 UJ	13 UJ	12 UJ	11 U
Methyl methanesulfonate	13 UJ	12 U	11 U	13 UJ	12 UJ	11 U
Naphthalene	0.85 UJ	0.81 U	0.69 U	0.84 UJ	0.76 UJ	0.71 U
Nitrobenzene	9.8 UJ	9.3 U	8 U	9.6 UJ	8.8 UJ	8.2 U
N-Nitro-o-toluidine	8.5 UJ	8.1 U	6.9 U	8.4 UJ	7.6 UJ	7.1 U
N-Nitrosodiethylamine	17 UJ	16 U	14 U	17 UJ	15 UJ	14 U
N-Nitrosodimethylamine	14 UJ	13 U	11 U	14 UJ	12 UJ	12 U
N-Nitrosodi-n-butylamine	13 UJ	12 UJ	10 UJ	13 UJ	12 UJ	11 U
N-Nitrosodi-n-propylamine	9.2 UJ	8.7 U	7.5 U	9.1 UJ	8.3 UJ	7.7 U
N-Nitrosodiphenylamine	10 UJ	9.5 U	8.2 U	9.9 UJ	9.1 UJ	8.4 U
N-Nitrosomethylethylamine	8.1 UJ	7.7 U	6.6 U	8 UJ	7.3 UJ	6.8 U
N-Nitrosomorpholine	9.3 UJ	8.9 UJ	7.6 UJ	9.2 UJ	8.4 UJ	7.8 U
N-Nitrosopiperidine	12 UJ	11 UJ	9.8 UJ	12 UJ	11 UJ	10 U
N-Nitrosopyrrolidine	13 UJ	12 U	10 U	12 UJ	11 UJ	11 U
p-Dimethylamino azobenzene	10 UJ	9.5 U	8.2 U	9.9 UJ	9.1 UJ	8.4 U
Pentachlorobenzene	8.8 UJ	8.3 U	7.1 U	8.7 UJ	7.9 UJ	7.4 U
Pentachloronitrobenzene	8.4 UJ	7.9 UJ	6.8 UJ	8.2 UJ	7.5 UJ	7 U
Pentachlorophenol	12 UJ	11 UJ	9.6 U	12 UJ	11 UJ	9.9 UJ
Phenacetin	6.7 UJ	6.3 U	5.4 U	6.6 UJ	6 UJ	5.6 U
Phenanthrene	4.2 J	21	2 U	2.4 UJ	2.2 UJ	5 U
Phenol	6.8 UJ	6.5 UJ	5.5 U	6.7 UJ	6.1 UJ	5.7 UJ
p-Phenylene diamine	230 UJ	220 U	180 U	220 UJ	200 UJ	190 U
Pronamide	13 UJ	12 U	10 U	13 UJ	11 UJ	11 U
Pyrene	23 J	200 J	2.4 J	2.8 J	3.9 J	10 J
Pyridine	16 UJ	15 U	13 U	15 UJ	14 UJ	13 U
Safrole, Total	12 UJ	11 U	9.6 U	12 UJ	11 UJ	9.9 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB17	69SB18	69SB19	69SB20	69SB21	69SB21
Sample ID	69SB17-00	69SB18-00	69SB19-00	69SB20-00	69SB21-00D	69SB21-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)						
Antimony	0.31 UJ	0.26 UJ	0.096 UJ	0.18 UJ	0.24 UJ	0.21 UJ
Arsenic	4.5	4.2	2.7	1.5	3.7	3.6
Barium	22	22	14	15	26	21
Beryllium	0.079 J	0.042 J	0.045 J	0.038 J	0.04 J	0.067 J
Cadmium	2.2 J	1.3 J	0.2 J	0.29 J	0.8 J	0.22 J
Chromium	35 J	31 J	44 J	85 J	23 J	20 J
Cobalt	9.8	7.5	9.2	17	6	5.9
Copper	42	23	24	41	20 J	46 J
Lead	48	12	2.9	4.3	7.1 J	1.8 J
Mercury	0.032	0.021 J	0.012 J	0.022 J	0.026	0.011 J
Nickel	12	9	13	25	7.1	6.1
Selenium	0.25 J	0.18 J	0.13 J	0.16 U	0.35 J	0.58
Silver	0.11 J	0.027 J	0.017 U	0.021 U	0.038 J	0.044 J
Thallium	0.16 U	0.16 U	0.13 U	0.16 U	0.15 U	0.13 U
Tin	5.2 U	5.2 U	4.2 U	5.3 U	5 U	4.2 U
Vanadium	110 J	86 J	82 J	140 J	71 J	120 J
Zinc	65	20	25	20	13	11

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)				
1,1,1,2-Tetrachloroethane	0.68 U	0.39 U	0.44 U	0.66 U
1,1,1-Trichloroethane	0.61 U	0.36 U	0.4 U	0.59 U
1,1,2,2-Tetrachloroethane	1.5 U	0.86 U	0.96 U	1.4 U
1,1,2-Trichloroethane	1.3 U	0.74 U	0.82 U	1.2 U
1,1-Dichloroethane	0.53 U	0.31 U	0.34 U	0.51 U
1,1-Dichloroethene	0.57 U	0.33 U	0.37 U	0.55 U
1,2,3-Trichloropropane	1.5 U	0.86 U	0.96 U	1.4 U
1,2-Dibromo-3-Chloropropane	3 U	1.7 U	1.9 U	2.9 U
1,2-Dichloroethane	1.1 U	0.61 U	0.69 U	1 U
1,2-Dichloropropane	1.2 U	0.67 U	0.76 U	1.1 U
2-Butanone (MEK)	19 U	12 U	6.2 U	19 U
2-Chloro-1,3-butadiene	0.6 U	0.35 U	0.39 U	0.58 U
2-Hexanone	2.2 U	1.3 U	1.4 U	2.1 U
3-Chloro-1-propene	1.6 U	0.92 U	1 U	1.5 U
4-Methyl-2-pentanone (MIBK)	7.7 J	1.8 U	2 U	3 U
Acetone	150	75	50	220
Acetonitrile	47 R	28 R	31 R	46 UJ
Acrolein	20 R	12 R	13 R	19 U
Acrylonitrile	24 U	14 UJ	16 UJ	24 U
Benzene	0.99 J	0.48 U	0.54 U	0.81 U
Bromoform	1.2 U	0.67 U	0.76 U	1.1 U
Bromomethane	1.7 UJ	0.98 UJ	1.1 UJ	1.6 U
Carbon disulfide	0.54 U	0.31 U	0.35 U	0.52 U
Carbon tetrachloride	1.1 U	0.61 U	0.69 U	1 U
Chlorobenzene	0.77 U	0.45 U	0.5 U	0.75 U
Chlorodibromomethane	0.53 U	0.31 U	0.34 U	0.51 U
Chloroethane	1.3 U	0.74 U	0.82 U	1.2 U
Chloroform	0.53 U	0.31 U	0.34 U	0.51 U
Chloromethane	0.75 U	0.43 U	0.49 U	0.73 U
cis-1,3-Dichloropropene	0.92 U	0.53 U	0.6 U	0.89 U
Dibromomethane	1.3 U	0.74 U	0.82 U	1.2 U
Dichlorobromomethane	0.88 U	0.51 U	0.57 U	0.85 U
Dichlorodifluoromethane	0.94 U	0.55 U	0.61 U	0.91 U
Ethyl methacrylate	2.3 UJ	1.3 UJ	1.5 UJ	2.3 U
Ethylbenzene	0.79 U	0.46 U	0.51 U	0.77 U
Ethylene Dibromide	1.6 U	0.92 U	1 U	1.5 U
Iodomethane	1.1 U	0.61 U	0.69 U	1 U
Isobutyl alcohol	73 R	42 R	47 R	71 R
Methacrylonitrile	25 UJ	15 U	16 U	25 U
Methyl methacrylate	3.9 UJ	2.3 UJ	2.5 UJ	3.8 U
Methylene Chloride	1.1 U	0.61 U	0.69 U	1 U
Pentachloroethane	2.3 U	1.3 U	1.5 U	2.3 UJ
Propionitrile	22 R	13 R	14 R	21 U
Styrene	0.7 U	0.4 U	0.45 U	0.68 U
Tetrachloroethene	0.77 U	0.45 U	0.5 U	0.75 U
Toluene	0.83 U	0.48 U	0.54 U	0.81 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)				
trans-1,2-Dichloroethene	1 U	0.59 U	0.67 U	0.99 U
trans-1,3-Dichloropropene	0.92 U	0.53 U	0.6 U	0.89 U
trans-1,4-Dichloro-2-butene	3.3 UJ	1.9 UJ	2.1 UJ	3.2 U
Trichloroethene	1.1 U	0.61 U	0.69 U	1 U
Trichlorofluoromethane	1.6 U	0.92 U	1 U	1.5 U
Vinyl acetate	1.6 U	0.92 U	1 U	1.5 U
Vinyl chloride	0.61 U	0.36 U	0.4 U	0.59 U
Xylenes, Total	2.4 U	1.4 U	1.6 U	2.4 U
Semivolatile Organic Compounds (ug/kg)				
1,1'-Biphenyl	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
1,2,4,5-Tetrachlorobenzene	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
1,2,4-Trichlorobenzene	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
1,2-Dichlorobenzene	8.2 UJ	9.3 UJ	8.3 UJ	8.9 UJ
1,3,5-Trinitrobenzene	20 UJ	23 UJ	20 UJ	22 UJ
1,3-Dichlorobenzene	7 UJ	8 UJ	7.1 UJ	7.6 UJ
1,3-Dinitrobenzene	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ
1,4-Dichlorobenzene	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
1,4-Dioxane	9.4 UJ	11 UJ	9.4 UJ	10 UJ
1,4-Naphthoquinone	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ
2,2'-oxybis[1-chloropropane]	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
2,3,4,6-Tetrachlorophenol	4.9 U	5.6 UJ	5 UJ	5.3 UJ
2,4,5-Trichlorophenol	8 U	9.1 UJ	8 UJ	8.6 UJ
2,4,6-Trichlorophenol	9.3 U	11 UJ	9.3 UJ	10 UJ
2,4-Dichlorophenol	9.5 U	11 UJ	9.5 UJ	10 UJ
2,4-Dimethylphenol	20 U	23 UJ	20 UJ	22 UJ
2,4-Dinitrophenol	97 U	110 UJ	98 UJ	110 UJ
2,4-Dinitrotoluene	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
2,6-Dichlorophenol	7.5 U	8.5 UJ	7.5 UJ	8.1 UJ
2,6-Dinitrotoluene	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
2-Acetylaminofluorene	6 UJ	6.8 UJ	6 UJ	6.5 UJ
2-Chloronaphthalene	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
2-Chlorophenol	7.7 U	8.8 UJ	7.8 UJ	8.4 UJ
2-Methylnaphthalene	2 UJ	2.3 UJ	2 UJ	2.2 UJ
2-Methylphenol	9.5 U	11 UJ	9.5 UJ	10 UJ
2-Naphthylamine	23 UJ	27 UJ	24 UJ	25 UJ
2-Nitroaniline	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ
2-Nitrophenol	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ
2-Picoline	14 UJ	16 UJ	14 UJ	15 UJ
2-Toluidine	11 UJ	12 UJ	11 UJ	12 UJ
3 & 4 Methylphenol	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ
3,3'-Dichlorobenzidine	11 UJ	12 UJ	11 UJ	12 UJ
3,3'-Dimethylbenzidine	210 UJ	240 UJ	210 UJ	230 UJ
3-Methylcholanthrene	7.2 UJ	8.1 UJ	7.2 UJ	7.8 UJ
3-Nitroaniline	5.3 UJ	6 UJ	5.3 UJ	5.7 UJ
4,6-Dinitro-2-methylphenol	6.8 U	7.7 UJ	6.8 UJ	7.4 UJ
4-Aminobiphenyl	15 UJ	17 UJ	15 UJ	17 UJ

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)				
4-Bromophenyl phenyl ether	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
4-Chloro-3-methylphenol	8.8 U	10 UJ	8.8 UJ	9.5 UJ
4-Chloroaniline	7 UJ	8 UJ	7.1 UJ	7.6 UJ
4-Chlorophenyl phenyl ether	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
4-Nitroaniline	9 UJ	10 UJ	9.1 UJ	9.8 UJ
4-Nitrophenol	39 U	44 UJ	39 UJ	42 UJ
4-Nitroquinoline-1-oxide	13 R	15 R	13 R	14 R
7,12-Dimethylbenz(a)anthracene	11 UJ	12 UJ	11 UJ	12 UJ
Acenaphthene	0.67 UJ	1.8 J	0.67 UJ	0.72 UJ
Acenaphthylene	2 UJ	2.3 UJ	2 UJ	2.2 UJ
Acetophenone	10 UJ	11 UJ	10 UJ	11 UJ
alpha,alpha-Dimethyl phenethylamine	69 UJ	79 UJ	70 UJ	75 UJ
Aniline	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
Anthracene	2 UJ	6 J	2 UJ	2.2 UJ
Aramite, Total	13 UJ	15 UJ	13 UJ	14 UJ
Benzo[a]anthracene	8 J	140 J	8 J	2.2 UJ
Benzo[a]pyrene	17 J	160 J	13 J	1.5 UJ
Benzo[b]fluoranthene	36 J	380 J	29 J	1.6 UJ
Benzo[g,h,i]perylene	26 J	220 J	26 J	3.2 UJ
Benzo[k]fluoranthene	1.2 UJ	1.3 UJ	1.2 UJ	1.8 UJ
Benzyl alcohol	9.4 U	11 UJ	9.4 UJ	10 UJ
Bis(2-chloroethoxy)methane	8 UJ	9.1 UJ	8 UJ	8.6 UJ
Bis(2-chloroethyl)ether	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ
Bis(2-ethylhexyl) phthalate	34 UJ	48 UJ	36 UJ	21 UJ
Butyl benzyl phthalate	18 J	34 J	72 J	9.1 UJ
Chrysene	21 J	210 J	12 J	0.78 UJ
Diallate	11 UJ	13 UJ	11 UJ	12 UJ
Dibenz(a,h)anthracene	4.5 UJ	33 J	3 J	1.8 UJ
Dibenzofuran	4.9 UJ	5.6 UJ	5 UJ	5.3 UJ
Diethyl phthalate	13 UJ	15 UJ	13 UJ	14 UJ
Dimethyl phthalate	7.5 UJ	8.5 UJ	7.5 UJ	8.1 UJ
Di-n-butyl phthalate	29 UJ	33 UJ	29 UJ	32 UJ
Di-n-octyl phthalate	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ
Dinoseb	20 UJ	23 UJ	20 UJ	22 UJ
Ethyl methanesulfonate	13 UJ	15 UJ	13 UJ	14 UJ
Fluoranthene	21 J	280 J	17 J	2.2 UJ
Fluorene	0.92 UJ	1.3 J	0.91 UJ	0.98 UJ
Hexachlorobenzene	8 UJ	9.1 UJ	8 UJ	8.6 UJ
Hexachlorobutadiene	11 UJ	12 UJ	11 UJ	12 UJ
Hexachlorocyclopentadiene	16 UJ	19 UJ	17 UJ	18 UJ
Hexachloroethane	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
Hexachlorophene	970 UJ	1100 UJ	980 UJ	1100 UJ
Hexachloropropene	8.5 UJ	9.6 UJ	8.5 UJ	9.1 UJ
Indeno[1,2,3-cd]pyrene	13 J	92 J	8.6 J	1.5 UJ
Isophorone	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
Isosafrole	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)				
Methapyrilene	11 UJ	12 UJ	11 UJ	12 UJ
Methyl methanesulfonate	11 UJ	12 UJ	11 UJ	12 UJ
Naphthalene	0.7 UJ	0.8 UJ	0.75 J	0.76 UJ
Nitrobenzene	8.1 UJ	9.2 UJ	8.1 UJ	8.8 UJ
N-Nitro-o-toluidine	7 UJ	8 UJ	7.1 UJ	7.6 UJ
N-Nitrosodiethylamine	14 UJ	16 UJ	14 UJ	15 UJ
N-Nitrosodimethylamine	12 UJ	13 UJ	12 UJ	12 UJ
N-Nitrosodi-n-butylamine	11 UJ	12 UJ	11 UJ	12 UJ
N-Nitrosodi-n-propylamine	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ
N-Nitrosodiphenylamine	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
N-Nitrosomethylethylamine	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ
N-Nitrosomorpholine	7.7 UJ	8.8 UJ	7.8 UJ	8.4 UJ
N-Nitrosopiperidine	10 UJ	11 UJ	10 UJ	11 UJ
N-Nitrosopyrrolidine	10 UJ	12 UJ	10 UJ	11 UJ
p-Dimethylamino azobenzene	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
Pentachlorobenzene	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
Pentachloronitrobenzene	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
Pentachlorophenol	9.7 U	11 UJ	9.8 UJ	11 UJ
Phenacetin	5.5 UJ	6.3 UJ	5.5 UJ	6 UJ
Phenanthrene	5.8 J	34 J	2.4 J	2.2 UJ
Phenol	5.6 UJ	6.4 UJ	5.7 UJ	6.1 UJ
p-Phenylene diamine	190 UJ	210 UJ	190 UJ	200 UJ
Pronamide	11 UJ	12 UJ	11 UJ	11 UJ
Pyrene	20 J	300 J	16 J	2.2 UJ
Pyridine	13 UJ	15 UJ	13 UJ	14 UJ
Safrole, Total	9.7 UJ	11 UJ	9.8 UJ	11 UJ

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)				
Antimony	0.17 UJ	0.35 UJ	0.22 UJ	0.09 UJ
Arsenic	2.5	3.4	3.7	1.4
Barium	17	410	66	90
Beryllium	0.051 J	0.047 J	0.056 J	0.26
Cadmium	0.61 J	1.7 J	0.69 J	0.13 J
Chromium	60 J	26	26	19
Cobalt	12	6.9	6.7	18
Copper	32	24	20	85
Lead	9.6	37	17	3.8
Mercury	0.011 J	0.0088 J	0.0087 J	0.056
Nickel	17	8.6	8.4	8.3
Selenium	0.13 U	0.19 J	0.16 J	0.52 J
Silver	0.028 J	0.053 J	0.062 J	0.054 J
Thallium	0.13 U	0.15 U	0.14 U	0.14 U
Tin	4.5 U	4.9 U	4.6 U	4.8 U
Vanadium	140 J	62	70	210
Zinc	36	69	22	50

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB07	69SB08	69SB08
Sample ID	69SB07-01	69SB07-05	69SB08-01	69SB08-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	9.0-11.0	1.0-3.0	9.0-11.0
Volatile Organic Compounds (ug/kg)				
1,1,1,2-Tetrachloroethane	0.71 U	0.81 U	0.7 U	0.76 U
1,1,1-Trichloroethane	0.65 U	0.73 U	0.63 U	0.69 U
1,1,2,2-Tetrachloroethane	1.6 U	1.8 U	1.5 U	1.7 U
1,1,2-Trichloroethane	1.3 U	1.5 U	1.3 U	1.4 U
1,1-Dichloroethane	0.56 U	0.63 U	0.54 U	0.6 U
1,1-Dichloroethene	0.6 U	0.68 U	0.59 U	0.64 U
1,2,3-Trichloropropane	1.6 U	1.8 U	1.5 U	1.7 U
1,2-Dibromo-3-Chloropropane	3.1 U	3.5 U	3 U	3.3 U
1,2-Dichloroethane	1.1 U	1.3 U	1.1 U	1.2 U
1,2-Dichloropropane	1.2 U	1.4 U	1.2 U	1.3 U
2-Butanone (MEK)	3 U	3.4 U	2.9 U	3.2 U
2-Chloro-1,3-butadiene	0.64 UJ	7.6 J	0.62 UJ	0.68 UJ
2-Hexanone	2.3 U	2.7 U	2.3 U	2.5 U
3-Chloro-1-propene	1.7 R	1.9 R	1.6 R	1.8 R
4-Methyl-2-pentanone (MIBK)	3.2 U	3.7 U	3.2 U	3.5 U
Acetone	9 J	7 J	28 J	15 J
Acetonitrile	50 UJ	57 UJ	49 UJ	54 UJ
Acrolein	21 R	24 R	21 R	23 R
Acrylonitrile	26 UJ	29 UJ	25 UJ	27 UJ
Benzene	0.88 U	1 U	0.86 U	0.94 U
Bromoform	1.2 U	1.4 U	1.2 U	1.3 U
Bromomethane	1.8 UJ	2 UJ	1.7 UJ	1.9 UJ
Carbon disulfide	0.57 U	0.64 U	0.55 U	0.61 U
Carbon tetrachloride	1.1 U	1.3 U	1.1 U	1.2 U
Chlorobenzene	0.81 U	0.92 U	0.79 U	0.87 U
Chlorodibromomethane	0.56 U	0.63 U	0.54 U	0.6 U
Chloroethane	1.3 U	1.5 U	1.3 U	1.4 U
Chloroform	0.56 U	0.63 U	0.54 U	0.6 U
Chloromethane	0.79 U	0.9 U	0.77 U	0.85 U
cis-1,3-Dichloropropene	0.97 U	1.1 U	0.95 U	1 U
Dibromomethane	1.3 U	1.5 U	1.3 U	1.4 U
Dichlorobromomethane	0.92 U	1 U	0.9 U	0.99 U
Dichlorodifluoromethane	0.99 U	1.1 U	0.97 U	1.1 U
Ethyl methacrylate	2.5 U	2.8 U	2.4 U	2.6 U
Ethylbenzene	0.84 U	0.95 U	0.82 U	0.89 U
Ethylene Dibromide	1.7 U	1.9 U	1.6 U	1.8 U
Iodomethane	1.1 U	1.3 U	1.1 U	1.2 U
Isobutyl alcohol	77 R	87 R	75 R	82 R
Methacrylonitrile	27 U	30 U	26 U	29 U
Methyl methacrylate	4.1 U	4.7 U	4 U	4.4 U
Methylene Chloride	1.1 U	1.3 U	1.1 U	1.2 U
Pentachloroethane	2.5 U	2.8 U	2.4 U	2.6 U
Propionitrile	23 UJ	27 UJ	23 UJ	25 UJ
Styrene	0.74 U	0.83 U	0.72 U	0.79 U
Tetrachloroethene	0.81 U	0.92 U	0.79 U	0.87 U
Toluene	0.88 U	1 U	0.86 U	0.94 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB07	69SB08	69SB08
Sample ID	69SB07-01	69SB07-05	69SB08-01	69SB08-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	9.0-11.0	1.0-3.0	9.0-11.0
Volatile Organic Compounds (ug/kg)				
trans-1,2-Dichloroethene	1.1 U	1.2 U	1.1 U	1.2 U
trans-1,3-Dichloropropene	0.97 U	1.1 U	0.95 U	1 U
trans-1,4-Dichloro-2-butene	3.5 U	3.9 U	3.4 U	3.7 U
Trichloroethene	1.1 U	1.3 U	1.1 U	1.2 U
Trichlorofluoromethane	1.7 U	1.9 U	1.6 U	1.8 U
Vinyl acetate	1.7 UJ	1.9 UJ	1.6 UJ	1.8 UJ
Vinyl chloride	0.65 U	0.73 U	0.63 U	0.69 U
Xylenes, Total	2.6 U	2.9 U	2.5 U	2.7 U
Semivolatile Organic Compounds (ug/kg)				
1,1'-Biphenyl	9.6 UJ	10 U	9.5 U	11 U
1,2,4,5-Tetrachlorobenzene	8.1 UJ	8.8 U	8.1 U	8.9 U
1,2,4-Trichlorobenzene	9.6 UJ	10 U	9.5 U	11 U
1,2-Dichlorobenzene	9 UJ	9.8 U	9 U	9.9 U
1,3,5-Trinitrobenzene	22 UJ	24 U	22 U	24 U
1,3-Dichlorobenzene	7.8 UJ	8.4 U	7.7 U	8.5 U
1,3-Dinitrobenzene	5 UJ	5.5 U	5 U	5.5 U
1,4-Dichlorobenzene	8 UJ	8.7 U	8 U	8.8 U
1,4-Dioxane	10 UJ	11 U	10 U	11 U
1,4-Naphthoquinone	5 UJ	5.5 U	5 U	5.5 U
2,2'-oxybis[1-chloropropane]	8.1 UJ	8.8 U	8.1 U	8.9 U
2,3,4,6-Tetrachlorophenol	5.4 UJ	5.9 U	5.4 U	6 U
2,4,5-Trichlorophenol	8.8 UJ	9.5 U	8.8 U	9.7 U
2,4,6-Trichlorophenol	10 UJ	11 U	10 U	11 U
2,4-Dichlorophenol	10 UJ	11 U	10 U	11 U
2,4-Dimethylphenol	22 UJ	24 U	22 U	24 U
2,4-Dinitrophenol	110 UJ	120 UJ	110 U	120 UJ
2,4-Dinitrotoluene	7.6 UJ	8.3 U	7.6 U	8.4 U
2,6-Dichlorophenol	8.3 UJ	9 U	8.2 U	9.1 U
2,6-Dinitrotoluene	8 UJ	8.7 U	8 U	8.8 U
2-Acetylaminofluorene	6.6 UJ	7.2 U	6.6 U	7.2 U
2-Chloronaphthalene	8 UJ	8.7 U	8 U	8.8 U
2-Chlorophenol	8.5 UJ	9.3 U	8.5 U	9.4 U
2-Methylnaphthalene	2.2 UJ	2.4 U	2.2 U	2.4 U
2-Methylphenol	10 UJ	11 U	10 U	11 U
2-Naphthylamine	26 UJ	28 UJ	26 UJ	28 UJ
2-Nitroaniline	8.4 UJ	9.1 U	8.4 U	9.2 U
2-Nitrophenol	9.4 UJ	10 U	9.4 U	10 U
2-Picoline	16 UJ	17 U	15 U	17 U
2-Toluidine	12 UJ	13 U	12 U	13 U
3 & 4 Methylphenol	9.4 UJ	10 U	9.4 U	10 U
3,3'-Dichlorobenzidine	12 UJ	13 U	12 U	13 U
3,3'-Dimethylbenzidine	230 UJ	250 UJ	230 UJ	260 UJ
3-Methylcholanthrene	7.9 UJ	8.6 U	7.9 U	8.7 U
3-Nitroaniline	5.8 UJ	6.3 U	5.8 U	6.4 U
4,6-Dinitro-2-methylphenol	7.5 UJ	8.1 UJ	7.5 UJ	8.2 UJ
4-Aminobiphenyl	17 UJ	18 U	17 U	18 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB07	69SB08	69SB08
Sample ID	69SB07-01	69SB07-05	69SB08-01	69SB08-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	9.0-11.0	1.0-3.0	9.0-11.0
Semivolatile Organic Compounds (ug/kg)				
4-Bromophenyl phenyl ether	9.2 UJ	10 U	9.1 U	10 U
4-Chloro-3-methylphenol	9.7 UJ	11 U	9.7 U	11 U
4-Chloroaniline	7.8 UJ	8.4 U	7.7 U	8.5 U
4-Chlorophenyl phenyl ether	8 UJ	8.7 U	8 U	8.8 U
4-Nitroaniline	9.9 UJ	11 U	9.9 U	11 U
4-Nitrophenol	43 UJ	46 U	42 UJ	47 U
4-Nitroquinoline-1-oxide	14 R	15 R	14 R	16 R
7,12-Dimethylbenz(a)anthracene	12 UJ	13 U	12 U	13 U
Acenaphthene	0.74 UJ	0.8 U	0.73 U	0.81 U
Acenaphthylene	2.2 UJ	2.4 U	2.2 U	2.4 U
Acetophenone	11 UJ	12 U	11 U	12 U
alpha,alpha-Dimethyl phenethylamine	76 UJ	83 U	76 U	84 U
Aniline	8.1 UJ	8.8 U	8.1 U	8.9 U
Anthracene	2.2 UJ	2.4 U	2.2 U	2.4 U
Aramite, Total	14 UJ	15 UJ	14 UJ	16 UJ
Benzo[a]anthracene	2.2 UJ	2.4 U	2.2 U	2.4 U
Benzo[a]pyrene	0.85 UJ	0.93 U	0.85 U	0.94 U
Benzo[b]fluoranthene	0.98 UJ	1.1 U	0.98 U	1.1 U
Benzo[g,h,i]perylene	2.2 UJ	2.4 U	2.2 U	2.4 U
Benzo[k]fluoranthene	1.3 UJ	1.4 U	1.3 U	1.4 U
Benzyl alcohol	10 UJ	11 U	10 U	11 U
Bis(2-chloroethoxy)methane	8.8 UJ	9.5 U	8.8 U	9.7 U
Bis(2-chloroethyl)ether	7.4 UJ	8 U	7.3 U	8.1 U
Bis(2-ethylhexyl) phthalate	47 UJ	14 J	18 U	31 U
Butyl benzyl phthalate	9.3 UJ	10 U	9.3 U	10 U
Chrysene	0.79 UJ	0.86 U	0.79 U	0.87 U
Diallate	12 UJ	13 U	12 U	14 U
Dibenz(a,h)anthracene	0.76 UJ	0.83 U	0.76 U	0.84 U
Dibenzofuran	5.4 UJ	5.9 U	5.4 U	6 U
Diethyl phthalate	14 UJ	15 U	14 U	16 U
Dimethyl phthalate	8.3 UJ	9 U	8.2 U	9.1 U
Di-n-butyl phthalate	32 UJ	35 U	32 U	35 U
Di-n-octyl phthalate	4.3 UJ	4.6 U	4.2 U	4.7 U
Dinoseb	22 UJ	24 U	22 U	24 U
Ethyl methanesulfonate	14 UJ	15 U	14 U	16 U
Fluoranthene	2.2 UJ	2.4 U	2.2 U	2.4 U
Fluorene	0.99 UJ	1.1 U	0.99 U	1.1 U
Hexachlorobenzene	8.8 UJ	9.5 U	8.8 U	9.7 U
Hexachlorobutadiene	12 UJ	13 U	12 U	13 U
Hexachlorocyclopentadiene	18 UJ	20 U	18 U	20 U
Hexachloroethane	9.6 UJ	10 U	9.5 U	11 U
Hexachlorophene	1100 UJ	1200 R	1100 R	1200 R
Hexachloropropene	9.3 UJ	10 UJ	9.3 UJ	10 UJ
Indeno[1,2,3-cd]pyrene	1.6 UJ	1.7 UJ	1.5 U	1.7 UJ
Isophorone	8 UJ	8.7 U	8 U	8.8 U
Isosafrole	9.2 UJ	10 U	9.1 U	10 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB07	69SB08	69SB08
Sample ID	69SB07-01	69SB07-05	69SB08-01	69SB08-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	9.0-11.0	1.0-3.0	9.0-11.0
Semivolatile Organic Compounds (ug/kg)				
Methapyrilene	12 UJ	13 UJ	12 UJ	13 UJ
Methyl methanesulfonate	12 UJ	13 U	12 U	13 U
Naphthalene	0.78 UJ	0.84 U	0.77 U	0.85 U
Nitrobenzene	8.9 UJ	9.7 U	8.9 U	9.8 U
N-Nitro-o-toluidine	7.8 UJ	8.4 U	7.7 U	8.5 U
N-Nitrosodiethylamine	16 UJ	17 U	15 U	17 U
N-Nitrosodimethylamine	13 UJ	14 U	13 U	14 U
N-Nitrosodi-n-butylamine	12 UJ	13 UJ	12 UJ	13 UJ
N-Nitrosodi-n-propylamine	8.4 UJ	9.1 U	8.4 U	9.2 U
N-Nitrosodiphenylamine	9.2 UJ	10 U	9.1 U	10 U
N-Nitrosomethylethylamine	7.4 UJ	8 U	7.3 U	8.1 U
N-Nitrosomorpholine	8.5 UJ	9.3 UJ	8.5 UJ	9.4 UJ
N-Nitrosopiperidine	11 UJ	12 UJ	11 UJ	12 UJ
N-Nitrosopyrrolidine	11 UJ	12 UJ	11 U	13 UJ
p-Dimethylamino azobenzene	9.2 UJ	10 U	9.1 U	10 U
Pentachlorobenzene	8 UJ	8.7 U	8 U	8.8 U
Pentachloronitrobenzene	7.6 UJ	8.3 U	7.6 U	8.4 U
Pentachlorophenol	11 UJ	12 U	11 U	12 U
Phenacetin	6.1 UJ	6.6 U	6.1 U	6.7 U
Phenanthrene	2.2 UJ	2.4 U	2.2 U	2.4 U
Phenol	6.2 UJ	6.7 U	6.2 U	6.8 U
p-Phenylene diamine	210 UJ	220 U	210 U	230 U
Pronamide	12 UJ	13 U	12 U	13 U
Pyrene	2.2 UJ	2.4 U	2.2 U	2.4 U
Pyridine	14 UJ	15 U	14 U	16 U
Safrole, Total	11 UJ	12 U	11 U	12 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB07	69SB08	69SB08
Sample ID	69SB07-01	69SB07-05	69SB08-01	69SB08-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	9.0-11.0	1.0-3.0	9.0-11.0
Metals (mg/kg)				
Antimony	0.096 U	0.098 U	0.096 U	0.098 U
Arsenic	1.3	0.83	2	0.54 J
Barium	18	10	73	7.1
Beryllium	0.18	0.18	0.16	0.18
Cadmium	0.035 UJ	0.041 UJ	0.051 J	0.041 UJ
Chromium	25	9	29	8 J
Cobalt	7.9	2.4	8.1	2.6 J
Copper	72 J	120	87	120 J
Lead	2.5	2.7	3.4	1.3
Mercury	0.11	0.0057 U	0.06	0.0062 J
Nickel	5.7	3.1	4.6	2.9
Selenium	0.58	0.97	1.2	0.64 J
Silver	0.068 J	0.047 J	0.03 J	0.071 J
Thallium	0.14 U	0.16 U	0.15 U	0.16 U
Tin	4.6 U	5.2 U	5 U	5.2 U
Vanadium	250	390	380	210 J
Zinc	29	11	26	10

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB11	69SB11	69SB12
Sample ID	69SB08-05D	69SB11-01	69SB11-05	69SB12-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0	1.0-3.0
Volatile Organic Compounds (ug/kg)				
1,1,1,2-Tetrachloroethane	0.75 U	0.69 U	0.6 U	0.69 U
1,1,1-Trichloroethane	0.68 U	0.62 U	0.55 U	0.62 U
1,1,2,2-Tetrachloroethane	1.6 U	1.5 U	1.3 U	1.5 U
1,1,2-Trichloroethane	1.4 U	1.3 U	1.1 U	1.3 U
1,1-Dichloroethane	0.58 U	0.54 U	0.47 U	0.54 U
1,1-Dichloroethene	0.63 U	0.58 U	0.51 U	0.58 U
1,2,3-Trichloropropane	1.6 U	1.5 U	1.3 U	1.5 U
1,2-Dibromo-3-Chloropropane	3.3 UJ	3 UJ	2.6 UJ	3 UJ
1,2-Dichloroethane	1.2 UJ	1.1 UJ	0.94 UJ	1.1 UJ
1,2-Dichloropropane	1.3 U	1.2 U	1 U	1.2 U
2-Butanone (MEK)	8.1 UJ	4.5 UJ	2.5 UJ	2.9 UJ
2-Chloro-1,3-butadiene	0.67 UJ	0.61 UJ	0.54 UJ	0.61 UJ
2-Hexanone	6.3 J	2.3 UJ	2 UJ	2.3 UJ
3-Chloro-1-propene	1.8 U	1.6 U	1.4 U	1.6 U
4-Methyl-2-pentanone (MIBK)	3.7 J	3.1 U	2.7 U	3.1 U
Acetone	16 J	26 J	4.1 UJ	10 J
Acetonitrile	53 U	48 U	42 U	48 U
Acrolein	22 R	20 R	18 R	20 R
Acrylonitrile	27 UJ	25 UJ	22 UJ	25 UJ
Benzene	0.92 U	0.85 U	0.74 U	0.85 U
Bromoform	1.3 U	1.2 U	1 U	1.2 U
Bromomethane	1.9 UJ	1.7 UJ	1.5 UJ	1.7 UJ
Carbon disulfide	0.6 U	0.55 U	0.48 U	0.55 U
Carbon tetrachloride	1.2 U	1.1 U	0.94 U	1.1 U
Chlorobenzene	0.85 U	0.79 U	0.69 U	0.78 U
Chlorodibromomethane	0.58 U	0.54 U	0.47 U	0.54 U
Chloroethane	1.4 U	1.3 U	1.1 U	1.3 U
Chloroform	0.58 U	0.54 U	0.47 U	0.54 U
Chloromethane	0.83 U	0.76 U	0.67 U	0.76 U
cis-1,3-Dichloropropene	1 U	0.94 U	0.82 U	0.93 U
Dibromomethane	1.4 U	1.3 U	1.1 U	1.3 U
Dichlorobromomethane	0.97 U	0.89 U	0.78 U	0.89 U
Dichlorodifluoromethane	1 U	0.96 U	0.84 U	0.95 U
Ethyl methacrylate	2.6 UJ	2.4 UJ	2.1 UJ	2.4 UJ
Ethylbenzene	0.88 U	0.81 U	0.71 U	0.8 U
Ethylene Dibromide	1.8 U	1.6 U	1.4 U	1.6 U
Iodomethane	1.2 UJ	1.1 UJ	0.94 UJ	1.1 UJ
Isobutyl alcohol	81 R	74 R	65 R	74 R
Methacrylonitrile	28 UJ	26 UJ	23 UJ	26 UJ
Methyl methacrylate	4.3 UJ	4 UJ	3.5 UJ	4 UJ
Methylene Chloride	1.2 U	1.1 U	0.94 U	1.1 U
Pentachloroethane	2.6 U	2.4 U	2.1 U	2.4 U
Propionitrile	25 U	23 U	20 U	23 U
Styrene	0.77 U	0.71 U	0.62 U	0.71 U
Tetrachloroethene	0.85 U	0.79 U	0.69 U	0.78 U
Toluene	0.92 U	0.85 U	0.74 U	0.85 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB11	69SB11	69SB12
Sample ID	69SB08-05D	69SB11-01	69SB11-05	69SB12-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0	1.0-3.0
Volatile Organic Compounds (ug/kg)				
trans-1,2-Dichloroethene	1.1 U	1 U	0.91 U	1 U
trans-1,3-Dichloropropene	1 U	0.94 U	0.82 U	0.93 U
trans-1,4-Dichloro-2-butene	3.6 U	3.3 U	2.9 U	3.3 U
Trichloroethene	1.2 U	1.1 U	0.94 U	1.1 U
Trichlorofluoromethane	1.8 U	1.6 U	1.4 U	1.6 U
Vinyl acetate	1.8 UJ	1.6 UJ	1.4 UJ	1.6 UJ
Vinyl chloride	0.68 U	0.62 U	0.55 U	0.62 U
Xylenes, Total	2.7 U	2.5 U	2.2 U	2.5 U
Semivolatile Organic Compounds (ug/kg)				
1,1'-Biphenyl	10 U	9.5 U	8.9 U	9.6 U
1,2,4,5-Tetrachlorobenzene	8.9 U	8.1 U	7.6 U	8.2 U
1,2,4-Trichlorobenzene	10 U	9.5 U	8.9 U	9.6 U
1,2-Dichlorobenzene	9.9 U	9 U	8.4 U	9.1 U
1,3,5-Trinitrobenzene	24 U	22 U	20 U	22 U
1,3-Dichlorobenzene	8.5 U	7.7 U	7.2 U	7.8 U
1,3-Dinitrobenzene	5.5 U	5 U	4.7 U	5.1 U
1,4-Dichlorobenzene	8.7 U	8 U	7.5 U	8 U
1,4-Dioxane	11 U	10 U	9.6 U	10 U
1,4-Naphthoquinone	5.5 U	5 U	4.7 U	5.1 U
2,2'-oxybis[1-chloropropane]	8.9 U	8.1 U	7.6 U	8.2 U
2,3,4,6-Tetrachlorophenol	5.9 U	5.4 U	5.1 U	5.4 U
2,4,5-Trichlorophenol	9.6 U	8.7 U	8.2 U	8.8 U
2,4,6-Trichlorophenol	11 U	10 U	9.5 U	10 U
2,4-Dichlorophenol	11 U	10 U	9.8 U	10 U
2,4-Dimethylphenol	24 U	22 U	20 U	22 U
2,4-Dinitrophenol	120 UJ	110 U	100 UJ	110 UJ
2,4-Dinitrotoluene	8.3 U	7.6 U	7.1 U	7.6 U
2,6-Dichlorophenol	9 U	8.2 U	7.7 U	8.3 U
2,6-Dinitrotoluene	8.7 U	8 U	7.5 U	8 U
2-Acetylaminofluorene	7.2 U	6.6 U	6.1 U	6.6 U
2-Chloronaphthalene	8.7 U	8 U	7.5 U	8 U
2-Chlorophenol	9.3 U	8.5 U	7.9 U	8.6 U
2-Methylnaphthalene	2.4 U	2.2 U	2 U	2.2 U
2-Methylphenol	11 U	10 U	9.8 U	10 U
2-Naphthylamine	28 UJ	26 UJ	24 UJ	26 UJ
2-Nitroaniline	9.2 U	8.4 U	7.8 U	8.4 U
2-Nitrophenol	10 U	9.4 U	8.8 U	9.5 U
2-Picoline	17 U	15 U	14 U	16 U
2-Toluidine	13 U	12 U	11 U	12 U
3 & 4 Methylphenol	10 U	9.4 U	8.8 U	9.5 U
3,3'-Dichlorobenzidine	13 U	12 U	11 UJ	12 UJ
3,3'-Dimethylbenzidine	250 UJ	230 UJ	220 UJ	230 U
3-Methylcholanthrene	8.6 U	7.8 U	7.3 U	7.9 UJ
3-Nitroaniline	6.3 U	5.8 U	5.4 U	5.8 U
4,6-Dinitro-2-methylphenol	8.2 UJ	7.5 UJ	7 UJ	7.5 UJ
4-Aminobiphenyl	18 U	17 U	16 U	17 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB11	69SB11	69SB12
Sample ID	69SB08-05D	69SB11-01	69SB11-05	69SB12-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0	1.0-3.0
Semivolatile Organic Compounds (ug/kg)				
4-Bromophenyl phenyl ether	10 U	9.1 U	8.6 U	9.2 U
4-Chloro-3-methylphenol	11 U	9.6 U	9 U	9.7 U
4-Chloroaniline	8.5 U	7.7 U	7.2 U	7.8 U
4-Chlorophenyl phenyl ether	8.7 U	8 U	7.5 U	8 U
4-Nitroaniline	11 U	9.9 U	9.3 U	10 U
4-Nitrophenol	47 U	42 UJ	40 U	43 U
4-Nitroquinoline-1-oxide	16 R	14 R	13 R	14 R
7,12-Dimethylbenz(a)anthracene	13 U	12 U	11 UJ	12 UJ
Acenaphthene	0.8 U	0.73 U	0.69 U	0.74 U
Acenaphthylene	2.4 U	2.2 U	2 U	2.2 U
Acetophenone	12 U	11 U	10 U	11 U
alpha,alpha-Dimethyl phenethylamine	83 U	76 U	71 U	76 U
Aniline	8.9 U	8.1 U	7.6 U	8.2 U
Anthracene	2.4 U	2.2 U	2 U	2.2 U
Aramite, Total	16 UJ	14 UJ	13 UJ	14 UJ
Benzo[a]anthracene	2.4 U	2.2 U	2 U	2.2 U
Benzo[a]pyrene	0.93 U	0.85 U	0.79 UJ	0.86 UJ
Benzo[b]fluoranthene	1.1 U	0.98 U	0.92 UJ	0.98 UJ
Benzo[g,h,i]perylene	2.4 U	2.2 U	2 UJ	2.2 UJ
Benzo[k]fluoranthene	1.4 U	1.3 U	1.2 UJ	1.3 UJ
Benzyl alcohol	11 U	10 U	9.6 U	10 U
Bis(2-chloroethoxy)methane	9.6 U	8.7 U	8.2 U	8.8 U
Bis(2-chloroethyl)ether	8 U	7.3 U	6.9 U	7.4 U
Bis(2-ethylhexyl) phthalate	23 U	32 U	24 U	20 U
Butyl benzyl phthalate	10 U	9.2 U	8.7 U	9.3 U
Chrysene	0.86 U	0.78 U	0.73 U	0.79 UJ
Diallate	14 U	12 U	12 U	12 U
Dibenz(a,h)anthracene	0.83 U	0.76 U	0.71 UJ	0.76 UJ
Dibenzofuran	5.9 U	5.4 U	5.1 U	5.4 U
Diethyl phthalate	16 U	14 U	13 U	14 U
Dimethyl phthalate	9 U	8.2 U	7.7 U	8.3 U
Di-n-butyl phthalate	35 U	32 U	30 U	32 U
Di-n-octyl phthalate	4.7 U	4.2 U	4 UJ	4.3 UJ
Dinoseb	24 U	22 U	20 U	22 U
Ethyl methanesulfonate	16 U	14 U	13 U	14 U
Fluoranthene	2.4 U	2.2 U	2 U	2.2 U
Fluorene	1.1 U	0.99 U	0.93 U	1 U
Hexachlorobenzene	9.6 U	8.7 U	8.2 U	8.8 U
Hexachlorobutadiene	13 U	12 U	11 U	12 U
Hexachlorocyclopentadiene	20 U	18 U	17 U	18 U
Hexachloroethane	10 U	9.5 U	8.9 U	9.6 U
Hexachlorophene	1200 R	1100 R	1000 R	1100 R
Hexachloropropene	10 UJ	9.2 UJ	8.7 UJ	9.3 UJ
Indeno[1,2,3-cd]pyrene	1.7 UJ	1.5 U	1.4 UJ	1.6 UJ
Isophorone	8.7 U	8 U	7.5 UJ	8 UJ
Isosafrole	10 U	9.1 U	8.6 U	9.2 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB11	69SB11	69SB12
Sample ID	69SB08-05D	69SB11-01	69SB11-05	69SB12-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0	1.0-3.0
Semivolatile Organic Compounds (ug/kg)				
Methapyrilene	13 UJ	12 UJ	11 UJ	12 UJ
Methyl methanesulfonate	13 U	12 U	11 U	12 U
Naphthalene	0.85 U	0.77 U	0.72 U	0.78 U
Nitrobenzene	9.7 U	8.9 U	8.3 U	8.9 U
N-Nitro-o-toluidine	8.5 U	7.7 U	7.2 U	7.8 U
N-Nitrosodiethylamine	17 U	15 U	14 U	16 U
N-Nitrosodimethylamine	14 U	13 U	12 U	13 U
N-Nitrosodi-n-butylamine	13 UJ	12 UJ	11 UJ	12 UJ
N-Nitrosodi-n-propylamine	9.2 U	8.4 U	7.8 U	8.4 U
N-Nitrosodiphenylamine	10 U	9.1 U	8.6 U	9.2 U
N-Nitrosomethylethylamine	8 U	7.3 U	6.9 U	7.4 U
N-Nitrosomorpholine	9.3 UJ	8.5 UJ	7.9 UJ	8.6 UJ
N-Nitrosopiperidine	12 UJ	11 UJ	10 UJ	11 UJ
N-Nitrosopyrrolidine	13 UJ	11 U	11 UJ	12 UJ
p-Dimethylamino azobenzene	10 U	9.1 U	8.6 U	9.2 U
Pentachlorobenzene	8.7 U	8 U	7.5 U	8 U
Pentachloronitrobenzene	8.3 U	7.6 U	7.1 U	7.6 U
Pentachlorophenol	12 U	11 U	10 U	11 U
Phenacetin	6.6 U	6 U	5.7 U	6.1 U
Phenanthrene	2.4 U	2.2 U	2 U	2.2 U
Phenol	6.8 U	6.2 U	5.8 U	6.2 U
p-Phenylene diamine	230 U	210 U	190 U	210 U
Pronamide	13 U	12 U	11 U	12 U
Pyrene	2.4 U	2.2 U	2 U	2.2 U
Pyridine	16 U	14 U	13 U	14 U
Safrole, Total	12 U	11 U	10 U	11 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB11	69SB11	69SB12
Sample ID	69SB08-05D	69SB11-01	69SB11-05	69SB12-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0	1.0-3.0
Metals (mg/kg)				
Antimony	0.1 U	0.089 U	0.1 U	0.094 U
Arsenic	0.93	0.84	1.5	1.3
Barium	10	120	64	96
Beryllium	0.26	0.27	0.26	0.26
Cadmium	0.041 UJ	0.037 UJ	0.034 UJ	0.2 J
Chromium	12 J	18	21	17
Cobalt	5 J	17	13	27
Copper	240 J	97	76	110
Lead	2.9	2.8	2.9	3
Mercury	0.0086 J	0.024	0.059	0.049
Nickel	4	10	8	11
Selenium	1.1	0.17 J	0.25 J	0.32 J
Silver	0.13 U	0.053 U	0.042 U	0.084 U
Thallium	0.16 U	0.14 U	0.13 U	0.15 U
Tin	5.3 U	4.7 U	4.3 U	5 U
Vanadium	460 J	170	230	240
Zinc	16	76	43	82

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB12	69SB27	69SB27
Sample ID	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	5/1/2008	5/1/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0
Volatile Organic Compounds (ug/kg)			
1,1,1,2-Tetrachloroethane	0.6 U	0.65 U	24 U
1,1,1-Trichloroethane	0.55 U	0.59 U	22 U
1,1,2,2-Tetrachloroethane	1.3 U	1.4 U	53 U
1,1,2-Trichloroethane	1.1 U	1.2 U	46 U
1,1-Dichloroethane	0.47 U	0.51 U	19 U
1,1-Dichloroethene	0.51 U	0.55 U	21 U
1,2,3-Trichloropropane	1.3 U	1.4 U	53 U
1,2-Dibromo-3-Chloropropane	2.6 UJ	2.8 U	110 U
1,2-Dichloroethane	0.94 UJ	1 U	38 U
1,2-Dichloropropane	1 U	1.1 U	42 U
2-Butanone (MEK)	2.5 UJ	2.7 U	100 U
2-Chloro-1,3-butadiene	0.54 UJ	0.58 U	22 UJ
2-Hexanone	2 UJ	2.1 U	80 U
3-Chloro-1-propene	1.4 U	1.5 UJ	57 UJ
4-Methyl-2-pentanone (MIBK)	2.7 U	3 U	110 U
Acetone	4.1 UJ	47 J	520 R
Acetonitrile	42 U	46 U	1700 UJ
Acrolein	18 R	19 R	730 R
Acrylonitrile	22 UJ	23 U	880 UJ
Benzene	0.74 U	0.8 U	30 U
Bromoform	1 U	1.1 U	42 U
Bromomethane	1.5 UJ	1.6 U	61 U
Carbon disulfide	0.48 U	0.59 J	19 U
Carbon tetrachloride	0.94 U	1 U	38 U
Chlorobenzene	0.69 U	0.74 U	28 U
Chlorodibromomethane	0.47 U	0.51 U	19 U
Chloroethane	1.1 U	1.2 U	46 U
Chloroform	0.47 U	0.51 U	19 U
Chloromethane	0.67 U	0.72 U	27 U
cis-1,3-Dichloropropene	0.82 U	0.89 U	33 U
Dibromomethane	1.1 U	1.2 U	46 U
Dichlorobromomethane	0.78 U	0.84 U	32 U
Dichlorodifluoromethane	0.84 U	0.91 U	34 U
Ethyl methacrylate	2.1 UJ	2.2 U	84 U
Ethylbenzene	0.71 U	0.76 U	29 U
Ethylene Dibromide	1.4 U	1.5 U	57 U
Iodomethane	0.94 UJ	1 UJ	38 U
Isobutyl alcohol	65 R	70 R	2600 R
Methacrylonitrile	23 UJ	24 UJ	920 U
Methyl methacrylate	3.5 UJ	3.8 UJ	140 U
Methylene Chloride	0.94 U	1 U	38 U
Pentachloroethane	2.1 U	2.2 UJ	84 UJ
Propionitrile	20 U	21 U	800 UJ
Styrene	0.62 U	0.67 U	25 U
Tetrachloroethene	0.69 U	0.74 U	28 U
Toluene	0.74 U	0.8 U	30 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB12	69SB27	69SB27
Sample ID	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	5/1/2008	5/1/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0
Volatile Organic Compounds (ug/kg)			
trans-1,2-Dichloroethene	0.91 U	0.99 U	37 U
trans-1,3-Dichloropropene	0.82 U	0.89 U	33 U
trans-1,4-Dichloro-2-butene	2.9 U	3.2 UJ	120 U
Trichloroethene	0.94 U	1 U	38 U
Trichlorofluoromethane	1.4 U	1.5 U	57 U
Vinyl acetate	1.4 UJ	1.5 U	57 U
Vinyl chloride	0.55 U	0.59 U	22 U
Xylenes, Total	2.2 U	2.3 U	88 U
Semivolatile Organic Compounds (ug/kg)			
1,1'-Biphenyl	9.1 U	9.1 UJ	9 UJ
1,2,4,5-Tetrachlorobenzene	7.7 U	7.8 UJ	7.7 UJ
1,2,4-Trichlorobenzene	9.1 U	9.1 UJ	9 UJ
1,2-Dichlorobenzene	8.6 U	8.6 UJ	8.6 UJ
1,3,5-Trinitrobenzene	21 U	21 UJ	21 UJ
1,3-Dichlorobenzene	7.3 U	7.4 UJ	7.3 UJ
1,3-Dinitrobenzene	4.8 U	4.8 UJ	4.8 UJ
1,4-Dichlorobenzene	7.6 U	7.6 UJ	7.6 UJ
1,4-Dioxane	9.8 U	9.9 UJ	9.8 UJ
1,4-Naphthoquinone	4.8 U	4.8 UJ	4.8 UJ
2,2'-oxybis[1-chloropropane]	7.7 U	7.8 UJ	7.7 UJ
2,3,4,6-Tetrachlorophenol	5.1 U	5.2 UJ	5.1 UJ
2,4,5-Trichlorophenol	8.3 U	8.4 UJ	8.3 UJ
2,4,6-Trichlorophenol	9.7 U	9.7 UJ	9.6 UJ
2,4-Dichlorophenol	9.9 U	10 UJ	9.9 UJ
2,4-Dimethylphenol	21 U	21 UJ	21 UJ
2,4-Dinitrophenol	100 U	100 UJ	100 UJ
2,4-Dinitrotoluene	7.2 U	7.3 UJ	7.2 UJ
2,6-Dichlorophenol	7.8 U	7.9 UJ	7.8 UJ
2,6-Dinitrotoluene	7.6 U	7.6 UJ	7.6 UJ
2-Acetylaminofluorene	6.2 U	6.3 UJ	6.2 UJ
2-Chloronaphthalene	7.6 U	7.6 UJ	7.6 UJ
2-Chlorophenol	8.1 U	8.1 UJ	8.1 UJ
2-Methylnaphthalene	2.1 U	2.1 UJ	2.1 UJ
2-Methylphenol	9.9 U	10 UJ	9.9 UJ
2-Naphthylamine	24 UJ	25 UJ	24 UJ
2-Nitroaniline	8 U	8 UJ	7.9 UJ
2-Nitrophenol	8.9 U	9 UJ	8.9 UJ
2-Picoline	15 U	15 UJ	15 UJ
2-Toluidine	11 U	11 UJ	11 UJ
3 & 4 Methylphenol	8.9 U	9 UJ	8.9 UJ
3,3'-Dichlorobenzidine	11 U	11 UJ	11 UJ
3,3'-Dimethylbenzidine	220 UJ	220 UJ	220 UJ
3-Methylcholanthrene	7.5 U	7.5 UJ	7.5 UJ
3-Nitroaniline	5.5 U	5.6 UJ	5.5 UJ
4,6-Dinitro-2-methylphenol	7.1 UJ	7.2 UJ	7.1 UJ
4-Aminobiphenyl	16 U	16 UJ	16 UJ

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB12	69SB27	69SB27
Sample ID	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	5/1/2008	5/1/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0
Semivolatile Organic Compounds (ug/kg)			
4-Bromophenyl phenyl ether	8.7 U	8.8 UJ	8.7 UJ
4-Chloro-3-methylphenol	9.2 U	9.3 UJ	9.2 UJ
4-Chloroaniline	7.3 U	7.4 UJ	7.3 UJ
4-Chlorophenyl phenyl ether	7.6 U	7.6 UJ	7.6 UJ
4-Nitroaniline	9.4 U	9.5 UJ	9.4 UJ
4-Nitrophenol	40 UJ	41 UJ	40 UJ
4-Nitroquinoline-1-oxide	13 R	14 R	13 R
7,12-Dimethylbenz(a)anthracene	11 U	11 UJ	11 UJ
Acenaphthene	0.7 U	0.7 UJ	0.7 UJ
Acenaphthylene	2.1 U	2.1 UJ	2.1 UJ
Acetophenone	11 U	11 UJ	11 UJ
alpha,alpha-Dimethyl phenethylamine	72 U	73 UJ	72 UJ
Aniline	7.7 U	7.8 UJ	7.7 UJ
Anthracene	2.1 U	2.1 UJ	2.1 UJ
Aramite, Total	13 UJ	14 UJ	13 UJ
Benzo[a]anthracene	2.1 U	2.1 UJ	2.1 UJ
Benzo[a]pyrene	0.81 U	0.81 UJ	0.81 UJ
Benzo[b]fluoranthene	0.93 U	0.94 UJ	0.93 UJ
Benzo[g,h,i]perylene	2.1 U	2.1 UJ	2.1 UJ
Benzo[k]fluoranthene	1.2 U	1.2 UJ	1.2 UJ
Benzyl alcohol	9.8 U	9.9 UJ	9.8 UJ
Bis(2-chloroethoxy)methane	8.3 U	8.4 UJ	8.3 UJ
Bis(2-chloroethyl)ether	7 U	7 UJ	7 UJ
Bis(2-ethylhexyl) phthalate	29 U	22 UJ	30 UJ
Butyl benzyl phthalate	8.8 U	8.9 UJ	8.8 UJ
Chrysene	0.75 U	0.75 UJ	0.75 UJ
Diallate	12 U	12 UJ	12 UJ
Dibenz(a,h)anthracene	0.72 U	0.73 UJ	0.72 UJ
Dibenzofuran	5.1 U	5.2 UJ	5.1 UJ
Diethyl phthalate	13 U	14 UJ	13 UJ
Dimethyl phthalate	7.8 U	7.9 UJ	7.8 UJ
Di-n-butyl phthalate	31 U	31 UJ	31 UJ
Di-n-octyl phthalate	4 U	4.1 UJ	4 UJ
Dinoseb	21 U	21 UJ	21 UJ
Ethyl methanesulfonate	13 U	14 UJ	13 UJ
Fluoranthene	2.1 U	2.1 UJ	2.1 UJ
Fluorene	0.94 U	0.95 UJ	0.94 UJ
Hexachlorobenzene	8.3 U	8.4 UJ	8.3 UJ
Hexachlorobutadiene	11 U	11 UJ	11 UJ
Hexachlorocyclopentadiene	17 U	17 UJ	17 UJ
Hexachloroethane	9.1 U	9.1 UJ	9 UJ
Hexachlorophene	1000 R	1000 UJ	1000 UJ
Hexachloropropene	8.8 UJ	8.9 UJ	8.8 UJ
Indeno[1,2,3-cd]pyrene	1.5 U	1.5 UJ	1.5 UJ
Isophorone	7.6 U	7.6 UJ	7.6 UJ
Isosafrole	8.7 U	8.8 UJ	8.7 UJ

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB12	69SB27	69SB27
Sample ID	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	5/1/2008	5/1/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0
Semivolatile Organic Compounds (ug/kg)			
Methapyrilene	11 UJ	11 UJ	11 UJ
Methyl methanesulfonate	11 U	11 UJ	11 UJ
Naphthalene	0.73 U	0.74 UJ	0.73 UJ
Nitrobenzene	8.4 U	8.5 UJ	8.4 UJ
N-Nitro-o-toluidine	7.3 U	7.4 UJ	7.3 UJ
N-Nitrosodiethylamine	15 U	15 UJ	15 UJ
N-Nitrosodimethylamine	12 U	12 UJ	12 UJ
N-Nitrosodi-n-butylamine	11 UJ	11 UJ	11 UJ
N-Nitrosodi-n-propylamine	8 U	8 UJ	7.9 UJ
N-Nitrosodiphenylamine	8.7 U	8.8 UJ	8.7 UJ
N-Nitrosomethylethylamine	7 U	7 UJ	7 UJ
N-Nitrosomorpholine	8.1 UJ	8.1 UJ	8.1 UJ
N-Nitrosopiperidine	10 UJ	10 UJ	10 UJ
N-Nitrosopyrrolidine	11 U	11 UJ	11 UJ
p-Dimethylamino azobenzene	8.7 U	8.8 UJ	8.7 UJ
Pentachlorobenzene	7.6 U	7.6 UJ	7.6 UJ
Pentachloronitrobenzene	7.2 U	7.3 UJ	7.2 UJ
Pentachlorophenol	10 U	10 UJ	10 UJ
Phenacetin	5.7 U	5.8 UJ	5.7 UJ
Phenanthrene	2.1 U	2.1 UJ	2.1 UJ
Phenol	5.9 U	5.9 UJ	5.9 UJ
p-Phenylene diamine	200 U	200 UJ	200 UJ
Pronamide	11 U	11 UJ	11 UJ
Pyrene	2.1 U	2.1 UJ	2.1 UJ
Pyridine	13 U	14 UJ	13 UJ
Safrole, Total	10 U	10 UJ	10 UJ

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB12	69SB27	69SB27
Sample ID	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	5/1/2008	5/1/2008
Depth Range	9.0-11.0	1.0-3.0	9.0-11.0
Metals (mg/kg)			
Antimony	0.083 U	0.085 UJ	0.11 UJ
Arsenic	1.1	0.85	2.2
Barium	78	64	11
Beryllium	0.28	0.26	0.35
Cadmium	0.046 J	0.035 UJ	0.036 UJ
Chromium	18	20	20
Cobalt	16	13	3.3
Copper	79	88	270
Lead	2.8	2.7	4.3
Mercury	0.03	0.067	0.0081 J
Nickel	9	9.6	2.7
Selenium	0.23 J	0.37 J	1.2
Silver	0.04 U	0.057 J	0.088 J
Thallium	0.13 U	0.14 U	0.14 U
Tin	4.4 U	4.6 U	4.7 U
Vanadium	230	180	430
Zinc	45	64	14

GROUNDWATER DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB11D	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW11D	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Volatile Organic Compounds (ug/L)					
1,1,1,2-Tetrachloroethane	0.29 U	0.29 U	0.29 U	0.29 U	0.29 UJ
1,1,1-Trichloroethane	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ
1,1,2,2-Tetrachloroethane	0.26 U	0.26 U	0.26 U	0.26 U	0.26 UJ
1,1,2-Trichloroethane	0.51 U	0.51 U	0.51 U	0.51 U	0.51 UJ
1,1-Dichloroethane	0.32 U	0.32 U	0.32 U	0.32 U	0.32 UJ
1,1-Dichloroethene	0.36 U	0.36 U	0.36 U	0.36 U	0.36 UJ
1,2,3-Trichloropropane	0.42 U	0.42 U	0.42 U	0.42 U	0.42 UJ
1,2-Dibromo-3-Chloropropane	0.48 U	0.48 U	0.48 U	0.48 U	0.48 UJ
1,2-Dichloroethane	0.31 U	0.31 U	0.31 U	0.31 U	0.31 UJ
1,2-Dichloropropane	0.36 U	0.36 U	0.36 U	0.36 U	0.36 UJ
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.6 U	0.6 UJ
2-Chloro-1,3-butadiene	0.35 UJ	0.35 UJ	0.35 UJ	0.35 UJ	0.35 UJ
2-Hexanone	0.68 U	0.68 U	0.68 U	0.68 U	0.68 UJ
3-Chloro-1-propene	0.46 U	0.46 U	0.46 U	0.46 U	0.46 UJ
4-Methyl-2-pentanone (MIBK)	0.6 U	0.6 U	0.6 U	0.6 U	0.6 UJ
Acetone	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Acetonitrile	15 UJ	15 UJ	15 UJ	15 UJ	15 UJ
Acrolein	18 U	18 U	18 U	18 U	18 UJ
Acrylonitrile	3.8 U	3.8 U	3.8 U	3.8 U	3.8 UJ
Benzene	0.32 U	0.32 U	0.32 U	0.32 U	0.32 UJ
Bromoform	0.41 U	0.41 U	0.41 U	0.41 U	0.41 UJ
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
Carbon disulfide	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ
Carbon tetrachloride	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ
Chlorobenzene	0.34 U	0.34 U	0.34 U	0.34 U	0.34 UJ
Chlorodibromomethane	0.3 U	0.3 U	0.3 U	0.3 U	0.3 UJ
Chloroethane	1 U	1 U	1 U	1 U	1 UJ
Chloroform	0.29 U	0.29 U	0.29 U	0.29 U	0.29 UJ
Chloromethane	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ
cis-1,3-Dichloropropene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ
Dibromomethane	0.29 U	0.29 U	0.29 U	0.29 U	0.29 UJ
Dichlorobromomethane	0.34 U	0.34 U	0.34 U	0.34 U	0.34 UJ
Dichlorodifluoromethane	0.33 U	0.33 U	0.33 U	0.33 U	0.33 UJ
Ethyl methacrylate	1 U	1 U	1 U	1 U	1 UJ
Ethylbenzene	0.3 U	0.3 U	0.3 U	0.3 U	0.3 UJ
Ethylene Dibromide	0.3 U	0.3 U	0.3 U	0.3 U	0.3 UJ
Iodomethane	1 U	1 U	1 U	1 U	1 UJ
Isobutyl alcohol	19 R	19 R	19 R	19 R	19 UJ
Methacrylonitrile	6.6 U	6.6 U	6.6 U	6.6 U	6.6 UJ
Methyl methacrylate	0.38 UJ	0.38 UJ	0.38 UJ	0.38 UJ	0.38 UJ
Methylene Chloride	1 U	1 U	1 U	1 U	1 UJ
Pentachloroethane	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 U	9.2 U	9.2 U	9.2 U	9.2 UJ
Styrene	0.36 U	0.36 U	0.36 U	0.36 U	0.36 UJ
Tetrachloroethene	0.28 U	0.28 U	0.28 U	0.28 U	0.28 UJ
Toluene	0.31 U	0.31 U	0.31 U	0.31 U	0.31 UJ

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB11D	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW11D	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Volatile Organic Compounds (ug/L)					
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.3 U	0.3 U	0.3 UJ
trans-1,3-Dichloropropene	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ
trans-1,4-Dichloro-2-butene	0.83 UJ	0.83 UJ	0.83 UJ	0.83 UJ	0.83 UJ
Trichloroethene	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ
Trichlorofluoromethane	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ
Vinyl acetate	0.62 U	0.62 U	0.62 U	0.62 U	0.62 UJ
Vinyl chloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Xylenes, Total	0.87 U	0.87 U	0.87 U	0.87 U	0.87 UJ
Semivolatile Organic Compounds (ug/L)					
1,1'-Biphenyl	0.17 U	0.17 U	0.17 U	0.17 U	0.17 UJ
1,2,4,5-Tetrachlorobenzene	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
1,2,4-Trichlorobenzene	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UJ
1,2-Dichlorobenzene	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UJ
1,3,5-Trinitrobenzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
1,3-Dichlorobenzene	0.12 U	0.12 U	0.12 U	0.12 U	0.12 UJ
1,3-Dinitrobenzene	0.22 U	0.22 U	0.22 U	0.22 U	0.22 UJ
1,4-Dichlorobenzene	0.12 U	0.12 U	0.12 U	0.15 U	0.12 UJ
1,4-Dioxane	0.49 U	0.49 U	0.49 U	0.49 U	0.49 UJ
1,4-Naphthoquinone	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
2,2'-oxybis[1-chloropropane]	0.097 U	0.097 U	0.097 U	0.097 U	0.097 UJ
2,3,4,6-Tetrachlorophenol	0.29 U	0.29 U	0.29 U	0.29 U	0.29 UJ
2,4,5-Trichlorophenol	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
2,4,6-Trichlorophenol	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
2,4-Dichlorophenol	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
2,4-Dimethylphenol	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ
2,4-Dinitrophenol	2.4 UJ	2.4 U	2.4 UJ	2.4 UJ	2.4 UJ
2,4-Dinitrotoluene	0.17 U	0.17 U	0.17 U	0.17 U	0.17 UJ
2,6-Dichlorophenol	0.21 U	0.21 U	0.21 U	0.21 U	0.21 UJ
2,6-Dinitrotoluene	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
2-Acetylaminofluorene	0.19 UJ	0.19 U	0.19 UJ	0.19 UJ	0.19 UJ
2-Chloronaphthalene	0.12 U	0.12 U	0.12 U	0.12 U	0.12 UJ
2-Chlorophenol	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
2-Methylnaphthalene	0.022 U	0.022 U	0.022 U	0.022 U	0.022 UJ
2-Methylphenol	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
2-Naphthylamine	1.1 U	1.1 U	1.1 U	1.1 U	1.1 UJ
2-Nitroaniline	0.14 U	0.14 U	0.14 U	0.14 U	0.14 UJ
2-Nitrophenol	0.17 U	0.17 U	0.17 U	0.17 U	0.17 UJ
2-Picoline	0.57 U	0.57 U	0.57 U	0.57 U	0.57 UJ
2-Toluidine	0.32 U	0.32 U	0.32 U	0.32 U	0.32 UJ
3 & 4 Methylphenol	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
3,3'-Dichlorobenzidine	3.7 U	3.7 UJ	3.7 U	3.7 U	3.7 UJ
3,3'-Dimethylbenzidine	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ
3-Methylcholanthrene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
3-Nitroaniline	0.28 U	0.28 U	0.28 U	0.28 U	0.28 UJ
4,6-Dinitro-2-methylphenol	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ
4-Aminobiphenyl	0.68 UJ	0.68 U	0.68 UJ	0.68 UJ	0.68 UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB11D	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW11D	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Semivolatile Organic Compounds (ug/L)					
4-Bromophenyl phenyl ether	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
4-Chloro-3-methylphenol	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
4-Chloroaniline	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ
4-Chlorophenyl phenyl ether	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
4-Nitroaniline	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ
4-Nitrophenol	0.18 U	0.18 U	0.18 U	0.18 U	0.18 UJ
4-Nitroquinoline-1-oxide	0.26 R	0.26 R	0.26 R	0.26 R	0.26 R
7,12-Dimethylbenz(a)anthracene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Acenaphthene	0.019 U	0.019 U	0.019 U	0.019 U	0.019 UJ
Acenaphthylene	0.049 U	0.049 U	0.049 U	0.049 U	0.049 UJ
Acetophenone	0.19 U	0.19 U	0.19 U	0.19 U	0.19 UJ
alpha,alpha-Dimethyl phenethylamine	1.3 UJ	1.3 U	1.3 UJ	1.3 UJ	1.3 UJ
Aniline	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ
Anthracene	0.021 U	0.021 U	0.021 U	0.021 U	0.021 UJ
Aramite, Total	0.49 UJ	0.49 U	0.49 UJ	0.49 UJ	0.49 UJ
Benzo[a]anthracene	0.025 U	0.025 U	0.025 U	0.025 U	0.025 UJ
Benzo[a]pyrene	0.024 U	0.024 U	0.024 U	0.024 U	0.024 UJ
Benzo[b]fluoranthene	0.036 U	0.036 U	0.036 U	0.036 U	0.036 UJ
Benzo[g,h,i]perylene	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ
Benzo[k]fluoranthene	0.019 U	0.019 U	0.019 U	0.019 U	0.019 UJ
Benzyl alcohol	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
Bis(2-chloroethoxy)methane	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
Bis(2-chloroethyl)ether	0.14 U	0.14 U	0.14 U	0.14 U	0.14 UJ
Bis(2-ethylhexyl) phthalate	0.34 U	0.34 U	0.34 U	0.34 U	0.34 UJ
Butyl benzyl phthalate	0.17 U	0.17 U	0.17 U	0.17 U	0.17 UJ
Chrysene	0.027 U	0.027 U	0.027 U	0.027 U	0.027 UJ
Diallate	0.19 U	0.19 U	0.19 U	0.19 U	0.19 UJ
Dibenz(a,h)anthracene	0.023 U	0.023 U	0.023 U	0.023 U	0.023 UJ
Dibenzofuran	0.097 U	0.097 U	0.097 U	0.097 U	0.097 UJ
Diethyl phthalate	0.18 U	0.18 U	0.18 U	0.18 U	0.18 UJ
Dimethyl phthalate	0.17 U	0.17 U	0.17 U	0.17 U	0.17 UJ
Di-n-butyl phthalate	0.26 U	0.21 U	0.19 U	0.16 U	0.44 UJ
Di-n-octyl phthalate	0.097 U	0.097 U	0.097 U	0.097 U	0.097 UJ
Dinoseb	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ
Ethyl methanesulfonate	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ
Fluoranthene	0.049 U	0.049 U	0.049 U	0.049 U	0.049 UJ
Fluorene	0.018 U	0.018 U	0.018 U	0.018 U	0.018 UJ
Hexachlorobenzene	0.16 U	0.16 U	0.16 U	0.16 U	0.16 UJ
Hexachlorobutadiene	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UJ
Hexachlorocyclopentadiene	0.49 U	0.49 U	0.49 U	0.49 U	0.49 UJ
Hexachloroethane	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
Hexachlorophene	49 R	49 R	49 R	49 R	49 R
Hexachloropropene	0.12 U	0.12 U	0.12 U	0.12 U	0.12 UJ
Indeno[1,2,3-cd]pyrene	0.022 U	0.022 UJ	0.022 U	0.022 U	0.022 UJ
Isophorone	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
Isosafrole	0.3 U	0.3 U	0.3 U	0.3 U	0.3 UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB11D	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW11D	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Semivolatile Organic Compounds (ug/L)					
Methapyrilene	0.26 UJ	0.26 U	0.26 UJ	0.26 UJ	0.26 UJ
Methyl methanesulfonate	0.46 U	0.46 U	0.46 U	0.46 U	0.46 UJ
Naphthalene	0.049 U	0.049 U	0.049 U	0.049 U	0.049 UJ
Nitrobenzene	0.14 U	0.14 U	0.14 U	0.14 U	0.14 UJ
N-Nitro-o-toluidine	0.24 U	0.24 U	0.24 U	0.24 U	0.24 UJ
N-Nitrosodiethylamine	0.32 U	0.32 U	0.32 U	0.32 U	0.32 UJ
N-Nitrosodimethylamine	0.19 U	0.19 U	0.19 U	0.19 U	0.19 UJ
N-Nitrosodi-n-butylamine	0.18 U	0.18 U	0.18 U	0.18 U	0.18 UJ
N-Nitrosodi-n-propylamine	0.13 U	0.13 U	0.13 U	0.13 U	0.13 UJ
N-Nitrosodiphenylamine	0.17 U	0.17 U	0.17 U	0.17 U	0.17 UJ
N-Nitrosomethylethylamine	0.28 U	0.28 U	0.28 U	0.28 U	0.28 UJ
N-Nitrosomorpholine	0.19 U	0.19 U	0.19 U	0.19 U	0.19 UJ
N-Nitrosopiperidine	0.22 U	0.22 U	0.22 U	0.22 U	0.22 UJ
N-Nitrosopyrrolidine	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
p-Dimethylamino azobenzene	0.6 U	0.6 U	0.6 U	0.6 U	0.6 UJ
Pentachlorobenzene	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ
Pentachloronitrobenzene	0.3 U	0.3 U	0.3 U	0.3 U	0.3 UJ
Pentachlorophenol	0.18 U	0.18 U	0.18 U	0.18 U	0.18 UJ
Phenacetin	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ	0.2 UJ
Phenanthrene	0.017 U	0.017 U	0.017 U	0.017 U	0.017 UJ
Phenol	0.14 U	0.14 U	0.14 U	0.14 U	0.14 UJ
p-Phenylene diamine	2.4 U	2.4 U	2.4 U	2.4 U	2.4 UJ
Pronamide	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
Pyrene	0.026 U	0.026 U	0.026 U	0.026 U	0.026 UJ
Pyridine	0.22 U	0.22 U	0.22 U	0.22 U	0.22 UJ
Safrole, Total	0.23 U	0.23 U	0.23 U	0.23 U	0.23 UJ

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB11D	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW11D	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Total Metals (ug/L)					
Antimony	0.36 U	0.36 U	0.36 U	0.36 U	0.36 UJ
Arsenic	1.7 U	1.5 U	1.4 U	1.7 U	0.43 J
Barium	23	23	570	560	580 J
Beryllium	0.065 U	0.065 U	0.065 U	0.065 U	0.065 UJ
Cadmium	0.12 J	0.12 UJ	0.12 UJ	0.12 UJ	0.16 J
Chromium	1.3 U	1.4 U	1.3 U	1.3 U	0.6 UJ
Cobalt	0.24 U	0.32 U	11	11	9.9 J
Copper	1.2 U	1.2 U	1.2 U	1.2 U	1.4 UJ
Lead	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
Mercury	0.08 R	0.08 R	0.08 R	0.08 R	0.08 UJ
Nickel	0.47 J	0.44 J	0.55 J	0.51 J	0.52 J
Selenium	0.6 U	0.6 U	0.6 U	0.6 U	0.6 UJ
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 U	0.55 U	0.55 U	0.55 U	0.55 UJ
Tin	0.9 U	0.9 U	0.9 U	0.9 U	0.98 UJ
Vanadium	6.9	5.7	6.4	6.6	4.8 J
Zinc	7.7 J	6.5 U	6.5 U	6.5 U	7.2 J
Dissolved Metals (ug/L)					
Antimony	0.36 U	0.36 U	0.36 U	0.36 U	0.36 UJ
Arsenic	1.5 U	1.3 U	1.4 U	1.3 U	0.32 J
Barium	23	23	540	530	570 J
Beryllium	0.065 U	0.065 U	0.065 U	0.065 U	0.065 UJ
Cadmium	0.14 J	0.12 UJ	0.12 UJ	0.12 UJ	0.16 J
Chromium	1.1 U	1.2 U	1.3 U	1.3 U	0.6 UJ
Cobalt	0.41 U	0.43 U	11	10	12 J
Copper	1.2 U	1.2 U	1.5 U	1.2 U	1.2 UJ
Lead	0.15 U	0.15 U	0.15 U	0.15 U	0.15 UJ
Mercury	0.08 U	0.08 U	0.08 U	0.08 U	0.08 UJ
Nickel	0.42 J	0.42 J	0.67 J	0.45 J	0.78 J
Selenium	0.6 U	0.6 U	0.6 U	0.6 U	0.6 UJ
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 U	0.55 U	0.55 U	0.55 U	0.55 UJ
Tin	0.9 U	0.9 U	0.9 U	0.9 U	0.9 UJ
Vanadium	6.1	5.4	6.6	5.9	4.2 J
Zinc	6.5 U	6.5 U	6.5 U	6.5 U	7.2 J

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L)			
1,1,1,2-Tetrachloroethane	0.29 UJ	0.29 U	0.29 U
1,1,1-Trichloroethane	0.39 UJ	0.39 U	0.39 U
1,1,2,2-Tetrachloroethane	0.26 UJ	0.26 U	0.26 U
1,1,2-Trichloroethane	0.51 UJ	0.51 U	0.51 U
1,1-Dichloroethane	0.32 UJ	0.32 U	0.32 U
1,1-Dichloroethene	0.36 UJ	0.36 U	0.36 U
1,2,3-Trichloropropane	0.42 UJ	0.42 U	0.42 U
1,2-Dibromo-3-Chloropropane	0.48 UJ	0.48 U	0.48 U
1,2-Dichloroethane	0.31 UJ	0.31 U	0.31 U
1,2-Dichloropropane	0.36 UJ	0.36 U	0.36 U
2-Butanone (MEK)	0.6 UJ	0.6 U	0.6 U
2-Chloro-1,3-butadiene	0.35 UJ	0.35 U	0.35 U
2-Hexanone	0.68 UJ	1.1 J	0.68 U
3-Chloro-1-propene	0.46 UJ	0.46 U	0.46 U
4-Methyl-2-pentanone (MIBK)	0.6 UJ	0.6 U	0.6 U
Acetone	5 UJ	5 U	15 J
Acetonitrile	15 UJ	15 U	15 U
Acrolein	18 UJ	18 R	18 R
Acrylonitrile	3.8 UJ	3.8 UJ	3.8 UJ
Benzene	0.32 UJ	0.32 U	0.32 U
Bromoform	0.41 UJ	0.41 U	0.41 U
Bromomethane	0.5 UJ	0.5 UJ	0.5 UJ
Carbon disulfide	0.17 UJ	0.17 U	0.17 U
Carbon tetrachloride	0.27 UJ	0.27 U	0.27 U
Chlorobenzene	0.34 UJ	0.34 U	0.34 U
Chlorodibromomethane	0.3 UJ	0.3 U	0.3 U
Chloroethane	1 UJ	1 U	1 U
Chloroform	0.29 UJ	0.29 U	0.29 U
Chloromethane	1.5 J	0.28 U	0.28 U
cis-1,3-Dichloropropene	0.37 UJ	0.37 U	0.37 U
Dibromomethane	0.29 UJ	0.29 U	0.29 U
Dichlorobromomethane	0.34 UJ	0.34 U	0.34 U
Dichlorodifluoromethane	0.33 UJ	0.33 UJ	0.33 UJ
Ethyl methacrylate	1 UJ	1 U	1 U
Ethylbenzene	0.3 UJ	0.3 U	0.3 U
Ethylene Dibromide	0.3 UJ	0.3 U	0.3 U
Iodomethane	1 UJ	1 U	1 U
Isobutyl alcohol	19 UJ	19 U	19 U
Methacrylonitrile	6.6 UJ	6.6 U	6.6 U
Methyl methacrylate	0.38 UJ	0.38 U	0.38 U
Methylene Chloride	1 UJ	1 U	1 U
Pentachloroethane	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 UJ	9.2 U	9.2 U
Styrene	0.36 UJ	0.36 U	0.36 U
Tetrachloroethene	0.28 UJ	0.28 U	0.28 U
Toluene	0.31 UJ	0.31 U	0.31 U

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L)			
trans-1,2-Dichloroethene	0.3 UJ	0.3 U	0.3 U
trans-1,3-Dichloropropene	0.27 UJ	0.27 UJ	0.27 UJ
trans-1,4-Dichloro-2-butene	0.83 UJ	0.83 U	0.83 U
Trichloroethene	0.4 UJ	0.4 U	0.4 U
Trichlorofluoromethane	0.29 UJ	0.29 U	0.29 U
Vinyl acetate	0.62 UJ	0.62 UJ	0.62 UJ
Vinyl chloride	0.2 UJ	0.2 U	0.2 U
Xylenes, Total	0.87 UJ	0.87 U	0.87 U
Semivolatile Organic Compounds (ug/L)			
1,1'-Biphenyl	0.17 UJ	0.17 U	0.17 U
1,2,4,5-Tetrachlorobenzene	0.23 UJ	0.23 U	0.23 U
1,2,4-Trichlorobenzene	0.13 UJ	0.13 U	0.13 U
1,2-Dichlorobenzene	0.13 UJ	0.13 U	0.13 U
1,3,5-Trinitrobenzene	0.2 UJ	0.2 U	0.2 U
1,3-Dichlorobenzene	0.12 UJ	0.12 U	0.12 U
1,3-Dinitrobenzene	0.22 UJ	0.22 U	0.22 U
1,4-Dichlorobenzene	0.12 UJ	0.12 U	0.12 U
1,4-Dioxane	0.49 UJ	0.49 U	0.49 U
1,4-Naphthoquinone	0.16 UJ	0.16 U	0.16 U
2,2'-oxybis[1-chloropropane]	0.097 UJ	0.097 U	0.097 U
2,3,4,6-Tetrachlorophenol	0.29 UJ	0.29 U	0.29 U
2,4,5-Trichlorophenol	0.16 UJ	0.16 U	0.16 U
2,4,6-Trichlorophenol	0.16 UJ	0.16 U	0.16 U
2,4-Dichlorophenol	0.15 UJ	0.15 U	0.15 U
2,4-Dimethylphenol	0.4 UJ	0.4 U	0.4 U
2,4-Dinitrophenol	2.4 UJ	2.4 U	2.4 U
2,4-Dinitrotoluene	0.17 UJ	0.17 UJ	0.17 UJ
2,6-Dichlorophenol	0.21 UJ	0.21 U	0.21 U
2,6-Dinitrotoluene	0.15 UJ	0.15 U	0.15 U
2-Acetylaminofluorene	0.19 UJ	0.19 U	0.19 U
2-Chloronaphthalene	0.12 UJ	0.12 U	0.12 U
2-Chlorophenol	0.15 UJ	0.15 U	0.15 U
2-Methylnaphthalene	0.022 UJ	0.022 U	0.022 U
2-Methylphenol	0.15 UJ	0.15 U	0.15 U
2-Naphthylamine	1.1 UJ	1.1 U	1.1 U
2-Nitroaniline	0.14 UJ	0.14 U	0.14 U
2-Nitrophenol	0.17 UJ	0.17 U	0.17 U
2-Picoline	0.57 UJ	0.57 U	0.57 U
2-Toluidine	0.32 UJ	0.32 U	0.32 U
3 & 4 Methylphenol	0.15 UJ	0.15 U	2.1
3,3'-Dichlorobenzidine	3.7 UJ	3.7 U	3.7 U
3,3'-Dimethylbenzidine	3.7 UJ	3.7 U	3.7 U
3-Methylcholanthrene	0.2 UJ	0.2 U	0.2 U
3-Nitroaniline	0.28 UJ	0.28 U	0.28 U
4,6-Dinitro-2-methylphenol	0.49 UJ	0.49 UJ	0.49 UJ
4-Aminobiphenyl	0.68 UJ	0.68 U	0.68 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L)			
4-Bromophenyl phenyl ether	0.16 UJ	0.16 U	0.16 U
4-Chloro-3-methylphenol	0.16 UJ	0.16 U	0.16 U
4-Chloroaniline	0.4 UJ	0.4 U	0.4 U
4-Chlorophenyl phenyl ether	0.15 UJ	0.15 U	0.15 U
4-Nitroaniline	0.26 UJ	0.26 U	0.26 U
4-Nitrophenol	0.18 UJ	0.18 UJ	0.18 UJ
4-Nitroquinoline-1-oxide	0.26 R	0.26 R	0.26 R
7,12-Dimethylbenz(a)anthracene	0.2 UJ	0.2 U	0.2 U
Acenaphthene	0.019 UJ	0.019 U	0.11 J
Acenaphthylene	0.049 UJ	0.049 U	0.049 U
Acetophenone	0.19 UJ	0.19 U	0.19 U
alpha,alpha-Dimethyl phenethylamine	1.3 UJ	1.3 U	1.3 U
Aniline	0.4 UJ	0.4 U	0.4 U
Anthracene	0.021 UJ	0.021 U	0.021 U
Aramite, Total	0.49 UJ	0.49 UJ	0.49 UJ
Benzo[a]anthracene	0.025 UJ	0.025 U	0.025 U
Benzo[a]pyrene	0.024 UJ	0.024 U	0.024 U
Benzo[b]fluoranthene	0.036 UJ	0.036 U	0.036 U
Benzo[g,h,i]perylene	0.023 UJ	0.023 UJ	0.023 UJ
Benzo[k]fluoranthene	0.019 UJ	0.019 U	0.019 U
Benzyl alcohol	0.16 UJ	0.16 U	0.16 U
Bis(2-chloroethoxy)methane	0.15 UJ	0.15 U	0.15 U
Bis(2-chloroethyl)ether	0.14 UJ	0.14 U	0.14 U
Bis(2-ethylhexyl) phthalate	0.6 J	0.61 U	0.78 U
Butyl benzyl phthalate	0.17 UJ	0.17 U	0.17 U
Chrysene	0.027 UJ	0.027 U	0.027 U
Diallate	0.19 UJ	0.19 U	0.19 U
Dibenz(a,h)anthracene	0.023 UJ	0.023 UJ	0.023 UJ
Dibenzofuran	0.097 UJ	0.097 U	0.36 J
Diethyl phthalate	0.18 UJ	0.18 U	0.18 U
Dimethyl phthalate	0.17 UJ	0.17 U	0.17 U
Di-n-butyl phthalate	0.31 UJ	0.11 U	0.72 U
Di-n-octyl phthalate	0.097 UJ	0.097 U	0.097 U
Dinoseb	0.49 UJ	0.49 U	0.49 U
Ethyl methanesulfonate	0.23 UJ	0.23 U	0.23 U
Fluoranthene	0.049 UJ	0.049 U	0.049 U
Fluorene	0.018 UJ	0.083 J	0.018 U
Hexachlorobenzene	0.16 UJ	0.16 U	0.16 U
Hexachlorobutadiene	0.13 UJ	0.13 U	0.13 U
Hexachlorocyclopentadiene	0.49 UJ	0.49 U	0.49 U
Hexachloroethane	0.15 UJ	0.15 U	0.15 U
Hexachlorophene	49 R	49 R	49 R
Hexachloropropene	0.12 UJ	0.12 UJ	0.12 UJ
Indeno[1,2,3-cd]pyrene	0.022 UJ	0.022 U	0.022 U
Isophorone	0.15 UJ	0.15 U	0.15 U
Isosafrole	0.3 UJ	0.3 U	0.3 U

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L)			
Methapyrilene	0.26 UJ	0.26 UJ	0.26 UJ
Methyl methanesulfonate	0.46 UJ	0.46 U	0.46 U
Naphthalene	0.049 UJ	0.049 U	0.049 U
Nitrobenzene	0.14 UJ	0.14 U	0.14 U
N-Nitro-o-toluidine	0.24 UJ	0.24 U	0.24 U
N-Nitrosodiethylamine	0.32 UJ	0.32 U	0.32 U
N-Nitrosodimethylamine	0.19 UJ	0.19 U	0.19 U
N-Nitrosodi-n-butylamine	0.18 UJ	0.18 UJ	0.18 UJ
N-Nitrosodi-n-propylamine	0.13 UJ	0.13 U	0.13 U
N-Nitrosodiphenylamine	0.17 UJ	0.17 U	0.17 U
N-Nitrosomethylethylamine	0.28 UJ	0.28 U	0.28 U
N-Nitrosomorpholine	0.19 UJ	0.19 UJ	0.19 UJ
N-Nitrosopiperidine	0.22 UJ	0.22 UJ	0.22 UJ
N-Nitrosopyrrolidine	0.25 UJ	0.25 U	0.25 U
p-Dimethylamino azobenzene	0.6 UJ	0.6 U	0.6 U
Pentachlorobenzene	0.27 UJ	0.27 U	0.27 U
Pentachloronitrobenzene	0.3 UJ	0.3 U	0.3 U
Pentachlorophenol	0.18 UJ	0.18 U	0.18 U
Phenacetin	0.2 UJ	0.2 U	0.2 U
Phenanthrene	0.017 UJ	0.28	0.017 U
Phenol	0.14 UJ	0.14 U	0.14 U
p-Phenylene diamine	2.4 UJ	2.4 U	2.4 U
Pronamide	0.25 UJ	0.25 U	0.25 U
Pyrene	0.026 UJ	0.026 U	0.026 U
Pyridine	0.22 UJ	0.22 U	0.22 U
Safrole, Total	0.23 UJ	0.23 U	0.23 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Total Metals (ug/L)			
Antimony	0.36 UJ	0.36 U	0.36 U
Arsenic	0.34 J	0.46 J	0.56 J
Barium	12 J	28	42
Beryllium	0.065 UJ	0.065 U	0.065 U
Cadmium	0.12 UJ	0.12 UJ	0.12 UJ
Chromium	0.6 UJ	0.6 U	0.6 U
Cobalt	1.7 J	0.81 J	0.27 U
Copper	1.8 UJ	1.2 U	2.5 U
Lead	0.15 UJ	0.15 U	0.15 U
Mercury	0.08 UJ	0.08 U	0.08 U
Nickel	0.9 J	0.74 J	0.57 J
Selenium	0.6 UJ	0.6 U	0.6 U
Silver	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 UJ	0.55 U	0.55 U
Tin	0.9 UJ	0.9 U	0.9 U
Vanadium	5.1 J	2.7 J	3.3 J
Zinc	6.5 UJ	10 J	8.9 J
Dissolved Metals (ug/L)			
Antimony	0.36 UJ	0.36 U	0.36 U
Arsenic	0.28 UJ	0.37 J	0.38 J
Barium	12 J	27	40
Beryllium	0.065 UJ	0.065 U	0.065 U
Cadmium	0.12 UJ	0.12 U	0.12 U
Chromium	0.6 UJ	0.6 U	0.6 U
Cobalt	2.4 J	1.2 J	0.71 J
Copper	1.7 UJ	1.2 U	1.8 U
Lead	0.15 UJ	0.15 U	0.15 U
Mercury	0.08 UJ	0.08 U	0.08 U
Nickel	0.89 J	0.85 J	0.59 J
Selenium	0.6 UJ	0.6 U	0.6 U
Silver	0.09 UJ	0.09 U	0.09 U
Thallium	0.55 UJ	0.55 U	0.55 U
Tin	0.9 UJ	0.9 U	0.9 U
Vanadium	4.8 J	2.5 J	2.4 J
Zinc	13 J	16 J	7.5 J

QA/QC DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER03	ER04	ER05	FB01	69TB01
Date	4/30/2008	5/1/2008	5/2/2008	5/2/2008	4/29/2008
Volatile Organic Compounds (ug/L)					
1,1,1,2-Tetrachloroethane	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U
1,1,1-Trichloroethane	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
1,1,2,2-Tetrachloroethane	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
1,1,2-Trichloroethane	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U
1,1-Dichloroethane	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
1,1-Dichloroethene	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
1,2,3-Trichloropropane	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
1,2-Dibromo-3-Chloropropane	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
1,2-Dichloroethane	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
1,2-Dichloropropane	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.69 J	0.6 U
2-Chloro-1,3-butadiene	0.35 U	0.35 U	0.35 U	0.35 U	0.35 UJ
2-Hexanone	0.68 U	0.68 U	0.68 U	0.68 U	0.68 U
3-Chloro-1-propene	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
4-Methyl-2-pentanone (MIBK)	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Acetone	5 U	5 U	5 U	5 U	5 U
Acetonitrile	15 U	15 U	15 U	15 U	15 U
Acrolein	18 U	18 U	18 U	18 U	18 U
Acrylonitrile	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U
Benzene	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
Bromoform	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U
Carbon disulfide	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
Carbon tetrachloride	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Chlorobenzene	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
Chlorodibromomethane	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Chloroethane	1 U	1 U	1 U	1 U	1 U
Chloroform	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U
Chloromethane	0.28 U	0.28 U	0.28 U	0.28 UJ	0.28 U
cis-1,3-Dichloropropene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Dibromomethane	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U
Dichlorobromomethane	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
Dichlorodifluoromethane	0.33 U	0.33 U	0.33 U	0.33 U	0.33 UJ
Ethyl methacrylate	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Ethylene Dibromide	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Iodomethane	1 U	1 U	1 U	1 U	1 U
Isobutyl alcohol	19 U	19 U	19 U	19 U	19 R
Methacrylonitrile	6.6 U	6.6 U	6.6 U	6.6 U	6.6 U
Methyl methacrylate	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ
Methylene Chloride	1 U	1 U	1 U	1 U	1 U
Pentachloroethane	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U
Styrene	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
Tetrachloroethene	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER03	ER04	ER05	FB01	69TB01
Date	4/30/2008	5/1/2008	5/2/2008	5/2/2008	4/29/2008
Volatile Organic Compounds (ug/L)					
Toluene	0.31 U	0.79 J	0.9 J	0.31 U	0.31 U
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
trans-1,3-Dichloropropene	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
trans-1,4-Dichloro-2-butene	0.83 U	0.83 U	0.83 U	0.83 U	0.83 UJ
Trichloroethene	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Trichlorofluoromethane	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U
Vinyl acetate	0.62 UJ	0.62 UJ	0.62 UJ	0.62 UJ	0.62 U
Vinyl chloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Xylenes, Total	0.87 U	0.87 U	0.87 U	0.87 U	0.87 U
Semivolatile Organic Compounds (ug/L)					
1,1'-Biphenyl	0.17 UJ	0.17 UJ	0.22 UJ	0.17 UJ	NA
1,2,4,5-Tetrachlorobenzene	0.23 UJ	0.23 UJ	0.31 UJ	0.23 UJ	NA
1,2,4-Trichlorobenzene	0.13 UJ	0.13 UJ	0.17 UJ	0.13 UJ	NA
1,2-Dichlorobenzene	0.13 UJ	0.13 UJ	0.17 UJ	0.13 UJ	NA
1,3,5-Trinitrobenzene	0.2 UJ	0.2 UJ	0.27 UJ	0.2 UJ	NA
1,3-Dichlorobenzene	0.12 UJ	0.12 UJ	0.15 UJ	0.12 UJ	NA
1,3-Dinitrobenzene	0.22 UJ	0.22 UJ	0.29 UJ	0.22 UJ	NA
1,4-Dichlorobenzene	0.17 J	0.12 UJ	0.15 UJ	0.16 J	NA
1,4-Dioxane	0.49 UJ	0.49 UJ	0.64 UJ	0.49 UJ	NA
1,4-Naphthoquinone	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
2,2'-oxybis[1-chloropropane]	0.097 UJ	0.097 UJ	0.13 UJ	0.097 UJ	NA
2,3,4,6-Tetrachlorophenol	0.29 UJ	0.29 UJ	0.38 UJ	0.29 UJ	NA
2,4,5-Trichlorophenol	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
2,4,6-Trichlorophenol	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
2,4-Dichlorophenol	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
2,4-Dimethylphenol	0.4 UJ	0.4 UJ	0.53 UJ	0.4 UJ	NA
2,4-Dinitrophenol	2.4 UJ	2.4 UJ	3.2 UJ	2.4 UJ	NA
2,4-Dinitrotoluene	0.17 UJ	0.17 UJ	0.23 UJ	0.17 UJ	NA
2,6-Dichlorophenol	0.21 UJ	0.21 UJ	0.28 UJ	0.21 UJ	NA
2,6-Dinitrotoluene	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
2-Acetylaminofluorene	0.19 UJ	0.19 UJ	0.26 UJ	0.19 UJ	NA
2-Chloronaphthalene	0.12 UJ	0.12 UJ	0.15 UJ	0.12 UJ	NA
2-Chlorophenol	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
2-Methylnaphthalene	0.022 UJ	0.022 UJ	0.029 UJ	0.022 UJ	NA
2-Methylphenol	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
2-Naphthylamine	1.1 UJ	1.1 UJ	1.4 UJ	1.1 UJ	NA
2-Nitroaniline	0.14 UJ	0.14 UJ	0.18 UJ	0.14 UJ	NA
2-Nitrophenol	0.17 UJ	0.17 UJ	0.22 UJ	0.17 UJ	NA
2-Picoline	0.57 UJ	0.57 UJ	0.76 UJ	0.57 UJ	NA
2-Toluidine	0.32 UJ	0.32 UJ	0.42 UJ	0.32 UJ	NA
3 & 4 Methylphenol	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
3,3'-Dichlorobenzidine	3.7 UJ	3.7 UJ	4.9 UJ	3.7 UJ	NA
3,3'-Dimethylbenzidine	3.7 UJ	3.7 UJ	4.9 UJ	3.7 UJ	NA
3-Methylcholanthrene	0.2 UJ	0.2 UJ	0.27 UJ	0.2 UJ	NA
3-Nitroaniline	0.28 UJ	0.28 UJ	0.37 UJ	0.28 UJ	NA
4,6-Dinitro-2-methylphenol	0.49 UJ	0.49 UJ	0.64 UJ	0.49 UJ	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER03	ER04	ER05	FB01	69TB01
Date	4/30/2008	5/1/2008	5/2/2008	5/2/2008	4/29/2008
Semivolatile Organic Compounds (ug/L)					
4-Aminobiphenyl	0.68 UJ	0.68 UJ	0.9 UJ	0.68 UJ	NA
4-Bromophenyl phenyl ether	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
4-Chloro-3-methylphenol	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
4-Chloroaniline	0.4 UJ	0.4 UJ	0.53 UJ	0.4 UJ	NA
4-Chlorophenyl phenyl ether	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
4-Nitroaniline	0.26 UJ	0.26 UJ	0.35 UJ	0.26 UJ	NA
4-Nitrophenol	0.18 UJ	0.18 UJ	0.24 UJ	0.18 UJ	NA
4-Nitroquinoline-1-oxide	0.26 R	0.26 R	0.35 R	0.26 R	NA
7,12-Dimethylbenz(a)anthracene	0.2 UJ	0.2 UJ	0.27 UJ	0.2 UJ	NA
Acenaphthene	0.019 UJ	0.019 UJ	0.026 UJ	0.019 UJ	NA
Acenaphthylene	0.049 UJ	0.049 UJ	0.064 UJ	0.049 UJ	NA
Acetophenone	0.39 J	0.35 J	0.35 J	0.38 J	NA
alpha,alpha-Dimethyl phenethylamine	1.3 UJ	1.3 UJ	1.7 UJ	1.3 UJ	NA
Aniline	0.4 UJ	0.4 UJ	0.53 UJ	0.4 UJ	NA
Anthracene	0.021 UJ	0.021 UJ	0.028 UJ	0.021 UJ	NA
Aramite, Total	0.49 UJ	0.49 UJ	0.64 UJ	0.49 UJ	NA
Benzo[a]anthracene	0.025 UJ	0.025 UJ	0.033 UJ	0.025 UJ	NA
Benzo[a]pyrene	0.024 UJ	0.024 R	0.032 UJ	0.024 UJ	NA
Benzo[b]fluoranthene	0.036 UJ	0.036 R	0.047 UJ	0.036 UJ	NA
Benzo[g,h,i]perylene	0.023 UJ	0.023 R	0.031 UJ	0.023 UJ	NA
Benzo[k]fluoranthene	0.019 UJ	0.019 R	0.026 UJ	0.019 UJ	NA
Benzyl alcohol	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
Bis(2-chloroethoxy)methane	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
Bis(2-chloroethyl)ether	0.14 UJ	0.14 UJ	0.18 UJ	0.14 UJ	NA
Bis(2-ethylhexyl) phthalate	0.34 UJ	0.34 UJ	0.45 UJ	0.34 UJ	NA
Butyl benzyl phthalate	0.17 UJ	0.17 UJ	0.22 UJ	0.17 UJ	NA
Chrysene	0.027 UJ	0.027 UJ	0.036 UJ	0.027 UJ	NA
Diallate	0.19 UJ	0.19 UJ	0.26 UJ	0.19 UJ	NA
Dibenz(a,h)anthracene	0.023 UJ	0.023 R	0.031 UJ	0.023 UJ	NA
Dibenzofuran	0.097 UJ	0.097 UJ	0.13 UJ	0.097 UJ	NA
Diethyl phthalate	0.27 J	0.18 UJ	0.24 UJ	0.33 J	NA
Dimethoate	0.49 UJ	0.49 UJ	0.64 UJ	0.49 UJ	NA
Dimethyl phthalate	0.17 UJ	0.17 UJ	0.23 UJ	0.17 UJ	NA
Di-n-butyl phthalate	1.2 J	0.32 J	0.42 J	1.2 J	NA
Di-n-octyl phthalate	0.097 UJ	0.097 R	0.13 UJ	0.097 UJ	NA
Dinoseb	0.49 UJ	0.49 UJ	0.64 UJ	0.49 UJ	NA
Disulfoton	0.17 UJ	0.17 UJ	0.23 UJ	0.17 UJ	NA
Ethyl methanesulfonate	0.23 UJ	0.23 UJ	0.31 UJ	0.23 UJ	NA
Ethyl Parathion	0.19 UJ	0.19 UJ	0.26 UJ	0.19 UJ	NA
Famphur	0.32 UJ	0.32 UJ	0.42 UJ	0.32 UJ	NA
Fluoranthene	0.049 UJ	0.049 UJ	0.064 UJ	0.049 UJ	NA
Fluorene	0.018 UJ	0.018 UJ	0.024 UJ	0.018 UJ	NA
Hexachlorobenzene	0.16 UJ	0.16 UJ	0.21 UJ	0.16 UJ	NA
Hexachlorobutadiene	0.13 UJ	0.13 UJ	0.17 UJ	0.13 UJ	NA
Hexachlorocyclopentadiene	0.49 UJ	0.49 UJ	0.64 UJ	0.49 UJ	NA
Hexachloroethane	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER03	ER04	ER05	FB01	69TB01
Date	4/30/2008	5/1/2008	5/2/2008	5/2/2008	4/29/2008
Semivolatile Organic Compounds (ug/L)					
Hexachlorophene	49 R	49 R	64 R	49 R	NA
Hexachloropropene	0.12 UJ	0.12 UJ	0.15 UJ	0.12 UJ	NA
Indeno[1,2,3-cd]pyrene	0.022 UJ	0.022 R	0.029 UJ	0.022 UJ	NA
Isophorone	0.15 UJ	0.15 UJ	0.19 UJ	0.15 UJ	NA
Isosafrole	0.3 UJ	0.3 UJ	0.4 UJ	0.3 UJ	NA
Methapyrilene	0.26 UJ	0.26 UJ	0.35 UJ	0.26 UJ	NA
Methyl methanesulfonate	0.46 UJ	0.46 UJ	0.6 UJ	0.46 UJ	NA
Methyl parathion	0.17 UJ	0.17 UJ	0.22 UJ	0.17 UJ	NA
Naphthalene	0.049 UJ	0.049 UJ	0.064 UJ	0.049 UJ	NA
Nitrobenzene	0.14 UJ	0.14 UJ	0.18 UJ	0.14 UJ	NA
N-Nitro-o-toluidine	0.24 UJ	0.24 UJ	0.32 UJ	0.24 UJ	NA
N-Nitrosodiethylamine	0.32 UJ	0.32 UJ	0.42 UJ	0.32 UJ	NA
N-Nitrosodimethylamine	0.19 UJ	0.19 UJ	0.26 UJ	0.19 UJ	NA
N-Nitrosodi-n-butylamine	0.18 UJ	0.18 UJ	0.24 UJ	0.18 UJ	NA
N-Nitrosodi-n-propylamine	0.13 UJ	0.13 UJ	0.17 UJ	0.13 UJ	NA
N-Nitrosodiphenylamine	0.17 UJ	0.17 UJ	0.23 UJ	0.17 UJ	NA
N-Nitrosomethylethylamine	0.28 UJ	0.28 UJ	0.37 UJ	0.28 UJ	NA
N-Nitrosomorpholine	0.19 UJ	0.19 UJ	0.26 UJ	0.19 UJ	NA
N-Nitrosopiperidine	0.22 UJ	0.22 UJ	0.29 UJ	0.22 UJ	NA
N-Nitrosopyrrolidine	0.25 UJ	0.25 UJ	0.33 UJ	0.25 UJ	NA
o,o',o"-Triethylphosphorothioate	0.26 UJ	0.26 UJ	0.35 UJ	0.26 UJ	NA
p-Dimethylamino azobenzene	0.6 UJ	0.6 UJ	0.79 UJ	0.6 UJ	NA
Pentachlorobenzene	0.27 UJ	0.27 UJ	0.36 UJ	0.27 UJ	NA
Pentachloronitrobenzene	0.3 UJ	0.3 UJ	0.4 UJ	0.3 UJ	NA
Pentachlorophenol	0.18 UJ	0.18 UJ	0.24 UJ	0.18 UJ	NA
Phenacetin	0.2 UJ	0.2 UJ	0.27 UJ	0.2 UJ	NA
Phenanthrene	0.017 UJ	0.017 UJ	0.023 UJ	0.017 UJ	NA
Phenol	0.14 UJ	0.14 UJ	0.18 UJ	0.14 UJ	NA
Phorate	0.18 UJ	0.18 UJ	0.24 UJ	0.18 UJ	NA
p-Phenylene diamine	2.4 UJ	2.4 UJ	3.2 UJ	2.4 UJ	NA
Pronamide	0.25 UJ	0.25 UJ	0.33 UJ	0.25 UJ	NA
Pyrene	0.026 UJ	0.026 UJ	0.035 UJ	0.026 UJ	NA
Pyridine	0.22 UJ	0.22 UJ	0.29 UJ	0.22 UJ	NA
Safrole, Total	0.23 UJ	0.23 UJ	0.31 UJ	0.23 UJ	NA
Sulfotepp	0.22 UJ	0.22 UJ	0.29 UJ	0.22 UJ	NA
Thionazin	0.2 UJ	0.2 UJ	0.27 UJ	0.2 UJ	NA
Metals (ug/L)					
Antimony	0.36 UJ	0.36 UJ	0.36 UJ	0.36 UJ	NA
Arsenic	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	NA
Barium	2 UJ	2 UJ	2 UJ	2 UJ	NA
Beryllium	0.065 UJ	0.065 UJ	0.065 UJ	0.065 UJ	NA
Cadmium	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	NA
Chromium	0.6 UJ	0.6 UJ	0.6 UJ	0.6 UJ	NA
Cobalt	0.029 UJ	0.029 UJ	0.029 UJ	0.029 UJ	NA
Copper	2.1 J	1.2 UJ	1.2 UJ	2.1 J	NA
Lead	0.15 UJ	0.15 UJ	0.15 UJ	0.38 J	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER03	ER04	ER05	FB01	69TB01
Date	4/30/2008	5/1/2008	5/2/2008	5/2/2008	4/29/2008
Metals (ug/L)					
Mercury	0.08 UJ	0.08 UJ	0.08 UJ	0.08 UJ	NA
Nickel	0.32 UJ	0.32 UJ	0.32 UJ	0.32 UJ	NA
Selenium	0.6 UJ	0.6 UJ	0.6 UJ	0.6 UJ	NA
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ	NA
Thallium	0.55 UJ	0.55 UJ	0.55 UJ	0.55 UJ	NA
Tin	0.9 UJ	0.9 UJ	0.9 UJ	0.9 UJ	NA
Vanadium	0.8 UJ	0.8 UJ	0.8 UJ	0.8 UJ	NA
Zinc	6.5 UJ	6.5 UJ	6.5 UJ	6.5 UJ	NA
TPH DRO and GRO (ug/L)					
Diesel Range Organics [C10-C28]	0.028 U	NA	NA	0.028 UJ	NA
Gasoline Range Organics (GRO)-C6-C10	0.012 U	NA	NA	0.012 U	NA

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SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	69TB02	56TB03	56TB04	QATB01	74TB12
Date	4/30/2008	5/2/2008	5/4/2008	5/2/2008	5/7/2008
Volatile Organic Compounds (ug/L)					
1,1,1,2-Tetrachloroethane	0.29 R	0.29 UJ	0.29 U	0.29 U	0.29 U
1,1,1-Trichloroethane	0.39 R	0.39 UJ	0.39 U	0.39 U	0.39 U
1,1,2,2-Tetrachloroethane	0.26 R	0.26 UJ	0.26 U	0.26 U	0.26 U
1,1,2-Trichloroethane	0.51 R	0.51 UJ	0.51 U	0.51 U	0.51 U
1,1-Dichloroethane	0.32 R	0.32 UJ	0.32 U	0.32 U	0.32 U
1,1-Dichloroethene	0.36 R	0.36 UJ	0.36 U	0.36 U	0.36 U
1,2,3-Trichloropropane	0.42 R	0.42 UJ	0.42 U	0.42 U	0.42 U
1,2-Dibromo-3-Chloropropane	0.48 R	0.48 UJ	0.48 U	0.48 U	0.48 U
1,2-Dichloroethane	0.31 R	0.31 UJ	0.31 U	0.31 U	0.31 U
1,2-Dichloropropane	0.36 R	0.36 UJ	0.36 U	0.36 U	0.36 U
2-Butanone (MEK)	0.6 R	0.6 UJ	0.6 U	0.6 U	0.6 U
2-Chloro-1,3-butadiene	0.35 R	0.35 UJ	0.35 U	0.35 U	0.35 U
2-Hexanone	0.68 R	0.68 UJ	0.68 U	0.68 U	0.68 U
3-Chloro-1-propene	0.46 R	0.46 UJ	0.46 U	0.46 U	0.46 U
4-Methyl-2-pentanone (MIBK)	0.6 R	0.6 UJ	0.6 U	0.6 U	0.6 U
Acetone	5 R	5 UJ	5 U	5 U	5 U
Acetonitrile	15 R	15 UJ	15 U	15 U	15 U
Acrolein	18 R	18 R	18 R	18 U	18 R
Acrylonitrile	3.8 R	3.8 UJ	3.8 UJ	3.8 U	3.8 UJ
Benzene	0.32 R	0.32 UJ	0.32 U	0.32 U	0.32 U
Bromoform	0.41 R	0.41 UJ	0.41 U	0.41 U	0.41 U
Bromomethane	0.5 R	0.5 UJ	0.5 UJ	0.5 U	0.5 UJ
Carbon disulfide	0.17 R	0.17 UJ	0.17 U	0.17 U	0.17 U
Carbon tetrachloride	0.27 R	0.27 UJ	0.27 U	0.27 U	0.27 U
Chlorobenzene	0.34 R	0.34 UJ	0.34 U	0.34 U	0.34 U
Chlorodibromomethane	0.3 R	0.3 UJ	0.3 U	0.3 U	0.3 U
Chloroethane	1 R	1 UJ	1 U	1 U	1 UJ
Chloroform	0.29 R	0.29 UJ	0.29 U	0.29 U	0.29 U
Chloromethane	1.4 J	0.38 J	0.28 U	0.28 U	0.28 U
cis-1,3-Dichloropropene	0.37 R	0.37 UJ	0.37 U	0.37 U	0.37 UJ
Dibromomethane	0.29 R	0.29 UJ	0.29 U	0.29 U	0.29 U
Dichlorobromomethane	0.34 R	0.34 UJ	0.34 U	0.34 U	0.34 U
Dichlorodifluoromethane	0.33 R	0.33 UJ	0.33 UJ	0.33 U	0.33 U
Ethyl methacrylate	1 R	1 UJ	1 U	1 U	1 U
Ethylbenzene	0.3 R	0.3 UJ	0.3 U	0.3 U	0.3 U
Ethylene Dibromide	0.3 R	0.3 UJ	0.3 U	0.3 U	0.3 U
Iodomethane	1 R	1 UJ	1 U	1 U	1 UJ
Isobutyl alcohol	19 R	19 UJ	19 U	19 U	19 U
Methacrylonitrile	6.6 R	6.6 UJ	6.6 U	6.6 U	6.6 U
Methyl methacrylate	0.38 R	0.38 UJ	0.38 U	0.38 U	0.38 U
Methylene Chloride	1 R	1 UJ	1 U	1 U	1 U
Pentachloroethane	1.3 R	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 R	9.2 UJ	9.2 U	9.2 U	9.2 U
Styrene	0.36 R	0.36 UJ	0.36 U	0.36 U	0.36 U
Tetrachloroethene	0.28 R	0.28 UJ	0.28 U	0.28 U	0.28 U

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SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	69TB02	56TB03	56TB04	QATB01	74TB12
Date	4/30/2008	5/2/2008	5/4/2008	5/2/2008	5/7/2008
Volatile Organic Compounds (ug/L)					
Toluene	0.31 R	0.31 UJ	0.31 U	0.31 U	0.31 U
trans-1,2-Dichloroethene	0.3 R	0.3 UJ	0.3 U	0.3 U	0.3 U
trans-1,3-Dichloropropene	0.27 R	0.27 UJ	0.27 U	0.27 U	0.27 U
trans-1,4-Dichloro-2-butene	0.83 R	0.83 UJ	0.83 U	0.83 U	0.83 U
Trichloroethene	0.4 R	0.4 UJ	0.4 U	0.4 U	0.4 U
Trichlorofluoromethane	0.29 R	0.29 UJ	0.29 U	0.29 U	0.29 UJ
Vinyl acetate	0.62 R	0.62 UJ	0.62 UJ	0.62 UJ	0.62 U
Vinyl chloride	0.2 R	0.2 UJ	0.2 U	0.2 U	0.2 U
Xylenes, Total	0.87 R	0.87 UJ	0.87 U	0.87 U	0.87 U
Semivolatile Organic Compounds (ug/L)					
1,1'-Biphenyl	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA
2-Picoline	NA	NA	NA	NA	NA
2-Toluidine	NA	NA	NA	NA	NA
3 & 4 Methylphenol	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA

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SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	69TB02	56TB03	56TB04	QATB01	74TB12
Date	4/30/2008	5/2/2008	5/4/2008	5/2/2008	5/7/2008
Semivolatile Organic Compounds (ug/L)					
4-Aminobiphenyl	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA
Aramite, Total	NA	NA	NA	NA	NA
Benzo[a]anthracene	NA	NA	NA	NA	NA
Benzo[a]pyrene	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	NA	NA	NA	NA	NA
Benzyl alcohol	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA
Dimethoate	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA
Disulfoton	NA	NA	NA	NA	NA
Ethyl methanesulfonate	NA	NA	NA	NA	NA
Ethyl Parathion	NA	NA	NA	NA	NA
Famphur	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	69TB02	56TB03	56TB04	QATB01	74TB12
Date	4/30/2008	5/2/2008	5/4/2008	5/2/2008	5/7/2008
Semivolatile Organic Compounds (ug/L)					
Hexachlorophene	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA
Methapyrilene	NA	NA	NA	NA	NA
Methyl methanesulfonate	NA	NA	NA	NA	NA
Methyl parathion	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA
N-Nitro-o-toluidine	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA
o,o',o"-Triethylphosphorothioate	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA
Phorate	NA	NA	NA	NA	NA
p-Phenylene diamine	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA
Safrole, Total	NA	NA	NA	NA	NA
Sulfotepp	NA	NA	NA	NA	NA
Thionazin	NA	NA	NA	NA	NA
Metals (ug/L)					
Antimony	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA

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SUMMARY OF ANALYTICAL RESULTS - QA/QC
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	69TB02	56TB03	56TB04	QATB01		74TB12
Date	4/30/2008	5/2/2008	5/4/2008	5/2/2008		5/7/2008
Metals (ug/L)						
Mercury	NA	NA	NA	NA		NA
Nickel	NA	NA	NA	NA		NA
Selenium	NA	NA	NA	NA		NA
Silver	NA	NA	NA	NA		NA
Thallium	NA	NA	NA	NA		NA
Tin	NA	NA	NA	NA		NA
Vanadium	NA	NA	NA	NA		NA
Zinc	NA	NA	NA	NA		NA
TPH DRO and GRO (ug/L)						
Diesel Range Organics [C10-C28]	NA	NA	NA	NA		NA
Gasoline Range Organics (GRO)-C6-C10	NA	NA	NA	0.012	U	NA

ECP PHASE II DATA

APPENDIX B

SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05	15E-05
Sample ID	15E-SS01	15E-SS02	15E-SS03	15E-SS04	15E-SS05	15E-SS05D
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
Volatile Organic Compounds (ug/kg)						
Chloroform	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Dichlorodifluoromethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,1-Dichloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,2-Dichloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,1-Dichloroethene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,2-Dichloropropane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Ethyl benzene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Acrolein	110 U	110 U	170 U	160 U	100 U	110 U
Methylene chloride	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,1,2,2-Tetrachloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Tetrachloroethene	5.6 U	5.6 U	5.2 J	6.6 J	1.9 J	5.6 U
Toluene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
trans-1,2-Dichloroethene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,1,1-Trichloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,1,2-Trichloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
2-Butanone	28 U	28 U	44 U	40 U	25 U	28 U
Chloroprene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
2-Hexanone	28 U	28 U	44 U	40 U	25 U	28 U
Acrylonitrile	110 U	110 U	170 U	160 U	100 U	110 U
3-Chloro-1-propene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Benzene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Bromoform	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Carbon tetrachloride	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Chlorobenzene	5.6 U	5.6 U	2.5 J	2.6 J	5 U	5.6 U
Acetonitrile	230 U	220 U	350 U	320 U	200 U	220 U
1,2-Dibromo-3-chloropropane	11 U	11 U	17 U	16 U	10 U	11 U
Dibromomethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
trans-1,4-Dichloro-2-butene	11 U	11 U	17 U	16 U	10 U	11 U
cis-1,3-Dichloropropene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
trans-1,3-Dichloropropene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Ethyl methacrylate	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Iodomethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Methacrylonitrile	110 U	110 U	170 U	160 U	100 U	110 U
Methyl methacrylate	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Pentachloroethane	28 U	28 U	44 U	40 U	25 U	28 U
1,1,1,2-Tetrachloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Trichlorofluoromethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,2,3-Trichloropropane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Vinyl chloride	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Dibromochloromethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Chloroethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Acetone	56 U	56 U	87 U	80 U	50 U	56 U
Bromodichloromethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Bromomethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Chloromethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U

APPENDIX B

SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05	15E-05
Sample ID	15E-SS01	15E-SS02	15E-SS03	15E-SS04	15E-SS05	15E-SS05D
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
Volatile Organic Compounds (ug/kg)						
Carbon disulfide	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
1,2-Dibromoethane	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Propionitrile	110 U	110 U	170 U	160 U	100 U	110 U
Isobutanol	230 U	220 U	350 U	320 U	200 U	220 U
4-Methyl-2-pentanone	28 U	28 U	44 U	40 U	25 U	28 U
Styrene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Trichloroethene	5.6 U	5.6 U	8.7 U	8 U	5 U	5.6 U
Vinyl acetate	11 U	11 U	17 U	16 U	10 U	11 U
Xylene	11 U	11 U	17 U	16 U	10 U	11 U
Semivolatile Organic Compounds (ug/kg)						
Phenol	390 U	380 U	620 U	550 U	380 U	380 U
bis(2-Chloroethoxy)methane	390 U	380 U	620 U	550 U	380 U	380 U
2,4,6-Trichlorophenol	390 U	380 U	620 U	550 U	380 U	380 U
bis(2-Chloroethyl)ether	390 U	380 U	620 U	550 U	380 U	380 U
bis(2-Chloroisopropyl)ether	390 U	380 U	620 U	550 U	380 U	380 U
bis(2-Ethylhexyl)phthalate	390 U	380 U	1,000	210 J	380 U	380 U
4-Bromophenylphenyl ether	390 U	380 U	620 U	550 U	380 U	380 U
Butylbenzylphthalate	390 U	380 U	200 J	58 J	380 U	380 U
2-Chloronaphthalene	390 U	380 U	620 U	550 U	380 U	380 U
4-Chlorophenyl phenyl ether	390 U	380 U	620 U	550 U	380 U	380 U
Chrysene	390 U	380 U	680	100 J	120 J	45 J
Dibenzo(a,h)anthracene	390 U	380 U	140 J	54 J	380 U	380 U
2-Chlorophenol	390 U	380 U	620 U	550 U	380 U	380 U
Acenaphthene	390 U	380 U	620 U	550 U	380 U	380 U
3,3'-Dichlorobenzidine	780 U	760 U	1,200 U	1,100 U	750 U	770 U
Diethylphthalate	390 U	380 U	620 U	550 U	380 U	380 U
Dimethyl phthalate	390 U	380 U	620 U	550 U	380 U	380 U
2,4-Dinitrotoluene	390 U	380 U	620 U	550 U	380 U	380 U
2,6-Dinitrotoluene	390 U	380 U	620 U	550 U	380 U	380 U
Di-n-octylphthalate	390 U	380 U	620 U	550 U	380 U	380 U
2,4-Dichlorophenol	390 U	380 U	620 U	550 U	380 U	380 U
Acenaphthylene	390 U	380 U	620 U	550 U	380 U	380 U
2-Methylnaphthalene	390 U	380 U	620 U	550 U	380 U	380 U
Fluoranthene	390 U	380 U	680	87 J	140 J	46 J
Fluorene	390 U	380 U	620 U	550 U	380 U	380 U
Hexachlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
Hexachlorobutadiene	390 U	380 U	620 U	550 U	380 U	380 U
Hexachlorocyclopentadiene	390 U	380 U	620 U	550 U	380 U	380 U
Hexachloroethane	390 U	380 U	620 U	550 U	380 U	380 U
Indeno(1,2,3-cd)pyrene	390 U	380 U	590 J	120 J	67 J	44 J
Isophorone	390 U	380 U	620 U	550 U	410	380 U
Naphthalene	390 U	380 U	620 U	550 U	380 U	380 U
2,4-Dimethylphenol	390 U	380 U	620 U	550 U	380 U	380 U
Anthracene	390 U	380 U	620 U	550 U	38 J	380 U
4,6-Dinitro-2-methylphenol	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U

APPENDIX B

SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05	15E-05
Sample ID	15E-SS01	15E-SS02	15E-SS03	15E-SS04	15E-SS05	15E-SS05D
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
Semivolatile Organic Compounds (ug/kg)						
Nitrobenzene	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosodimethylamine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosodiphenylamine	390 U	380 U	620 U	550 U	380 U	380 U
Phenanthrene	390 U	380 U	210 J	550 U	380 U	380 U
Pyrene	390 U	20 J	700	97 J	150 J	54 J
1,2,4-Trichlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
4-Nitroquinoline-1-oxide	3,900 U	3,800 U	6,200 U	5,500 U	3,800 U	3,800 U
2,4-Dinitrophenol	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
Benzo(a)anthracene	390 U	380 U	350 J	100 J	62 J	380 U
Benzo(a)pyrene	390 U	380 U	380 J	75 J	58 J	41 J
2,6-Dichlorophenol	390 U	380 U	620 U	550 U	380 U	380 U
Benzo(b)fluoranthene	390 U	380 U	560 J	94 J	94 J	48 J
4-Aminobiphenyl	390 U	380 U	620 U	550 U	380 U	380 U
p-(Dimethylamino)azobenzene	390 U	380 U	620 U	550 U	380 U	380 U
7,12-Dimethylbenz(a)anthracene	390 U	380 U	620 U	550 U	380 U	380 U
3,3'-Dimethyl benzidine	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
alpha,alpha-Dimethylphenethylamine	79,000 U	77,000 U	130,000 U	110,000 U	76,000 U	78,000 U
1,4-Dioxane	390 U	380 U	620 U	550 U	380 U	380 U
n-Nitrosodi-n-propylamine	390 U	380 U	620 U	550 U	380 U	380 U
Aniline	390 U	380 U	620 U	550 U	380 U	380 U
Ethylmethanesulfonate	390 U	380 U	620 U	550 U	380 U	380 U
Acetophenone	390 U	380 U	620 U	550 U	380 U	380 U
Aramite	390 U	380 U	620 U	550 U	380 U	380 U
Hexachlorophene	200,000 U	200,000 U	320,000 U	280,000 U	190,000 U	200,000 U
Hexachloropropene	390 U	380 U	620 U	550 U	380 U	380 U
Isosafrole	390 U	380 U	620 U	550 U	380 U	380 U
Methapyrilene	79,000 U	77,000 U	130,000 U	110,000 U	76,000 U	78,000 U
3-Methylcholanthrene	390 U	380 U	620 U	550 U	380 U	380 U
Methyl methanesulfonate	390 U	380 U	620 U	550 U	380 U	380 U
1,4-Naphthoquinone	390 U	380 U	620 U	550 U	380 U	380 U
1-Naphthylamine	390 U	380 U	620 U	550 U	380 U	380 U
2-Naphthylamine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosodi-n-butylamine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosodiethylamine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosomethylethylamine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosomorpholine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosopiperidine	390 U	380 U	620 U	550 U	380 U	380 U
N-Nitrosopyrrolidine	390 U	380 U	620 U	550 U	380 U	380 U
5-Nitro-o-toluidine	390 U	380 U	620 U	550 U	380 U	380 U
Pentachlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
Pentachloronitrobenzene	390 U	380 U	620 U	550 U	380 U	380 U
Phenacetin	390 U	380 U	620 U	550 U	380 U	380 U
2-Picoline	390 U	380 U	620 U	550 U	380 U	380 U
Pronamide	390 U	380 U	620 U	550 U	380 U	380 U
Pyridine	390 U	380 U	620 U	550 U	380 U	380 U

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05	15E-05
Sample ID	15E-SS01	15E-SS02	15E-SS03	15E-SS04	15E-SS05	15E-SS05D
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
Semivolatile Organic Compounds (ug/kg)						
Safrole	390 U	380 U	620 U	550 U	380 U	380 U
1,2,4,5-Tetrachlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
2,3,4,6-Tetrachlorophenol	390 U	380 U	620 U	550 U	380 U	380 U
2,4,5-Trichlorophenol	390 U	380 U	620 U	550 U	380 U	380 U
1,3,5-Trinitrobenzene	390 U	380 U	620 U	550 U	380 U	380 U
2-Acetylaminofluorene	390 U	380 U	620 U	550 U	380 U	380 U
Dinoseb	390 U	380 U	620 U	550 U	380 U	380 U
4-Chloroaniline	780 U	760 U	1,200 U	1,100 U	750 U	770 U
4-Chloro-3-methylphenol	390 U	380 U	620 U	550 U	380 U	380 U
Benzo(g,h,i)perylene	390 U	48 J	640	140 J	76 J	60 J
Pentachlorophenol	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
Benzo(k)fluoranthene	390 U	380 U	260 J	44 J	81 J	39 J
Benzyl alcohol	390 U	380 U	620 U	550 U	380 U	380 U
Diallate	390 U	380 U	620 U	550 U	380 U	380 U
Dibenzofuran	390 U	380 U	620 U	550 U	380 U	380 U
Di-n-butylphthalate	390 U	380 U	620 U	550 U	380 U	380 U
Cresol, m & p	390 U	380 U	620 U	550 U	380 U	380 U
m-Dichlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
m-Dinitrobenzene	390 U	380 U	620 U	550 U	380 U	380 U
3-Nitroaniline	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
Cresol (ortho)	390 U	380 U	620 U	550 U	380 U	380 U
o-Dichlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
2-Nitroaniline	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
2-Nitrophenol	390 U	380 U	620 U	550 U	380 U	380 U
o-Toluidine	390 U	380 U	620 U	550 U	380 U	380 U
p-Dichlorobenzene	390 U	380 U	620 U	550 U	380 U	380 U
4-Nitroaniline	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
4-Nitrophenol	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
1,4-Phenylenediamine	2,000 U	2,000 U	3,200 U	2,800 U	1,900 U	2,000 U
Total Petroleum Hydrocarbons (mg/kg)						
Diesel Range Organics	2.8 J	8.8	300	170	6	8.4
Gasoline Range Organics	0.29 U	0.26 U	0.47 U	0.38 U	0.27 U	0.27 U

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SUMMARY OF INORGANIC ANALYTICAL RESULTS IN SURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05	15E-05
Sample ID	15E-SS01	15E-SS02	15E-SS03	15E-SS04	15E-SS05	15E-SS05D
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
Appendix IX Inorganic Compounds (mg/kg)						
Silver	1.1 U	1.1 U	0.25 B	0.3 B	0.98 U	1.1 U
Arsenic	3.5	3.6	2.9	3.6	1	1.9
Barium	14	30	43	1,400	25	19
Beryllium	0.06 B	0.092 B	0.2 B	0.23 B	0.095 B	0.097 B
Cadmium	0.57 U	0.86	16	24	0.32 B	0.37 B
Cobalt	2.4	6	11	10	16	13
Chromium	11	17	50	58	45	41
Copper	9.5	19	110	100	55	46
Nickel	3.4 B	6.5	16	20	18	16
Lead	4.6	19	390	450	16	23
Antimony	2.3 U	2.3 U	3.6 U	3.1 U	2 U	2.1 U
Selenium	1.1 U	1.1 U	1.8 U	1.5 U	0.98 U	1.1 U
Tin	2.4 B	3 B	6.6 B	5.6 B	2.6 B	3 B
Thallium	1.1 U	2.3 U	1.8 U	1.5 U	4.9 U	1.1 U
Vanadium	22	46	94	70	79	87
Zinc	8.6 E	26 E	250 E	380 E	40 E	39 E
Mercury	0.022 U	0.0052 B	0.054	0.061	0.015 B	0.015 B

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SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05
Sample ID	15E-SB01-01	15E-SB02-01	15E-SB03-01	15E-SB04-01	15E-SB05-02
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	3.00 - 5.00
Volatile Organic Compounds (ug/kg)					
Chloroform	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Dichlorodifluoromethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,1-Dichloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,2-Dichloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,1-Dichloroethene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,2-Dichloropropane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Ethyl benzene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Acrolein	120 U	120 U	120 U	130 U	120 U
Methylene chloride	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,1,2,2-Tetrachloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Tetrachloroethene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Toluene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
trans-1,2-Dichloroethene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,1,1-Trichloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,1,2-Trichloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
2-Butanone	31 U	30 U	31 U	34 U	8.4 J
Chloroprene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
2-Hexanone	31 U	30 U	31 U	34 U	31 U
Acrylonitrile	120 U	120 U	120 U	130 U	120 U
3-Chloro-1-propene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Benzene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Bromoform	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Carbon tetrachloride	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Chlorobenzene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Acetonitrile	250 U	240 U	250 U	270 U	250 U
1,2-Dibromo-3-chloropropane	12 U	12 U	12 U	13 U	12 U
Dibromomethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
trans-1,4-Dichloro-2-butene	12 U	12 U	12 U	13 U	12 U
cis-1,3-Dichloropropene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
trans-1,3-Dichloropropene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Ethyl methacrylate	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Iodomethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Methacrylonitrile	120 U	120 U	120 U	130 U	120 U
Methyl methacrylate	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Pentachloroethane	31 U	30 U	31 U	34 U	31 U
1,1,1,2-Tetrachloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Trichlorofluoromethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,2,3-Trichloropropane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Vinyl chloride	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Dibromochloromethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Chloroethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Acetone	62 U	61 U	63 U	67 U	28 J
Bromodichloromethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U

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SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05
Sample ID	15E-SB01-01	15E-SB02-01	15E-SB03-01	15E-SB04-01	15E-SB05-02
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	3.00 - 5.00
Volatile Organic Compounds (ug/kg) (Cont.)					
Bromomethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Chloromethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Carbon disulfide	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
1,2-Dibromoethane	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Propionitrile	120 U	120 U	120 U	130 U	120 U
Isobutanol	250 U	240 U	250 U	270 U	250 U
4-Methyl-2-pentanone	31 U	30 U	31 U	34 U	31 U
Styrene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Trichloroethene	6.2 U	6.1 U	6.3 U	6.7 U	6.2 U
Vinyl acetate	12 U	12 U	12 U	13 U	12 U
Xylene	12 U	12 U	12 U	13 U	12 U
Semivolatile Organic Compounds (ug/kg)					
Phenol	430 U	430 U	420 U	450 U	430 U
bis(2-Chloroethoxy)methane	430 U	430 U	420 U	450 U	430 U
2,4,6-Trichlorophenol	430 U	430 U	420 U	450 U	430 U
bis(2-Chloroethyl)ether	430 U	430 U	420 U	450 U	430 U
bis(2-Chloroisopropyl)ether	430 U	430 U	420 U	450 U	430 U
bis(2-Ethylhexyl)phthalate	430 U	190 J	420 U	450 U	430 U
4-Bromophenylphenyl ether	430 U	430 U	420 U	450 U	430 U
Butylbenzylphthalate	430 U	430 U	420 U	450 U	430 U
2-Chloronaphthalene	430 U	430 U	420 U	450 U	430 U
4-Chlorophenyl phenyl ether	430 U	430 U	420 U	450 U	430 U
Chrysene	430 U	430 U	420 U	450 U	430 U
Dibenzo(a,h)anthracene	430 U	430 U	420 U	450 U	430 U
2-Chlorophenol	430 U	430 U	420 U	450 U	430 U
Acenaphthene	430 U	430 U	420 U	450 U	430 U
3,3'-Dichlorobenzidine	870 U	870 U	850 U	900 U	860 U
Diethylphthalate	430 U	430 U	420 U	450 U	430 U
Dimethyl phthalate	430 U	430 U	420 U	450 U	430 U
2,4-Dinitrotoluene	430 U	430 U	420 U	450 U	430 U
2,6-Dinitrotoluene	430 U	430 U	420 U	450 U	430 U
Di-n-octylphthalate	430 U	430 U	420 U	450 U	430 U
2,4-Dichlorophenol	430 U	430 U	420 U	450 U	430 U
Acenaphthylene	430 U	430 U	420 U	450 U	430 U
2-Methylnaphthalene	430 U	430 U	420 U	450 U	430 U
Fluoranthene	430 U	430 U	420 U	450 U	430 U
Fluorene	430 U	430 U	420 U	450 U	430 U
Hexachlorobenzene	430 U	430 U	420 U	450 U	430 U
Hexachlorobutadiene	430 U	430 U	420 U	450 U	430 U
Hexachlorocyclopentadiene	430 U	430 U	420 U	450 U	430 U
Hexachloroethane	430 U	430 U	420 U	450 U	430 U
Indeno(1,2,3-cd)pyrene	430 U	430 U	420 U	450 U	430 U

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SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05
Sample ID	15E-SB01-01	15E-SB02-01	15E-SB03-01	15E-SB04-01	15E-SB05-02
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	3.00 - 5.00
Semivolatile Organic Compounds (ug/kg) (Cont.)					
Isophorone	430 U	430 U	420 U	450 U	430 U
Naphthalene	430 U	430 U	420 U	450 U	430 U
2,4-Dimethylphenol	430 U	430 U	420 U	450 U	430 U
Anthracene	430 U	430 U	420 U	450 U	430 U
4,6-Dinitro-2-methylphenol	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
Nitrobenzene	430 U	430 U	420 U	450 U	430 U
N-Nitrosodimethylamine	430 U	430 U	420 U	450 U	430 U
N-Nitrosodiphenylamine	430 U	430 U	420 U	450 U	430 U
Phenanthrene	430 U	430 U	420 U	450 U	430 U
Pyrene	430 U	430 U	420 U	450 U	430 U
1,2,4-Trichlorobenzene	430 U	430 U	420 U	450 U	430 U
4-Nitroquinoline-1-oxide	4,300 U	4,300 U	4,200 U	4,500 U	4,300 U
2,4-Dinitrophenol	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
Benzo(a)anthracene	430 U	430 U	420 U	450 U	430 U
Benzo(a)pyrene	430 U	430 U	420 U	450 U	430 U
2,6-Dichlorophenol	430 U	430 U	420 U	450 U	430 U
Benzo(b)fluoranthene	430 U	430 U	420 U	450 U	430 U
4-Aminobiphenyl	430 U	430 U	420 U	450 U	430 U
p-(Dimethylamino)azobenzene	430 U	430 U	420 U	450 U	430 U
7,12-Dimethylbenz(a)anthracene	430 U	430 U	420 U	450 U	430 U
3,3'-Dimethyl benzidine	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
alpha,alpha-Dimethylphenethylamine	88,000 U	88,000 U	86,000 U	92,000 U	87,000 U
1,4-Dioxane	430 U	430 U	420 U	450 U	430 U
n-Nitrosodi-n-propylamine	430 U	430 U	420 U	450 U	430 U
Aniline	430 U	430 U	420 U	450 U	430 U
Ethylmethanesulfonate	430 U	430 U	420 U	450 U	430 U
Acetophenone	430 U	430 U	420 U	450 U	430 U
Aramite	430 U	430 U	420 U	450 U	430 U
Hexachlorophene	220,000 U	220,000 U	220,000 U	230,000 U	220,000 U
Hexachloropropene	430 U	430 U	420 U	450 U	430 U
Isosafrole	430 U	430 U	420 U	450 U	430 U
Methapyrilene	88,000 U	88,000 U	86,000 U	92,000 U	87,000 U
3-Methylcholanthrene	430 U	430 U	420 U	450 U	430 U
Methyl methanesulfonate	430 U	430 U	420 U	450 U	430 U
1,4-Naphthoquinone	430 U	430 U	420 U	450 U	430 U
1-Naphthylamine	430 U	430 U	420 U	450 U	430 U
2-Naphthylamine	430 U	430 U	420 U	450 U	430 U
N-Nitrosodi-n-butylamine	430 U	430 U	420 U	450 U	430 U
N-Nitrosodiethylamine	430 U	430 U	420 U	450 U	430 U
N-Nitrosomethylethylamine	430 U	430 U	420 U	450 U	430 U
N-Nitrosomorpholine	430 U	430 U	420 U	450 U	430 U
N-Nitrosopiperidine	430 U	430 U	420 U	450 U	430 U
N-Nitrosopyrrolidine	430 U	430 U	420 U	450 U	430 U

APPENDIX B

SUMMARY OF ORGANIC ANALYTICAL RESULTS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05
Sample ID	15E-SB01-01	15E-SB02-01	15E-SB03-01	15E-SB04-01	15E-SB05-02
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	3.00 - 5.00
Semivolatile Organic Compounds (ug/kg) (Cont.)					
5-Nitro-o-toluidine	430 U	430 U	420 U	450 U	430 U
Pentachlorobenzene	430 U	430 U	420 U	450 U	430 U
Pentachloronitrobenzene	430 U	430 U	420 U	450 U	430 U
Phenacetin	430 U	430 U	420 U	450 U	430 U
2-Picoline	430 U	430 U	420 U	450 U	430 U
Pronamide	430 U	430 U	420 U	450 U	430 U
Pyridine	430 U	430 U	420 U	450 U	430 U
Safrole	430 U	430 U	420 U	450 U	430 U
1,2,4,5-Tetrachlorobenzene	430 U	430 U	420 U	450 U	430 U
2,3,4,6-Tetrachlorophenol	430 U	430 U	420 U	450 U	430 U
2,4,5-Trichlorophenol	430 U	430 U	420 U	450 U	430 U
1,3,5-Trinitrobenzene	430 U	430 U	420 U	450 U	430 U
2-Acetylaminofluorene	430 U	430 U	420 U	450 U	430 U
Dinoseb	430 U	430 U	420 U	450 U	430 U
4-Chloroaniline	870 U	870 U	850 U	900 U	860 U
4-Chloro-3-methylphenol	430 U	430 U	420 U	450 U	430 U
Benzo(g,h,i)perylene	58 J	430 U	420 U	450 U	430 U
Pentachlorophenol	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
Benzo(k)fluoranthene	430 U	430 U	420 U	450 U	430 U
Benzyl alcohol	430 U	430 U	420 U	450 U	430 U
Diallate	430 U	430 U	420 U	450 U	430 U
Dibenzofuran	430 U	430 U	420 U	450 U	430 U
Di-n-butylphthalate	430 U	430 U	420 U	450 U	430 U
Cresol, m & p	430 U	430 U	420 U	450 U	430 U
m-Dichlorobenzene	430 U	430 U	420 U	450 U	430 U
m-Dinitrobenzene	430 U	430 U	420 U	450 U	430 U
3-Nitroaniline	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
Cresol (ortho)	430 U	430 U	420 U	450 U	430 U
o-Dichlorobenzene	430 U	430 U	420 U	450 U	430 U
2-Nitroaniline	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
2-Nitrophenol	430 U	430 U	420 U	450 U	430 U
o-Toluidine	430 U	430 U	420 U	450 U	430 U
p-Dichlorobenzene	430 U	430 U	420 U	450 U	430 U
4-Nitroaniline	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
4-Nitrophenol	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
1,4-Phenylenediamine	2,200 U	2,200 U	2,200 U	2,300 U	2,200 U
Total Petroleum Hydrocarbons (mg/kg)					
Diesel Range Organics	3.6 J	2.9 J	3.2 J	4 J	2.7 J
Gasoline Range Organics	0.32 U	0.32 U	0.3 U	0.32 U	0.31 U

APPENDIX B

SUMMARY OF INORGANIC ANALYTICAL RESULTS IN SUBSURFACE SOIL - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	15E-01	15E-02	15E-03	15E-04	15E-05
Sample ID	15E-SB01-01	15E-SB02-01	15E-SB03-01	15E-SB04-01	15E-SB05-02
Sample Date	05/09/04	05/09/04	05/09/04	05/09/04	05/09/04
Sample Depth (ft bgs)	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	1.00 - 3.00	3.00 - 5.00
Appendix IX Inorganic Compounds (mg/kg)					
Silver	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Arsenic	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Barium	17	35	85	77	100
Beryllium	0.15 B	0.18 B	0.26 B	0.34 B	0.32 B
Cadmium	2.9 U	3 U	1.2 U	1.2 U	1.2 U
Cobalt	9.4	4.9	12	19	19
Chromium	10	9.8	15	15	16
Copper	220	120	88	100	68
Nickel	2.2 B	3.3 B	7.9	8.2	7.4
Lead	0.53 B	1.8	2.7	2.6	2.2
Antimony	2.3 U	2.4 U	2.4 U	2.5 U	2.5 U
Selenium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Tin	3.1 B	3.1 B	2.4 B	3.2 B	3.7 B
Thallium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Vanadium	270	170	130	210	160
Zinc	16 E	22 E	65 E	71 E	70 E
Mercury	0.018 B	0.063	0.03	0.023 B	0.039

2010 LABORATORY ANALYTICAL RESULTS

SOIL DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB101	69SB101	69SB102	69SB103	69SB104	69SB105	69SB106	69SB107	69SB108	69SB109
Sample ID	69SB101-00	69SB101-00D	69SB102-00	69SB103-00	69SB104-00	69SB105-00	69SB106-00	69SB107-00	69SB108-00	69SB109-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)										
Antimony	2.2 U	2 U	2.3 U	2 U	2.2 U	2.1 U	2.1 U	2.3 UJ	2.4 UJ	2.2 UJ
Arsenic	5.1	6.2	3.7	2.6	4	2.1	2.9	3.9	4.1	2.3
Barium	17 J	10 J	9.7 J	16 J	9 J	35 J	14 J	17	21	34
Beryllium	0.11 U	0.1 U	0.12 U	0.063 J	0.11 U	0.057 J	0.1 U	0.11 U	0.12 U	0.11 U
Cadmium	0.047 J	0.035 J	0.12 U	0.1 U	0.11 U	0.29	0.1 U	0.066 J	1.4	0.62
Chromium	12 J	18 J	20 J	21 J	5.9 J	14 J	13 J	26	23	15
Cobalt	3.8	5.3	5	4.1	1.3	7.9	4.2	7	6.6	4.9
Copper	15	15	17	44	3	33	14	15	19	24
Lead	0.52	0.59	0.67	2.6	0.25 J	9.7	1.7	2.5	12	6
Mercury	0.029	0.011 J	0.013 J	0.021	0.021 U	0.0096 J	0.02 U	0.022 U	0.024 U	0.013 J
Nickel	4.6	6.4	7.3	5	2	6.2	4.9	8.6	7.6	5.2
Selenium	1.1 U	1 U	1.2 U	1 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U	1.1 U
Silver	0.22 U	0.2 U	0.23 U	0.2 U	0.22 U	0.21 U	0.21 U	0.23 U	0.24 U	0.22 U
Thallium	0.43 U	0.054 J	0.46 U	0.41 U	0.43 U	0.43 U	0.42 U	0.45 U	0.47 U	0.44 U
Tin	22 U	20 U	23 U	20 U	22 U	21 U	21 U	23 U	24 U	22 U
Vanadium	45 J	70 J	110	75	9	76	44	65 J	62 J	66 J
Zinc	6	7.5	10	8.6	4.3 U	21	7.2	11	16	19

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB110	69SB111	69SB111	69SB112	69SB113	69SB114	69SB115	69SB116	69SB117	69SB118
Sample ID	69SB110-00	69SB111-00	69SB111-00D	69SB112-00	69SB113-00	69SB114-00	69SB115-00	69SB116-00	69SB117-00	69SB118-00
Date	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)										
Antimony	2.3 UJ	2.6 UJ	2.2 UJ	2.2 UJ	2.1 U	2.5 U	2.3 U	2.5 U	2.1 U	2.1 U
Arsenic	3.4	2.8 J	4.1 J	3.9	3.9	3.7	3.5	4	4.3	5.8
Barium	24	19	18	11	19	41	130	29	20	18
Beryllium	0.06 J	0.13 U	0.11 U	0.11 U	0.058 J	0.24	0.21	0.067 J	0.11 U	0.056 J
Cadmium	0.082 J	0.35	0.45	0.086 J	0.16	0.72	5.3	0.35	0.063 J	0.15
Chromium	23	16	18	38	26	20	35	14	26	26
Cobalt	7.6	5.3	5.8	9.8	5.9	12	11	5.5	6.5	6.1
Copper	28	14	16	32	17 J	32 J	57 J	20 J	16 J	18 J
Lead	7	3.7 R	6.4 R	1.1	3.6 J	17 J	53 J	6.8 J	2.5 J	9.1 J
Mercury	0.022 U	0.028 U	0.022 U	0.021 U	0.0086 J	0.036	0.1	0.012 J	0.021 U	0.009 J
Nickel	7.4	6	6.3	12	7.9	6.7	13	5.3	7.7	7.4
Selenium	1.2 U	1.3 U	1.1 U	1.1 U	1.1 U	1.2 U	1.2 U	1.3 U	1.1 U	1 U
Silver	0.23 U	0.26 U	0.22 U	0.22 U	0.21 U	0.25 U	0.15 J	0.25 U	0.21 U	0.21 U
Thallium	0.47 U	0.52 U	0.45 U	0.43 U	0.071 J	0.5 U	0.061 J	0.5 U	0.43 U	0.42 U
Tin	23 U	26 U	22 U	22 U	21 U	25 U	23 U	25 U	21 U	21 U
Vanadium	76 J	50 J	52 J	100 J	71 J	100 J	93 J	52 J	74 J	71 J
Zinc	18	11	14	10	8.7	88	200	27	9.9	9.2

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB119	69SB120	69SB121	69SB121	69SB122	69SB123	69SB124	69SB125	69SB126	69SB127
Sample ID	69SB119-00	69SB120-00	69SB121-00	69SB121-00D	69SB122-00	69SB123-00	69SB124-00	69SB125-00	69SB126-00	69SB127-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)										
Antimony	2.8 U	2.4 U	2.2 U	2.4 U	2.5 U	2.3 U	3.2 U	2.7 UJ	2.8 UJ	2.8 UJ
Arsenic	3	4	4.3	4.1	3.6	2.3	2.7	2.8	3	2.2
Barium	13	41	22	27	32	28	80	59 J	470 J	50 J
Beryllium	0.14 U	0.13	0.072 J	0.072 J	0.09 J	0.067 J	0.25	0.23	0.25	0.2
Cadmium	0.32	0.55	0.67	0.72	4.4	0.79	1.7	0.28	0.47	1.3
Chromium	36	22	27	26	33	68	27	18 J	27 J	22 J
Cobalt	6.7	12	7.9	7.3	8.3	16	13	64	45	10
Copper	20	82	24	21	43	37	87	67	89	70
Lead	5.4 J	11 J	9.1 J	12 J	71 J	7.3 J	16 J	7.1	8.2	19
Mercury	0.03 J	0.025 J	0.029 J	0.028 J	0.034 J	0.032 J	0.053 J	0.18	0.17	0.15
Nickel	7.8	9.1	8.8	8.9	10	19	13	7.3	5.7	7.6
Selenium	1.4 U	1.2 U	1.1 U	1.2 U	1.3 U	1.1 U	1.6 U	2	2.1	0.83 J
Silver	0.28 U	0.24 U	0.22 U	0.24 U	0.25 U	0.23 U	0.18 J	0.27	0.2 J	0.28 U
Thallium	0.57 U	0.077 J	0.44 U	0.12 J	0.51 U	0.46 U	0.14 J	0.26 J	0.32 J	0.57 U
Tin	28 U	24 U	22 U	24 U	25 U	23 U	32 U	27 U	28 U	28 U
Vanadium	77	100	73	70	100	110	100	270	310	240
Zinc	13 J	29 J	25 J	21 J	77 J	26 J	110 J	60	52	44

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SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB128	69SB129	69SB130	69SB131	69SB131	69SB132	69SB133	69SB134	69SB135	69SB136
Sample ID	69SB128-00	69SB129-00	69SB130-00	69SB131-00	69SB131-00D	69SB132-00	69SB133-00	69SB134-00	69SB135-00	69SB136-00
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)										
Antimony	2.9 UJ	3 UJ	2.5 UJ	2.6 UJ	3 UJ	2.6 UJ	2.6 UJ	2.5 UJ	2.5 UJ	2.5 UJ
Arsenic	1.4	1.6	1.7	1.8	0.97	2	2.6	2.4	2	1
Barium	16 J	26 J	20 J	50 J	36 J	10 J	29 J	54 J	63 J	68 J
Beryllium	0.15	0.12 J	0.13	0.19	0.11 J	0.11 J	0.13	0.13	0.16	0.29
Cadmium	0.059 J	0.26	0.22	0.67 J	1.5 J	0.044 J	0.34	0.75	1.5	0.092 J
Chromium	27 J	19 J	36 J	22 J	11 J	17	19	18	16	12
Cobalt	4.5	3.8	2.3	11	7.8 J	2 J	6.4 J	11 J	13 J	17 J
Copper	120	84	55	68 J	45 J	95	86	48	64	73
Lead	3.8	3.6	4.6	13 J	32 J	2.2	8.6	13	35	3.4
Mercury	0.12	0.093	0.18	0.047	0.039	0.11	0.066	0.028	0.04	0.073
Nickel	3.3	3.7	3.6	5.6	4.9	2.6	4.5	6.9	7.4	7.3
Selenium	1 J	0.91 J	0.71 J	1.3 U	1.5 U	0.67 J	1 J	1.3 U	1.3 U	1.2 U
Silver	0.29 U	0.3 U	0.25 U	0.26 U	0.3 U	0.26 U	0.26 U	0.25 U	0.25 U	0.25 U
Thallium	0.58 U	0.6 U	0.49 U	0.11 J	0.6 U	0.51 U	0.53 U	0.073 J	0.07 J	0.099 J
Tin	29 U	30 U	25 U	26 U	30 U	26 U	26 U	25 U	25 U	25 U
Vanadium	410	330	240	160 J	95 J	550	370	100	120	160
Zinc	12	24	12	47	51	11	21	43	70	71

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB137	69SB138	69SB139	69SB140	69SB141	69SB141	69SB142	69SB143	69SB144	69SB145
Sample ID	69SB137-00	69SB138-00	69SB139-00	69SB140-00	69SB141-00	69SB141-00D	69SB142-00	69SB143-00	69SB144-00	69SB145-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)										
Antimony	2.5 UJ	2.4 U	2.6 U	2.7 U	2.3 U	2.6 U	3.2 U	2.3 U	2.2 U	2.3 U
Arsenic	0.93	1.3	5.1	1.2	4.7	3.8	2.6	1.8	2.1	1.8
Barium	40 J	86	15	29	14	15	22	12	62	12
Beryllium	0.23	0.25	0.13 U	0.17	0.11 U	0.13 U	0.15 J	0.079 J	0.2	0.11 U
Cadmium	0.097 J	0.49	0.095 J	0.36	0.15	0.43	0.14 J	0.16	0.18	0.14
Chromium	12	20 J	7.8 J	17 J	25 J	35 J	60 J	19 J	14	68
Cobalt	11 J	19	2.1	8	7.8 J	13 J	12	4.5	14	14
Copper	74	88 J	7.4 J	90 J	19 J	44 J	79 J	55 J	57 J	33 J
Lead	4.1	15 J	2.6 J	8.5 J	1.5 J	5.6 J	4.8 J	2 J	7.4	1.4
Mercury	0.14	0.042 J	0.024 UJ	0.08 J	0.022 J	0.026 UJ	0.034 UJ	0.08 J	0.099 R	0.025 R
Nickel	6.4	6.6	2.5	5.1	9.7 J	14 J	10	4.7	6	19
Selenium	1.2 U	1.2 U	1.3 U	1.4 U	1.1 U	1.3 U	1.6 U	1.1 U	0.58 J	1.1 U
Silver	0.25 U	0.24 U	0.26 U	0.27 U	0.23 U	0.26 U	0.32 U	0.23 U	0.22 U	0.23 U
Thallium	0.067 J	0.15 J	0.51 U	0.54 U	0.45 U	0.53 U	0.083 J	0.063 J	0.13 J	0.46 U
Tin	25 U	24 U	26 U	27 U	23 U	26 U	32 U	23 U	22 U	23 U
Vanadium	190	210 J	18 J	210 J	59 J	94 J	210 J	180 J	150	120
Zinc	49	110	13	35	10 J	21 J	24	12	42	18

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SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB146	69SB147	69SB148	69SB149	69SB150	69SB151	69SB151	69SB152
Sample ID	69SB146-00	69SB147-00	69SB148-00	69SB149-00	69SB150-00	69SB151-00	69SB151-00D	69SB152-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.3 U	2.5 U	2.4 U	2.4 U	2.4 UJ	2.3 UJ	2.4 UJ	2.2 UJ
Arsenic	0.89	0.96	1.3	0.65	0.86	1.5	1.2	1.4
Barium	21	16	22	22	47	50	49	82
Beryllium	0.073 J	0.13 U	0.12	0.12 U	0.19	0.19	0.17	0.24
Cadmium	0.055 J	0.13 U	0.089 J	0.12 U	0.079 J	0.29	0.31	0.19
Chromium	7.6	9.7	14	4.2	16	12	13	13
Cobalt	3.2	0.61	3.7	1	15	13	13	17
Copper	65 J	37 J	88 J	55 J	96	52	68	59
Lead	2.6	1.8	2.8	1.3	3.6	7	5.8	5.3
Mercury	0.023 R	0.025 R	0.079 R	0.071 R	0.077	0.04	0.053	0.024
Nickel	1.9	1.2 J	4.2	1.3	7.2	11	8.5	7.3
Selenium	0.65 J	0.98 J	0.78 J	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U
Silver	0.23 U	0.25 U	0.24 U	0.24 U	0.24 U	0.23 U	0.24 U	0.22 U
Thallium	0.057 J	0.5 U	0.079 J	0.48 U	0.083 J	0.46 U	0.062 J	0.11 J
Tin	23 U	25 U	24 U	24 U	24 U	23 U	24 U	22 U
Vanadium	150	310	160	70	160 J	110 J	120 J	140 J
Zinc	10	5.1	13	4.9	49	51	44	58

Notes:

µg/L - micrograms per liter

U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
R - Result is rejected and unusable

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB101	69SB101	69SB102	69SB102	69SB103	69SB103	69SB104	69SB104	69SB104	69SB105
Sample ID	69SB101-01	69SB101-02	69SB102-01	69SB102-02	69SB103-01	69SB103-02	69SB104-01	69SB104-01D	69SB104-02	69SB105-01
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (µg/L)										
Antimony	2.4 U	2.3 U	2.6 U	2.3 U	2.5 U	2.6 U	2.2 U	2.8 U	2.5 U	2.3 U
Arsenic	1.6	0.73	1.5	0.84	1.2	0.76	0.7	0.69 J	0.27 J	1
Barium	17 J	15 J	13 J	12 J	27 J	24 J	80 J	46 J	76 J	15 J
Beryllium	0.12	0.11 U	0.12 J	0.057 J	0.09 J	0.17	0.12	0.22	0.074 J	0.058 J
Cadmium	0.12 U	0.11 U	0.13 U	0.11 U	0.12 U	0.13 U	0.11 U	0.14 U	0.12 U	0.11 U
Chromium	17 J	5.3 J	12 J	7.6 J	11 J	5.1 J	8.1 J	5.9 J	4 J	8.8 J
Cobalt	4.1	1.5	3.7	4.2	3.6	3.5	2 J	4.5 J	0.6	1.9
Copper	130	57	120	54	140	180	100 J	200 J	26	91
Lead	3.6	0.92	2.2	0.99	1.3	1.4	4.2 R	0.98 R	0.48 J	1.1
Mercury	0.074	0.099	0.017 J	0.021 J	0.026	0.026 U	0.0098 J	0.011 J	0.016 J	0.012 J
Nickel	3.9	1.8	4.4	2.7	2.4	2.1	2.3	3.2	2.2	1.1
Selenium	1.9	0.73 J	1.8	0.88 J	0.85 J	1.3 U	1.1 U	1.4 U	1.2 U	1.3
Silver	0.24 U	0.23 U	0.26 U	0.23 U	0.25 U	0.26 U	0.22 U	0.28 U	0.25 U	0.23 U
Thallium	0.11 J	0.46 U	0.13 J	0.097 J	0.071 J	0.52 U	0.068 J	0.56 U	0.078 J	0.46 U
Tin	24 U	23 U	26 U	23 U	25 U	26 U	22 U	28 U	25 U	23 U
Vanadium	270	170	220	120	130	330	210	290	140	300
Zinc	14	7.2	13	5.4	9.8	11	10 J	18 J	4.9 U	5.6

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB105	69SB106	69SB106	69SB107	69SB107	69SB107	69SB108	69SB108	69SB109	69SB109
Sample ID	69SB105-02	69SB106-01	69SB106-02	69SB107-01	69SB107-02	69SB107-02D	69SB108-01	69SB108-02	69SB109-01	69SB109-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)										
Antimony	2.4 U	2.8 U	2.5 U	2.2 UJ	2.6 UJ	3.2 UJ	2.5 UJ	2.1 UJ	2.6 UJ	2.6 UJ
Arsenic	0.72	0.45 J	0.41 J	4.1	4.3 J	1.2 J	4	3.4	0.99	0.95
Barium	9.8 J	12 J	11 J	20	16	22	17	17	26	32
Beryllium	0.12 U	0.14 U	0.13 U	0.055 J	0.13 U	0.16 U	0.13 U	0.071 J	0.16	0.18
Cadmium	0.12 U	0.14 U	0.13 U	0.058 J	0.052 J	0.16 U	0.06 J	0.073 J	0.13 U	0.13 U
Chromium	6.1 J	4.1 J	3 J	27	17	15	18	28	8.6	9.5
Cobalt	0.97	0.39	0.38	7.3	4.1	3.3	5.4	5.2	6.6	6.1
Copper	90	43	39	16	30 J	48 J	12	23	110	130
Lead	0.83	1	0.87	1.4	0.68	0.86	1.5	2.6	1.4	1.4
Mercury	0.01 J	0.11	0.021 J	0.023 U	0.024 U	0.03 U	0.024 U	0.02 U	0.1	0.084
Nickel	1.2	1 J	0.76 J	9.3	6.3	6.7	6.5	5.8	3.8	4.5
Selenium	0.88 J	1.4 U	1.3 U	1.1 U	1.3 U	1.6 U	1.3 U	1.1 U	1.3 U	1.3 U
Silver	0.24 U	0.28 U	0.25 U	0.22 U	0.26 U	0.32 U	0.25 U	0.21 U	0.26 U	0.26 U
Thallium	0.48 U	0.56 U	0.51 U	0.44 U	0.51 U	0.64 U	0.5 U	0.43 U	0.52 U	0.51 U
Tin	24 U	28 U	25 U	22 U	26 U	32 U	25 U	21 U	26 U	26 U
Vanadium	130	240	48	65 J	110 J	150 J	51 J	110 J	200 J	220 J
Zinc	6.5	5.6 U	5.1 U	10	7.5	7.7	8.1	9.5	23	26

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB110	69SB110	69SB111	69SB111	69SB112	69SB112	69SB113	69SB113	69SB114	69SB114
Sample ID	69SB110-01	69SB110-02	69SB111-01	69SB111-02	69SB112-01	69SB112-02	69SB113-01	69SB113-02	69SB114-01	69SB114-01D
Date	8/3/2010	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0
Inorganics (µg/L)										
Antimony	2.4 UJ	2.4 UJ	2.9 UJ	2.3 UJ	2.5 UJ	2.6 UJ	2.2 U	2.4 U	2.6 U	2.3 U
Arsenic	1.5	0.45 J	0.77	1.1	1.2	1.2	3.9	1.6	4.4	5.4
Barium	9.1	7.1	220	100	90	46	17	190	33 J	23 J
Beryllium	0.089 J	0.12 U	0.25	0.22	0.25	0.21	0.11 U	0.31	0.1 J	0.06 J
Cadmium	0.12 U	0.12 U	0.18	0.093 J	0.08 J	0.082 J	0.044 J	0.049 J	0.15	0.11
Chromium	9.2	3.2	15	15	15	14	28	18	29	25
Cobalt	3.3	0.76	29	22	18	16	6.5	21	7.2 J	4.6 J
Copper	97	42	76	94	87	89	13 J	77 J	26 J	11 J
Lead	1.9	0.5	2.2	2.2	2.3	2.4	0.75 J	3.3 J	3.6 J	2.4 J
Mercury	0.18	0.1	0.034	0.067	0.036	0.062	0.021 U	0.025	0.032	0.012 J
Nickel	3	1.2	9.3	6.2	7.6	6	9.1	9.1	8.2 J	5.4 J
Selenium	1.2 U	1.2 U	1.5 U	1.2 U	1.3 U	1.3 U	1.1 U	1.2 U	1.3 U	1.1 U
Silver	0.24 U	0.24 U	0.29 U	0.23 U	0.25 U	0.26 U	0.22 U	0.24 U	0.26 U	0.23 U
Thallium	0.07 J	0.48 U	0.094 J	0.099 J	0.09 J	0.087 J	0.44 U	0.11 J	0.53 U	0.46 U
Tin	24 U	24 U	29 U	23 U	25 U	26 U	22 U	24 U	26 U	23 U
Vanadium	320 J	110 J	180 J	220 J	210 J	270 J	83 J	210 J	88 J	49 J
Zinc	10	5.4	59	48	60	45	9.4	58	28 J	10 J

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB114	69SB115	69SB115	69SB116	69SB116	69SB117	69SB117	69SB117	69SB118	69SB118
Sample ID	69SB114-02	69SB115-01	69SB115-02	69SB116-01	69SB116-02	69SB117-01	69SB117-02	69SB117-02D	69SB118-01	69SB118-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)										
Antimony	2.5 U	2.1 U	2.5 U	2.5 U	2.4 U	2.6 U	2.6 U	2.7 U	2.6 U	2.6 U
Arsenic	1.1	4.7	1.4	1.2	0.89	1.1	0.66	0.88	0.88	1.2
Barium	150	14	110	66	76	100	69	62	110	110
Beryllium	0.27	0.11 U	0.33	0.35	0.29	0.32	0.29	0.31	0.32	0.31
Cadmium	0.12 J	0.044 J	0.084 J	0.076 J	0.069 J	0.072 J	0.076 J	0.082 J	0.064 J	0.095 J
Chromium	18	22	18	19	15	17	16	16	18	14
Cobalt	20	3.6	27	16	15	16	13	14	16	16
Copper	110 J	8.1 J	120 J	120 J	100 J	94 J	100 J	97 J	96 J	97 J
Lead	3 J	0.67 J	2.8 J	3 J	2.4 J	2.7 J	3 J	2.8 J	2.6 J	2.6 J
Mercury	0.072	0.02 U	0.045	0.037	0.035	0.032	0.037	0.032	0.034	0.023 J
Nickel	9.2	4.9	10	10	9.7	9.7	9.3	9.3	11	9.3
Selenium	1.3 U	1.1 U	1.3 U	1.3 U	1.2 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
Silver	0.25 U	0.21 U	0.25 U	0.25 U	0.24 U	0.26 U	0.26 U	0.27 U	0.76	0.96
Thallium	0.16 J	0.42 U	0.11 J	0.12 J	0.083 J	0.14 J	0.13 J	0.14 J	0.087 J	0.091 J
Tin	25 U	21 U	25 U	25 U	24 U	26 U	26 U	27 U	26 U	26 U
Vanadium	210 J	49 J	230 J	220 J	170 J	180 J	170 J	190 J	170 J	180 J
Zinc	76	6.4	72	50	72	79	85	81	86	83

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB119	69SB119	69SB120	69SB120	69SB121	69SB121	69SB122	69SB122	69SB123	69SB123
Sample ID	69SB119-01	69SB119-02	69SB120-01	69SB120-02	69SB121-01	69SB121-02	69SB122-01	69SB122-02	69SB123-01	69SB123-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)										
Antimony	2.2 U	2.3 U	2.3 U	2.5 U	2.4 U	2.4 U	2.8 U	2.6 U	2.3 U	2.5 U
Arsenic	4.4	1.2	3.4	0.99	1.4	1.4	2.6	2.3	2.5	0.87
Barium	17	97	39	84	59	30	40	53	40	63
Beryllium	0.066 J	0.27	0.091 J	0.3	0.42	0.33	0.18	0.16	0.11 J	0.34
Cadmium	0.064 J	0.12	0.084 J	0.069 J	0.063 J	0.067 J	0.26	0.13 U	0.069 J	0.047 J
Chromium	31	19	24	16	21	18	46	36	27	14
Cobalt	7.5	15	9.3	13	23	10	3	3.2	9.2	15
Copper	15	67	28	82	93	80	120	130	40	100
Lead	2.1 J	5.6 J	3.4 J	2.1 J	2.8 J	2.4 J	9.7 J	5.4 J	0.76 J	2.6 J
Mercury	0.021 UJ	0.035 J	0.022 UJ	0.098 J	0.11 J	0.11 J	0.09 J	0.073 J	0.022 UJ	0.03 J
Nickel	8.5	8.6	7.7	8.5	10	8.8	4.9	4.5	9.9	9.8
Selenium	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.3 J	1.1 J	1.2 U	1.3 U
Silver	0.22 U	0.21 J	0.23 U	0.25 U	0.24 U	0.24 U	0.28 U	0.26 U	0.23 U	0.24 J
Thallium	0.44 U	0.11 J	0.47 U	0.15 J	0.17 J	0.13 J	0.55 U	0.53 U	0.06 J	0.093 J
Tin	22 U	23 U	23 U	25 U	24 U	24 U	28 U	26 U	23 U	25 U
Vanadium	78	170	90	190	230	200	480	430	85	180
Zinc	15 J	56 J	20 J	67 J	80 J	71 J	17 J	15 J	28 J	80 J

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB124	69SB124	69SB124	69SB125	69SB125	69SB126	69SB126	69SB127	69SB127	69SB127
Sample ID	69SB124-01	69SB124-01D	69SB124-02	69SB125-01	69SB125-02	69SB126-01	69SB126-02	69SB127-01	69SB127-02	69SB127-02D
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0
Inorganics (µg/L)										
Antimony	2.5 U	2.7 U	2.6 U	2.3 UJ	2.5 UJ	2.1 UJ	2.4 UJ	2.5 UJ	2.4 UJ	2.9 UJ
Arsenic	0.38 J	0.37 J	0.42 J	4	2.4	3.5	1.2	1.7	0.84	0.73 U
Barium	240	250	92	18 J	54 J	130 J	77 J	25 J	21 J	27 J
Beryllium	0.39	0.36	0.3	0.11 U	0.21	0.074 J	0.3	0.13	0.11 J	0.15 U
Cadmium	0.12 J	0.13	0.043 J	0.072 J	0.25	0.18	0.11 J	0.065 J	0.031 J	0.15 U
Chromium	18	19	16	29 J	15 J	26 J	17 J	19 J	10 R	3.8 R
Cobalt	21	22	10	7.7	34	17	24	2.5	1.5 J	0.68 J
Copper	120	120	120	19	67	36	92	85	85 J	22 J
Lead	3.4 J	3.5 J	3.4 J	1.3	6	2.7	3	4.4	2.8 J	0.52 J
Mercury	0.033 J	0.064 J	0.12 J	0.021	0.15	0.03	0.048	0.026	0.087	0.032
Nickel	11	11	8.9	8	8	8.7	9.7	2.7	1.5	0.93 J
Selenium	1.3 U	1.3 U	1.3 U	1.1 U	1.7	1 U	1.2 U	1.6	0.91 J	1.5 U
Silver	0.25 U	0.27 U	0.26 U	0.23 U	0.17 J	0.21 U	0.24 U	0.25 U	0.24 U	0.29 U
Thallium	0.23 J	0.22 J	0.16 J	0.46 U	0.11 J	0.08 J	0.13 J	0.5 U	0.48 U	0.58 U
Tin	25 U	27 U	26 U	23 U	25 U	21 U	24 U	25 U	24 U	29 U
Vanadium	120	120	120	77	240	100	210	580	400 R	64 R
Zinc	100 J	100 J	76 J	10	58	19	74	11	6.7	5.8 U

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB128	69SB128	69SB129	69SB129	69SB130	69SB130	69SB131	69SB131	69SB132	69SB132
Sample ID	69SB128-01	69SB128-02	69SB129-01	69SB129-02	69SB130-01	69SB130-02	69SB131-01	69SB131-02	69SB132-01	69SB132-02
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)										
Antimony	2.8 UJ	2.5 UJ	2.7 UJ	2.4 UJ	2.5 UJ	2.7 UJ	2.2 UJ	2.5 UJ	2.3 UJ	2.7 UJ
Arsenic	1.5	0.33 J	0.79	2.4	1.4	2.8	0.68	0.99	1.1	0.77
Barium	21 J	28 J	18 J	17 J	22 J	19 J	49 J	31 J	12 J	8.2 J
Beryllium	0.14	0.068 J	0.075 J	0.12	0.11 J	0.2	0.15	0.17	0.098 J	0.11 J
Cadmium	0.057 J	0.034 J	0.14 U	0.12 U	0.035 J	0.045 J	0.11 U	0.12 U	0.12 U	0.13 U
Chromium	18 J	5.7 J	15 J	19 J	29 J	53 J	11	14	11	9.4
Cobalt	4.1	1.5	1.2	1.4	2	2.7	9.6 J	11 J	1.2 J	1 J
Copper	110	40	55	100	75	140	46	66	67	74
Lead	2.9	0.88	1.7	4.4	1.4	4.5	2	2.1	2.2	1.8
Mercury	0.066	0.081	0.042	0.083	0.071	0.15	0.046	0.069	0.044	0.034
Nickel	2.8	1.4	2.8	2.1	2.5	3.5	4.2	4.2	1.5	1.4
Selenium	1.1 J	1.2 U	1.4 U	2.2	0.79 J	1.9	1.1 U	1.2 U	1.2 U	1.3 U
Silver	0.28 U	0.25 U	0.27 U	0.24 U	0.25 U	0.27 U	0.22 U	0.25 U	0.23 U	0.27 U
Thallium	0.55 U	0.49 U	0.54 U	0.47 U	0.08 J	0.54 U	0.085 J	0.11 J	0.47 U	0.54 U
Tin	28 U	25 U	27 U	24 U	25 U	27 U	22 U	25 U	23 U	27 U
Vanadium	390	150	250	560	290	580	130	210	400	350
Zinc	9.9	5.8	7.3	10	10	14	34	38	6.1	7.7

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SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB133	69SB133	69SB134	69SB134	69SB134	69SB135	69SB135	69SB136	69SB136	69SB137
Sample ID	69SB133-01	69SB133-02	69SB134-01	69SB134-01D	69SB134-02	69SB135-01	69SB135-02	69SB136-01	69SB136-02	69SB137-01
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (µg/L)										
Antimony	2.4 UJ	2.6 UJ	2.3 UJ	2.4 UJ	2.4 UJ	2.6 UJ	2.4 UJ	2.5 UJ	2.4 UJ	2.5 U
Arsenic	1	1.2	1.1	1.3	1	1	0.59 J	1.3	1.2	1.4
Barium	14 J	14 J	130 J	270 J	42 J	78 J	41 J	51 J	30 J	26
Beryllium	0.095 J	0.098 J	0.37	0.36	0.28	0.25	0.19	0.19	0.17	0.19
Cadmium	0.045 J	0.13 U	0.27	0.16	0.065 J	0.15	0.066 J	0.07 J	0.092 J	0.05 J
Chromium	12	9.1	13	13	11	12	11	11	11	15 J
Cobalt	3.4 J	1.2 J	23 J	33 J	14 J	18 J	11 J	19 J	16 J	6.9
Copper	85	65	85	89	73	81	62	73	71	80 J
Lead	3.3	2.1	3	3	2.6	5.3	3	3.5	3.4	2.6 J
Mercury	0.07	0.058	0.059	0.069	0.04	0.035	0.047	0.085	0.11	0.13 J
Nickel	3.5	1.7	7.9	7.9	7.6	7.6	6.1	5.7	4.6	5.8
Selenium	0.92 J	0.79 J	1.2 U	1.2 U	1.2 U	1.3 U	1.2 U	1.2 U	1.2 U	0.74 J
Silver	0.24 U	0.26 U	0.23 U	0.24 U	0.24 U	0.26 U	0.24 U	0.25 U	0.24 U	0.25 U
Thallium	0.49 U	0.51 U	0.14 J	0.18 J	0.1 J	0.083 J	0.072 J	0.12 J	0.13 J	0.11 J
Tin	24 U	26 U	23 U	24 U	24 U	26 U	24 U	25 U	24 U	25 U
Vanadium	380	220	200	210	180	200	130	170	160	240 J
Zinc	12	7.8	71	72	65	68	55	57	42	33

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB137	69SB137	69SB138	69SB138	69SB139	69SB139	69SB140	69SB140	69SB141	69SB141
Sample ID	69SB137-02	69SB137-02D	69SB138-01	69SB138-02	69SB139-01	69SB139-02	69SB140-01	69SB140-02	69SB141-01	69SB141-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)										
Antimony	2.5 U	2.7 U	2.6 U	2.4 U	2.3 U	2.4 U	2.6 U	2.5 U	2.3 U	2.6 U
Arsenic	0.55 J	1.1	1.3	2.5	5.9	1.9	1.8	1.2	1.1	1
Barium	30	26	55	22	48	24	27	16	54	46
Beryllium	0.12 J	0.15	0.24	0.17	0.12	0.13	0.17	0.19	0.18	0.13
Cadmium	0.13 U	0.045 J	0.089 J	0.049 J	0.031 J	0.12 U	0.066 J	0.061 J	0.064 J	0.052 J
Chromium	12 J	13 J	18 J	28 J	15 J	14 J	52 J	20 J	28 J	12 J
Cobalt	4.5	6.9	19	9.4	8.3	3.9	6.9	7.8	11	15
Copper	61 J	70 J	78 J	130 J	57 J	87 J	67 J	90 J	91 J	81 J
Lead	1.8 J	2 J	3.3 J	3.7 J	1.7 J	2.1 J	5.9 J	4 J	3.2 J	2.5 J
Mercury	0.085 J	0.056 J	0.051 J	0.028 J	0.036 J	0.15 J	0.068 J	0.071 J	0.11 J	0.053 J
Nickel	4.3	4.5	8	5.6	4	3.4	3.3	4	5.7	4.6
Selenium	1.3 U	0.68 J	1.3 U	1.1 J	1.1 U	1 J	0.64 J	1.3 U	1.1 U	1.3 U
Silver	0.25 U	0.27 U	0.26 U	0.24 U	0.23 U	0.24 U	0.26 U	0.25 U	0.23 U	0.26 U
Thallium	0.071 J	0.077 J	0.094 J	0.099 J	0.099 J	0.065 J	0.51 U	0.51 U	0.099 J	0.088 J
Tin	25 U	27 U	26 U	24 U	23 U	24 U	26 U	25 U	23 U	26 U
Vanadium	140 J	230 J	200 J	280 J	140 J	270 J	530 J	370 J	260 J	280 J
Zinc	28	32	58	28	18	16	20	20	37	16

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB142	69SB142	69SB143	69SB143	69SB144	69SB144	69SB144	69SB145	69SB145	69SB146
Sample ID	69SB142-01	69SB142-02	69SB143-01	69SB143-02	69SB144-01	69SB144-01D	69SB144-02	69SB145-01	69SB145-02	69SB146-01
Date	8/4/2010	8/4/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (µg/L)										
Antimony	2.4 U	2.4 U	2.4 U	2.8 U	2.6 U	2.6 U	2.7 U	2.8 U	2.4 U	2.5 U
Arsenic	2.2	2.5	1	0.75	0.58 J	0.92	0.51 J	1.3	0.9	0.31 J
Barium	26	110	9.1	10	15	18	25	26	22	18
Beryllium	0.18	0.2	0.069 J	0.14 U	0.065 J	0.13	0.075 J	0.071 J	0.12	0.13 U
Cadmium	0.044 J	0.053 J	0.12 U	0.14 U	0.13 U	0.13 U	0.14 U	0.14 U	0.12 U	0.13 U
Chromium	30 J	22 J	6.2	5	10	14	9.4	13	13	4.4
Cobalt	18	14	1.8	1.8	2	1.7	2.7	1.8	2.3	0.53
Copper	120 J	130 J	76 J	54 J	67 J	100 J	77 J	77 J	170 J	34 J
Lead	3.6 J	2.3 J	1.2	0.82	1	1.4	0.94	2	1.5	1.5
Mercury	0.066 J	0.073 J	0.068 R	0.048 R	0.024 R	0.024 R	0.019 R	0.064 R	0.077 R	0.027 R
Nickel	6.9	4.8	1.9	1.8	1.9	2	2.1	2	1.5	1.3 U
Selenium	0.96 J	0.88 J	0.73 J	1.4 U	1.3 U	0.9 J	1.4 U	0.95 J	0.63 J	1.3 U
Silver	0.24 U	0.24 U	0.24 U	0.28 U	0.26 U	0.26 U	0.27 U	0.28 U	0.24 U	0.25 U
Thallium	0.17 J	0.15 J	0.078 J	0.07 J	0.11 J	0.53 U	0.14 J	0.55 U	0.49 U	0.5 U
Tin	24 U	24 U	24 U	28 U	26 U	26 U	27 U	28 U	24 U	25 U
Vanadium	270 J	320 J	200	190	190 J	380 J	130	240	280	87
Zinc	33	23	11	6.4	12	16	12	5.6	12	5 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB146	69SB147	69SB147	69SB147	69SB148	69SB148	69SB149	69SB149	69SB150
Sample ID	69SB146-02	69SB147-01	69SB147-02	69SB147-02D	69SB148-01	69SB148-02	69SB149-01	69SB149-02	69SB150-01
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	2.0-3.0	1.0-2.0	2.0-3.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0
Inorganics (µg/L)									
Antimony	2.8 U	2.6 U	2.5 U	2.5 U	2.6 U	2.5 U	2.3 UJ	2.4 UJ	2.4 UJ
Arsenic	0.4 J	0.85	0.62 U	0.73	1.2	1	1.2	1	0.61
Barium	8	15	12	14	18	16	20	31	60
Beryllium	0.092 J	0.13 U	0.12 U	0.072 J	0.26	0.17	0.15	0.11 J	0.21
Cadmium	0.14 U	0.13 U	0.12 U	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U	0.12 U
Chromium	3.1	10	5.4 J	8.5 J	17	13	15	6	6.9
Cobalt	1	0.88	0.32 R	2 R	2.9	2.7	22	2.3	7.4
Copper	67 J	63 J	21 J	74 J	170 J	160 J	110	110	150
Lead	1.5	1.8	0.92 J	1.4 J	1.3	0.98	2.9	4.4	1.2
Mercury	0.028 R	0.026 R	0.077 R	0.13 R	0.025 R	0.025 R	0.022 J	0.052	0.017 J
Nickel	1.4 U	1.3	1.1 J	1.5	2.9	3.9	1.6	0.99 J	3.4
Selenium	1.4 U	0.75 J	1.2 U	1.2 U	1.1 J	0.94 J	0.72 J	1.2 U	1.2 U
Silver	0.28 U	0.26 U	0.25 U	0.25 U	0.26 U	0.25 U	0.23 U	0.24 U	0.24 U
Thallium	0.56 U	0.51 U	0.49 U	0.084 J	0.52 U	0.49 U	0.068 J	0.073 J	0.091 J
Tin	28 U	26 U	25 U	25 U	26 U	25 U	23 U	24 U	24 U
Vanadium	120	250	46 R	260 R	270	180	170 J	130 J	210 J
Zinc	5.6 U	5.9	6.4	7.4	11	7.5	7.7	4.9 U	17

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB150	69SB151	69SB151	69SB152	69SB152
Sample ID	69SB150-02	69SB151-01	69SB151-02	69SB152-01	69SB152-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)					
Antimony	2.5 UJ	2.4 UJ	2.4 UJ	2.3 UJ	2.4 UJ
Arsenic	0.6 J	0.89	1.1	0.79	0.97
Barium	44	15	7.2	13	27
Beryllium	0.45	0.19	0.15	0.14	0.3
Cadmium	0.12 U	0.054 J	0.12 U	0.12 U	0.034 J
Chromium	5.7	14	15	11	13
Cobalt	12	8	5.5	5.5	6.2
Copper	280	120	150	120	200
Lead	0.44 J	4.6	2.1	1.2	3.2
Mercury	0.013 J	0.066	0.14	0.068	0.065
Nickel	3.9	5.6	3.4	4.5	6.4
Selenium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Silver	0.25 U	0.24 U	0.24 U	0.23 U	0.24 U
Thallium	0.13 J	0.15 J	0.1 J	0.47 U	0.48 U
Tin	25 U	24 U	24 U	23 U	24 U
Vanadium	260 J	170 J	220 J	200 J	310 J
Zinc	21	20	15	8.9	12

Notes:

µg/L - micrograms per liter

U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
R - Result is rejected and unusable

SEDIMENT DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SD01	69SD01	69SD02	69SD02	69SD03	69SD04	69SD05	69SD06	69SD07	69SD08
Sample ID	69SD01	69SD01D	69SD02	69SD02D	69SD03	69SD04	69SD05	69SD06	69SD07	69SD08
Sample Date	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)										
Antimony	3.7 UJ	4 UJ	4.6 UJ	4.2 UJ	4.3 UJ	3.3 U	3.3 U	4.1 UJ	5.3 UJ	4.6 UJ
Arsenic	1.2 J	1.6 J	1.8 J	1.8 J	2.8 J	1.9	3.4	3.8 J	4.6 J	3 J
Barium	31 J	38 J	38 J	33 J	48 J	24 J	26 J	110 J	130 J	140 J
Beryllium	0.11 J	0.13 J	0.15 J	0.13 J	0.14 J	0.16 J	0.2	0.29 J	0.33 J	0.2 J
Cadmium	0.89 J	1.1 J	0.77 J	0.52 J	4.6 J	0.38	0.44	16 J	24 J	12 J
Chromium	26 J	18 J	21 J	18 J	25 J	20	30	99 J	72 J	40 J
Cobalt	5.2 J	6.4 J	7.2 J	6.2 J	8.5 J	5.8 J	5.6 J	18 J	18 J	14 J
Copper	64 J	83 J	90 J	96 J	85 J	96 J	130 J	140 J	160 J	110 J
Lead	51 J	14 J	8.3 J	6.9 J	48 J	6.4	8.6	440 J	680 J	250 J
Mercury	0.081 J	0.067 J	0.068 J	0.077 J	0.073 J	0.067	0.062	0.085 J	0.076 J	0.067 J
Nickel	6.7 J	6.9 J	6.7 J	6.8 J	10 J	5.3	5.3	34 J	27 J	15 J
Selenium	1.9 UJ	1.1 J	1.2 J	1.1 J	2.1 UJ	0.85 J	1.3 J	2.1 UJ	2.7 UJ	2.3 UJ
Silver	0.37 UJ	0.4 UJ	0.46 UJ	0.42 UJ	0.43 UJ	0.33 U	0.33 U	0.7 J	0.47 J	0.25 J
Thallium	0.37 UJ	0.4 UJ	0.46 UJ	0.11 J	0.43 UJ	0.33 U	0.33 U	0.41 UJ	0.53 UJ	0.46 UJ
Tin	37 UJ	40 UJ	46 UJ	42 UJ	43 UJ	33 U	33 U	41 UJ	53 UJ	46 UJ
Vanadium	140 J	180 J	190 J	220 J	170 J	190 J	350 J	110 J	140 J	150 J
Zinc	49 J	41 J	44 J	33 J	100 J	40	55	450 J	490 J	220 J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SEDIMENT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SD09	69SD10	69SD11	69SD12	69SD13	69SD14
Sample ID	69SD09	69SD10	69SD11	69SD12	69SD13	69SD14
Sample Date	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)						
Antimony	4.1 UJ	6.2 UJ	3.6 U	3.7 U	3.9 U	3.2 U
Arsenic	4.8 J	2.4 J	2.1	1	2.1	4
Barium	77 J	100 J	52 J	33 J	65 J	99 J
Beryllium	0.25 J	0.22 J	0.18	0.098 J	0.21	0.28
Cadmium	2.9 J	4.1 J	1.5	1.4	1	0.92
Chromium	32 J	23 J	20	10	23	61
Cobalt	20 J	16 J	12 J	7.7 J	15 J	16 J
Copper	130 J	110 J	70 J	38 J	72 J	98 J
Lead	30 J	26 J	24	15	21	15
Mercury	0.07 J	0.14 J	0.063	0.048	0.045	0.05
Nickel	11 J	10 J	8.3	5.2	7.5	8.1
Selenium	1.3 J	3.1 UJ	1.8 U	1.8 U	1.9 U	1 J
Silver	0.41 UJ	0.62 UJ	0.36 U	0.37 U	0.39 U	0.32 U
Thallium	0.41 UJ	0.62 UJ	0.36 U	0.37 U	0.39 U	0.32 U
Tin	41 UJ	62 UJ	36 U	37 U	39 U	32 U
Vanadium	370 J	230 J	150 J	67 J	170 J	350 J
Zinc	89 J	110 J	71	44	63	70

Notes:

mg/kg - milligrams per kilogram

U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated

QA/QC DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69ER01	69ER02	69ER03	69FB01	69ER-SD	69FB-SD
Sample ID	69ER01	69ER02	69ER03	69FB01	69ER-SD	69FB-SD
Sample Date	8/3/2010	8/4/2010	8/5/2010	8/5/2010	11/5/2010	11/5/2010
Inorganics (µg/L)						
Antimony	5 U	5 U	5 U	5 U	5 U	5 U
Arsenic	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Barium	6 U	6 U	6 U	6 U	5 U	5 U
Beryllium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cadmium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chromium	5 U	5 U	5 U	5 U	5 U	5 U
Cobalt	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Copper	1.1 J	5 U	1.7 J	1.1 J	2.4 J	5 U
Lead	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Mercury	0.24 U	0.24 U	0.24 U	0.24 U	0.2 U	0.2 U
Nickel	5 U	5 U	5 U	5 U	5 U	5 U
Selenium	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Silver	1 U	1 U	1 U	1 U	1 U	1 U
Thallium	2 U	2 U	2 U	2 U	1 U	1 U
Tin	8.3	5 U	5 U	5 U	5 U	5 U
Vanadium	10 U	10 U	10 U	10 U	10 U	10 U
Zinc	20 U	9 J	13 J	9.1 J	20 U	20 U

Notes:

µg/L - micrograms per liter

U - Not detected
J - Analyte present - Reported value is estimated

APPENDIX C
DATA VALIDATION REPORT SUMMARIES

2008 DATA VALIDATION REPORT SUMMARIES

TEST AMERICA SAVANNAH SDG 36289-3

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36289-3, Test America-Savannah
NAPR SWMU 69, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36289-3. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006-SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	Metals
69SB07-00	680-36289-2	soil	X	X	X
69SB07-01	680-36289-29	soil	X	X	X
69SB07-05	680-36289-30	soil	X	X	X
69SB08-00	680-36289-31	soil	X	X	X
69SB08-01	680-36289-32	soil	X	X	X
69SB08-05	680-36289-33	soil	X	X	X
69SB08-05D	680-36289-34	soil	X	X	X
69SB11-00	680-36289-35	soil	X	X	X
69SB11-00D	680-36289-36	soil	X	X	X
69SB11-01	680-36289-37	soil	X	X	X
69SB11-05	680-36289-38	soil	X	X	X
69SB12-00	680-36289-39	soil	X	X	X
69SB12-01	680-36289-40	soil	X	X	X
69SB12-05	680-36289-41	soil	X	X	X
69TB01	680-36289-42	water	X		
69SB08-05 MS	680-36289-33MS	soil	X	X	X
69SB08-05 MSD	680-36289-33MSD	soil	X	X	X

The following quality control samples were provided with this SDG: sample 69SB08-05D-field duplicate of sample 69SB08-05; sample 69SB11-00D-field duplicate of sample 69SB11-00; and sample 69TB01-trip blank.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times
- GC/MS Tuning *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards
- CRDL Standards *
- Blanks
- Internal Standards
- Surrogate Recoveries
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation
- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

VOA

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in the rejection of non-detect values for these compounds. Due to high %D values some compounds were qualified as estimated.

Blank contamination was noted in the method and QC blanks associated with samples in this batch. Qualifications were added to the data.

SVOA

Sample 69SB07-01RE extraction holding time was exceeded; therefore all results were qualified as estimated (J/UJ).

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in the rejection of non-detect values for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Two samples exhibited non-compliant internal standards that resulted in qualifications to the data.

The associated matrix spike and matrix spike duplicate exhibited 2% and 3% recoveries for one compound; therefore the results for the compound in the native sample were qualified as estimated.

Blank contamination was noted in the method blanks associated with samples in this batch. Qualifications were added to the data.

The field duplicate pair did not exhibit comparable results for two compounds, which resulted in qualification of the data.

Metals

The ICSAB standard exhibited a non-compliant recovery below the QC limit for the analyte cadmium. Based on Region II guidelines all positive and non-detect results for cadmium in the field samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in the samples in this SDG.

The field duplicate pair of samples 69SB08-05 and 69SB08-05D exhibited non-compliant RPDs for the analytes chromium, copper, cobalt and vanadium >35% but less than 120%. The field duplicate pair of samples 69SB11-00 and 69SB11-00D exhibited non-compliant RPDs for the analyte arsenic > +/- 2X RL for results less than five times the RL. Based on the Region II guidance, these analytes were qualified as estimated in both the sample and field duplicate.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 04/29/08 and samples were received at the laboratory 04/30/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements with the following exceptions.

SVOA

The re-extraction of sample 69-SB07-01 exceeded the extraction holding time; therefore all results were qualified as estimated (J/UJ).

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 04/29/08	isobutyl alcohol	0.0458	69TB01	J/R
IC 05/02/08	acrolein isobutyl alcohol	0.0298 0.0260	all soil samples	J/R
CC 05/02/08	2-chloro-1,3-butadiene isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane dichlorodifluoromethane	28.1% 33.5% 23.2% 33.1% 24.2% 26.3%	69TB01	
CC 05/03/08	acrolein acetone 3-chloro-1-propene	0.01628 0.03509 110.6%	69SB07-00, 69SB07-01, 69SB07-05, 69SB08-00, 69SB08-01, 69SB08-05	J/R
	acetonitrile acrylonitrile 2-chloro-1,3-butadiene propionitrile bromomethane vinyl acetate	35.6% 32.0% 70.5% 25.3% 41.1% 22.2%		J/UJ

Technical Holding Times

According to chain of custody records, sampling was performed on 04/29/08 and samples were received at the laboratory 04/30/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements with the following exceptions

SVOA

The re-extraction of sample 69-SB07-01 exceeded the extraction holding time; therefore all results were qualified as estimated (J/UJ).

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 04/29/08	isobutyl alcohol	0.0458	69TB01	J/R
IC 05/02/08	acrolein isobutyl alcohol	0.0298 0.0260	all soil samples	J/R
CC 05/02/08	2-chloro-1,3-butadiene isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane dichlorodifluoromethane	28.1% 33.5% 23.2% 33.1% 24.2% 26.3%	69TB01	J/UJ
CC 05/03/08	acrolein acetone 3-chloro-1-propene	0.01628 0.03509 110.6%	69SB07-00, 69SB07-01, 69SB07-05, 69SB08-00, 69SB08-01, 69SB08-05	J/R
	acetonitrile acrylonitrile 2-chloro-1,3-butadiene propionitrile bromomethane vinyl acetate	35.6% 32.0% 70.5% 25.3% 41.1% 22.2%		J/UJ

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Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
69TB01	isobutyl alcohol	+/-	J/R
all soil samples	acrolein isobutyl alcohol	+/-	J/R
69TB01	2-chloro-1,3-butadiene isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane dichlorodifluoromethane	+/-	J/UJ
69SB07-00, 69SB07-01, 69SB07-05, 69SB08-00, 69SB08-01, 69SB08-05	acrolein acetone 3-chloro-1-propene	+/-	J/R
69SB07-00, 69SB07-01, 69SB07-05, 69SB08-00, 69SB08-01, 69SB08-05	acetonitrile acrylonitrile 2-chloro-1,3-butadiene propionitrile bromomethane vinyl acetate	+/-	J/UJ
69SB08-05D, 69SB11-00, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	acrolein isobutyl alcohol	+/-	J/R
69SB08-05D, 69SB11-00, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	iodomethane acrylonitrile 2-chloro-1,3-butadiene methacrylonitrile methyl methacrylate ethyl methacrylate bromomethane acetone vinyl acetate 2-butanone 1,2-dichloroethane 2-hexanone 1,2-dibromo-3-chloropropane	+/-	J/UJ
69SB12-00, 69SB11-00D	acetone acrolein isobutyl alcohol	+/-	J/R
69SB12-00, 69SB11-00D	bromomethane vinyl acetate 1,2-dibromo-3-chloropropane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene	+/-	J/UJ
69SB12-00, 69SB11-00D	acetone	+	U at reported value
69SB08-05D, 69SB11-00, 69SB11-01, 69SB12-00	2-butanone	+	U at reported value

011 JAC 62208

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/04/08	acrolein isobutyl alcohol	0.02189 0.02503	69SB08-05D, 69SB11-00, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	J/R
	iodomethane acrylonitrile 2-chloro-1,3-butadiene methacrylonitrile methyl methacrylate ethyl methacrylate bromomethane acetone vinyl acetate 2-butanone 1,2-dichloroethane 2-hexanone 1,2-dibromo-3-chloropropane	25.2% 36.9% 30.4% 23.2% 37.8% 26.7% 22.8% 47.8% 47.6% 39.4% 20.2% 25.3% 43.3%		J/UJ
CC 05/05/08	acetone acrolein isobutyl alcohol	0.03778 0.02121 0.0226	69SB12-00, 69SB11-00D	J/R
	bromomethane vinyl acetate 1,2-dibromo-3-chloropropane hexachlorobutadiene 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene	53.2% 24.5% 21.2% 25.8% 58.7% 23.3% 26.5% 21.7%		J/UJ

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/01/08	hexachlorophene	0.0466	all samples	J/R

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/09/08	4-nitroquinoline-1-oxide	0.03268	69SB07-00	J/R
	hexachlorophene	0.02812		
	2,4-dinitrophenol	29.3%		J/UJ
	4-nitrophenol	20.2%		
	2,4-dinitrotoluene	23.5%		
	4-nitroaniline	24.9%		
	4,6-dinitro-2-methylphenol	25.5%		
	phenanthrene	26.0%		
	indeno(1,2,3-cd)pyrene	24.2%		
	n-nitrosomorpholine	27.8%		
	hexachloropropene	40.6%		
	n-nitroso-di-n-butylamine	27.3%		
	disulfoton	22.3%		
	famphur	34.5%		
	methapyrilene	40.2%		
CC 05/12/08	n-nitrosopyrrolidine	22.0%	69SB07-05,	J/UJ
	n-nitrosomorpholine	22.6%	69SB08-00,	
	n-nitrosopiperidine	21.2%	69SB08-05,	
	hexachloropropene	37.7%	69SB08-05D,	
	n-nitroso-di-n-butylamine	29.5%	69SB11-00D,	
	2-naphthylamine	24.5%	69SB11-05,	
	methapyrilene	40.7%	69SB12-00,	
	3,3-dimethylbenzidine	51.9%	69SB12-01	
	aramite, total	33.2%		
	disulfoton	20.3%		
	2,4-dinitrophenol	23.1%		
	4,6-dinitro-2-methylphenol	30.7%		
	indeno(1,2,3-cd)pyrene	21.5%		
	4-nitroquinoline-1-oxide	0.03336		J/R
	hexachlorophene	0.03592		
CC 05/13/08	4-nitrophenol	23.5%	69SB08-01,	J/UJ
	4,6-dinitro-2-methylphenol	43.1%	69SB11-00,	
	n-nitrosomorpholine	23.2%	69SB11-01,	
	n-nitrosopiperidine	20.8%	69SB12-05	
	hexachloropropene	32.6%		
	n-nitroso-di-n-butylamine	28.6%		
	2-naphthylamine	21.6%		
	methapyrilene	32.7%		
	3,3-dimethylbenzidine	45.6%		
	aramite, total	38.7%		
	4-nitroquinline-1-oxide	0.03507		J/R
	hexachlorophene	0.03126		
CC 05/15/08	2,4-dinitrotoluene,	24.2%	69SB07-01RE	J/UJ
	4,6-dinitro-2-methylphenol	35.3%		
	n-nitrosopiperidine	23.2%		
	hexachloropropene	48.8%		
	a,a-dimethylphenethylamine	29.8%		
	n-nitroso-di-n-butylamine	27.8%		
	pronamide	21.2%		
	hexachlorophene	24.9%		
	4-nitroquinline-1-oxide	0.02950		J/R

ICSA/ICSAB Standards

Metals

The associated final ICSAB standard exhibited a non-compliant recovery less than the low QC limit for the analyte cadmium (78%). Based on Region II guidelines, reported positive and non-detect results for cadmium were qualified as estimated J/UJ in all samples.

Blanks

VOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blank 05/05/08	acetone	16J ug/Kg	50 ug/Kg	2X RL
FB01	2-butanone	0.69J ug/L	10 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69SB12-00, 69SB11-00D	acetone	U at reported value
69SB08-05D, 69SB11-00, 69SB11-01, 69SB12-00	2-butanone	U at reported value

SVOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
MB 05/12	bis(2ethylhexyl)phthalate	11J ug/Kg	33 ug/Kg	2X RL
MB 05/15	bis(2ethylhexyl)phthalate	16J ug/Kg	33 ug/Kg	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69SB08-01, 69SB08-05, 69SB08-05D, 69SB11-01, 69SB11-05, 69SB12-00, 69SB12-01, 69SB12-05, 69SB07-01RE	bis(2ethylhexyl)phthalate	U at reported value

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level	Q Flag
CCB	antimony	0.10150J ug/L	>MDL up to RL	U
	silver	0.019J ug/L	>MDL up to RL	U

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69SB07-00, 69SB08-00, 69SB11-00, 69SB11-00D, 69SB12-00, 69SB07-01, 69SB08-01, 69SB11-05	antimony	U
69SB08-05D, 69SB11-00, 69SB11-00D, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	silver	U

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Internal Standards

SVOA

Sample 69SB11-00D exhibited low recovery for internal standard chrysene-d5; therefore all the associated compounds were qualified as estimated (J/UJ).

Samples 69SB11-05 and 69SB12-01 exhibited low recovery for internal standard perylene-d12; therefore all the associated compounds were qualified as estimated (J/UJ).

Sample 69SB11-00D exhibited extremely low recovery for internal standard perylene-d12; therefore all associated compound positive results were qualified as estimated (J) and non-detected results were qualified as rejected (R).

Matrix Spike Recoveries

SVOA

A matrix spike and matrix spike duplicate was submitted for sample 69SB08-05. The MS exhibited 2% recovery and the MSD exhibited 3% for 2,4-dinitrophenol. The compound was qualified as estimated (J/UJ) in sample 69SB08-05.

Field Duplicates

SVOA

The field duplicate pair of samples 69SB11-00 and 69SB11-00D exhibited non-comparable results for benzo(a)pyrene with 119% RPD, bis(2-ethylehxyl)phthalate with 142% RPD, butyl benzyl phthalate with 126% RPD, dibenzo(a,h)anthracene with 200% RPD, indeno(1,2,3-cd)pyrene with 85% RPD and benzo(a)anthracene with 200 % RPD. The results for these compounds were qualified estimated (J/UJ).

Metals

The field duplicate pair of samples 69SB08-05 and 69SB08-05D exhibited non-comparable results for chromium, cobalt, copper and vanadium based on Region II guidelines. The field duplicate pair of samples 69SB11-00 and 69SB11-00D exhibited non-comparable results for arsenic based on Region II guidelines. The reported positive results for these analytes were qualified estimated J in the respective field duplicate pairs only.

Identification/Quantitation

SVOA

The following samples, 69SB07-01RA, 69SB11-00DRA, 69SB11-05RA and 69SB12-01RA, were re-analyzed due to non-compliant surrogate recoveries in the initial analysis. The re-analyzed samples exhibited similar results. Therefore, the re-analyzed samples were not used in favor of the initial analysis.

Sample 69SB07-01 was re-extracted due to non-compliant surrogate and internal standard area recoveries. The re-extraction exhibited compliant results and therefore was used instead of the initial analysis.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Laura Maschhoff
President

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
69TB01	isobutyl alcohol	+/-	J/R
all soil samples	acrolein isobutyl alcohol	+/-	J/R
69TB01	2-chloro-1,3-butadiene isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane dichlorodifluoromethane	+/-	
69SB07-00, 69SB07-01, 69SB07-05, 69SB08-00, 69SB08-01, 69SB08-05	acrolein acetone 3-chloro-1-propene	+/-	J/R
69SB07-00, 69SB07-01, 69SB07-05, 69SB08-00, 69SB08-01, 69SB08-05	acetonitrile acrylonitrile 2-chloro-1,3-butadiene propionitrile bromomethane vinyl acetate	+/-	J/UJ
69SB08-05D, 69SB11-00, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	acrolein isobutyl alcohol	+/-	J/R
69SB08-05D, 69SB11-00, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	iodomethane acrylonitrile 2-chloro-1,3-butadiene methacrylonitrile methyl methacrylate ethyl methacrylate bromomethane acetone vinyl acetate 2-butanone 1,2-dichloroethane 2-hexanone 1,2-dibromo-3-chloropropane	+/-	J/UJ
69SB12-00, 69SB11-00D	acetone acrolein isobutyl alcohol	+/-	J/R
69SB12-00, 69SB11-00D	bromomethane vinyl acetate 1,2-dibromo-3-chloropropane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene	+/-	J/UJ
69SB12-00, 69SB11-00D	acetone	+	U at reported value
69SB08-05D, 69SB11-00, 69SB11-01, 69SB12-00	2-butanone	+	U at reported value

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
69SB07-01RE	all results	+/-	J/UJ
all samples	hexachlorophene	+/-	J/R
69SB07-00	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69SB07-00	2,4-dinitrophenol 4-nitrophenol 2,4-dinitrotoluene 4-nitroaniline 4,6-dinitro-2-methylphenol phenanthrene indeno(1,2,3-cd)pyrene n-nitrosomorpholine hexachloropropene n-nitroso-di-n-butylamine disulfoton famphur methapyrilene	+/-	J/UJ
69SB07-05, 69SB08-00, 69SB08-05, 69SB08-05D, 69SB11-00D, 69SB11-05, 69SB12-00, 69SB12-01	n-nitrosopyrrolidine n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine 2-naphthylamine methapyrilene 3,3-dimethylbenzidine aramite, total disulfoton 2,4-dinitrophenol 4,6-dinitro-2-methylphenol indeno(1,2,3-cd)pyrene	+/-	J/UJ
69SB07-05, 69SB08-00, 69SB08-05, 69SB08-05D, 69SB11-00D, 69SB11-05, 69SB12-00, 69SB12-01	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69SB08-01, 69SB11-00, 69SB11-01, 69SB12-05	4-nitrophenol 4,6-dinitro-2-methylphenol n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine 2-naphthylamine methapyrilene 3,3-dimethylbenzidine aramite, total	+/-	J/UJ
69SB08-01, 69SB11-00, 69SB11-01, 69SB12-05	4-nitroquinline-1-oxide hexachlorophene	+/-	J/R

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
69SB07-01RE	2,4-dinitrotoluene, 4,6-dinitro-2-methylphenol n-nitrosopiperidine hexachloropropene a,a-dimethylphenethylamine n-nitroso-di-n-butylamine pronamide hexachlorophene	+/-	J/UJ
69SB07-01RE	4-nitroquinline-1-oxide	+/-	J/R
69SB08-01, 69SB08-05, 69SB08-05D, 69SB11-01, 69SB11-05, 69SB12-00, 69SB12-01, 69SB12-05, 69SB07-01RE	bis(2ethylhexyl)phthalate	+	U at reported value
69SB11-00D	all compounds associated with: chrysene-d5	+/-	J/UJ
69SB11-05, 69SB12-01	all compounds associated with: perylene-d12	+/-	J/UJ
69SB11-00D	all compounds associated with: perylene-d12	+/-	J/R
69SB08-05	2,4-dinitrophenol	+/-	J/UJ
69SB11-00, 69SB11-00D	benzo(a)pyrene bis(2-ethylehxyl)phthalate butyl benzyl phthalate dibenzo(a,h)anthracene indeno(1,2,3-cd)pyrene benzo(a)anthracene	+/-	J/UJ
69SB07-01RA, 69SB11-00DRA, 69SB11-05RA, 69SB12-01RA, 69SB07-01	all results	+/-	R

Summary of Data Qualifications, continued

Metals

Sample ID	Analyte	Results	Q flag
all samples	cadmium	+/-	J/UJ
69SB07-00, 69SB08-00, 69SB11-00, 69SB11-00D, 69SB12-00, 69SB07-01, 69SB08-01, 69SB11-05	antimony	+ >MDL up to RL	U
69SB08-05D, 69SB11-00, 69SB11-00D, 69SB11-01, 69SB11-05, 69SB12-01, 69SB12-05	silver	+ >MDL up to RL	U
69SB08-05, 69SB08-05D	chromium cobalt copper vanadium	+	J
69SB11-00, 69SB11-00D	arsenic	+	J

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Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 36360-3

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36360-3, Test America-Savannah
NAPR SWMU 69, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36360-3. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006-SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	Metals
69SB01-00	680-36360-29	soil	X	X	X
69SB01-00D	680-36360-30	soil	X	X	X
69SB02-00	680-36360-31	soil	X	X	X
69SB03-00	680-36360-32	soil	X	X	X
69SB04-00	680-36360-33	soil	X	X	X
69SB05-00	680-36360-34	soil	X	X	X
69SB06-00	680-36360-35	soil	X	X	X
69SB09-00	680-36360-36	soil	X	X	X
69SB10-00	680-36360-37	soil	X	X	X
69SB13-00	680-36360-38	soil	X	X	X
69SB14-00	680-36360-39	soil	X	X	X
69SB15-00	680-36360-40	soil	X	X	X
69SB16-00	680-36360-41	soil	X	X	X
69SB17-00	680-36360-42	soil	X	X	X
69SB18-00	680-36360-43	soil	X	X	X
69SB19-00	680-36360-44	soil	X	X	X
69SB20-00	680-36360-45	soil	X	X	X
69SB21-00	680-36360-46	soil	X	X	X
69SB21-00D	680-36360-47	soil	X	X	X
69SB22-00	680-36360-48	soil	X	X	X
69SB01-00 MS	680-36360-29MS	soil	X	X	X
69SB01-00 MSD	680-36360-29MSD	soil	X	X	X
69SB21-00 MS	680-36360-46MS	soil	X	X	X
69SB21-00 MSD	680-36360-46MSD	soil	X	X	X

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The following quality control samples were provided with this SDG: sample 69SB01-00D-field duplicate of sample 69SB01-00; and sample 69SB21-00D-field duplicate of sample 69SB21-00.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition
- Technical Holding Times *
- GC/MS Tuning *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards
- CRDL Standards *
- Blanks
- Internal Standards
- Surrogate Recoveries
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates
- Identification/Quantitation
- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

VOA

Two soil samples contained 50-90% water that resulted in qualifying the data results as estimated.

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Blank contamination was noted in the method and QC blanks associated with samples in this batch. Qualifications were added to the data.

SVOA

Two soil samples contained 50-90% water that resulted in qualifying the data results as estimated.

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Several samples exhibited non-compliant surrogate recoveries that resulted in qualifications to the data.

Several samples exhibited non-compliant internal standards that resulted in qualifications to the data.

Two matrix spike pairs were submitted with this data package. One matrix spike and matrix spike duplicate exhibited below 10% recoveries for two compounds; therefore the results for these compounds in the native sample were qualified as estimated. Another matrix spike pair exhibited high recoveries for four compounds that exhibited positive results in the native sample; the results were qualified as estimated (J).

Blank contamination was noted in the method blanks associated with samples in this batch. Qualifications were added to the data.

The field duplicate pair did not exhibit comparable results for several compounds that resulted in qualifications.

Metals

Two soil samples contained 50-90% water that resulted in the qualification of results as estimated.

The ICSAB standard exhibited a non-compliant recovery below the QC limit for the analyte cadmium. Based on Region II guidelines all positive and non-detect results for cadmium in the field samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spikes exhibited non-compliant %Rs for one analyte for which qualifications were required. Positive and non-detect results for antimony were flagged as estimated J/UJ in the samples.

The associated serial dilution exhibited non-compliant %Ds for two analytes. Positive and non-detect results for the analytes chromium and vanadium were qualified as estimated J in the samples.

The field duplicate pair of samples 69SB01-00 and 69SB01-00D exhibited a non-compliant RPD >35% but less than 120% for the analyte lead. The field duplicate pair of samples 69SB21-00 and 69SB21-00D exhibited non-compliant RPDs >35% but less than 120% for the analytes copper, lead and vanadium. Based on the Region II guidance, these analytes were qualified as estimated in both the sample and field duplicate of the respective field duplicate pairs.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets.

Sample Condition

All Fractions

The following soil samples contained 50-90% water that resulted in qualifying the positive results as estimated.

Sample ID	% Moisture	Qualifier
69SB09-00	73.1	J/UJ
69SB02-00	51.7	J/UJ

Technical Holding Times

According to chain of custody records, sampling was performed on 04/28-29/08 and samples were received at the laboratory 04/30/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/02/08	acrolein acetonitrile propionitrile isobutyl alcohol	0.0250 0.0406 0.0414 0.0126	69SB18-00, 69SB16-00, 69SB14-00, 69SB20-00, 69SB21-00, 69SB17-00, 69SB01-00, 69SB21-00D, 69SB22-00	J/R
CC 05/08/08	acrolein acetonitrile isobutyl alcohol	0.02689 0.03031 0.01971	69SB18-00, 69SB16-00, 69SB14-00, 69SB20-00, 69SB21-00, 69SB17-00, 69SB01-00, 69SB21-00D, 69SB22-00	J/R
	propionitrile methacrylonitrile methyl methacrylate ethyl methacrylate trans-1,4-dichloro-2-butene bromomethane	53.5% 36.6% 40.8% 28.1% 46.4% 24.9%		J/UJ
CC 05/08/08	isobutyl alcohol	0.01965	69SB19-00	J/R
	acetone acetonitrile pentachloroethane	21.6% 21.1% 25.2%		J/UJ
CC 05/09/08	acrolein isobutyl alcohol	0.04896 0.02421	69SB01-00D, 69SB05-00	J/R
	iodomethane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane	21.1% 54.0% 25.6% 22.0% 32.1% 35.8%		J/UJ
CC 05/10/08	acrolein isobutyl alcohol	0.03757 0.02072	69SB02-00, 69SB03-00, 69SB06-00, 69SB09-00, 69SB13-00, 69SB15-00	J/R
	3-chloro-1-propene acrylonitrile pentachloroethane	53.5% 22.0% 42.5%		J/UJ

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/11/08	acrolein isobutyl alcohol acetone	0.03831 0.01717 0.03838	69SB04-00	J/R
	acetonitrile 3-chloro-1-propene acrylonitrile pentachloroethane chloromethane bromomethane	23.4% 41.6% 26.3% 35.4% 20.9% 57.8%		J/UJ
CC 05/13/08	isobutyl alcohol	0.02138	69SB10-00	J/R
	acetonitrile pentachloroethane	86.3% 30.9%		J/UJ

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/01/08	hexachlorophene	0.0466	69SB01-00, 69SB01-00D, 69SB02-00, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB18-00, 69SB19-00	J/R
CC 05/16/08	4-nitroquinoline-1-oxide	0.03572	69SB01-00, 69SB01-00D, 69SB02-00, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB18-00, 69SB19-00	J/R
	2,4-dinitrophenol 4,6-dinitro-2-methylphenol 3,3-dichlorobenzidine n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine 1,4-naphthoquinone pentachloronitrobenzene methapyrilene 7,12-dimethylbenz(a)anthracene aramite, total	22.4% 34.3% 34.8% 25.0% 27.2% 40.4% 35.8% 26.6% 26.2% 30.5% 23.8% 38.4%		J/UJ
CC 05/28/08	4-nitroquinoline-1-oxide	0.0276	69SB20-00, 69SB21-00, 69DB21-00D, 69SB22-00	J/R
	4-nitroaniline 3,3-dichlorobenzidine sulfotepp	31.1% 39.9% 22.6%		J/UJ

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/24/08	4-nitroquinoline-1-oxide hexachlorophene	0.02164 0.04042	69SB03-00, 69SB04-00, 69SB05-00	J/R
	2,4-dinitrophenol 4-nitrophenol 4-nitroaniline 4,6-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene dinoseb a,a-dimethylphenethylamine phenacetin 4-aminobiphenyl methapyrilene 3,3-dimethylbenzidine 2-acetylaminofluorene aramite, total	30.6% 25.3% 23.5% 21.5% 23.8% 28.6% 27.7% 43.2% 25.4% 23.4% 28.0% 39.9% 41.1% 26.1%		J/UJ
CC 06/05/08	4-nitroquinoline-1-oxide hexachlorophene	0.02879 0.03294	69SB09-00	J/R
	3-nitroaniline 4-nitroaniline 3,3-dichlorobenzidine 3,3-dimethylbenzidine	24.1% 36.9% 47.3% 54.1%		J/UJ
CC 06/03/08	4-nitroquinoline-1-oxide hexachlorophene	0.03020 0.04975	69SB17-00	J/R
	3-nitroaniline 4-nitroaniline dibenzofuran 4-nitroaniline 3,3-dichlorobenzidine 3,3-dimethylbenzidine	27.1% 35.5% 25.7% 27.6% 28.6% 43.6%		J/UJ

ICSA/ICSAB Standards

Metals

The associated final ICSAB standard exhibited non-compliant recoveries less than the lower QC limit for the analyte cadmium (78%/73%). Based on Region II guidelines, reported positive and non-detect results for cadmium were qualified as estimated J/UJ in all samples.

Blanks

VOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to

the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blk 05/08/08	isobutyl alcohol	85J ug/Kg	200 ug/Kg	RL
Method Blk 05/10/08	acetone	9.4J ug/L	50 ug/Kg	2X RL
FB01	2-butanone	0.69J ug/L	10 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69SB19-00	isobutyl alcohol	U at reported value
69SB03-00, 69SB06-00	acetone	U at reported value
69SB01-00, 69SB01-00D, 69SB05-00, 69SB17-00, 69SB19-00, 69SB21-00, 69SB22-00	2-butanone	U at reported value

SVOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blk 59/21	bis(2ethylhexyl)phthalate	25J ug/Kg	33 ug/Kg	2X RL
Method Blk 62/21	bis(2ethylhexyl)phthalate	19J ug/Kg	33 ug/Kg	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69SB01-00D, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB19-00, 69SB03-00, 69SB17-00, 69SB20-00, 69SB21-00, 69SB21-00D, 69SB22-00	bis(2ethylhexyl)phthalate	U at reported value

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level	Q Flag
CCB	antimony	0.09983J ug/L	>MDL up to RL	U

Field QC blank qualifications were made using QC blank tracking. Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
All samples except 69SB05-00	antimony	U

Internal Standards

SVOA

The following samples exhibited non-compliant internal standard area recoveries and were qualified as indicated.

Sample ID	Non-compliant Standard	Qual
69SB06-00, 69SB16-00, 69SB18-00, 69SB19-00	perylene-d12 chrysene-d12	J/UJ
69SB10-00	perylene-d12	J/UJ

Surrogate Recoveries

SVOA

The following samples exhibited non-compliant surrogate recoveries and were qualified as indicated.

Sample ID	Non-compliant surrogate	% Rec	QC limits	Qualification
69SB01-00	2-fluorophenol phenol-d5	37 35	41-110 43-110	J/UJ acid

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Sample ID	Non-compliant surrogate	% Rec	QC limits	Qualification
69SB02-00	2-fluorophenol	20	41-110	J/UJ all
	phenol-d5	20	43-110	
	nitrobenzene-d5	22	36-110	
	2-fluorobiphenyl	26	44-110	
	2,4,6-tribromophenol	33	36-128	
69SB03-00	2-fluorophenol	31	41-110	J/UJ all
	phenol-d5	31	43-110	
	nitrobenzene-d5	30	36-110	
	2-fluorobiphenyl	37	44-110	
	2,4,6-tribromophenol	26	36-128	
69SB04-00	2-fluorophenol	31	41-110	J/UJ all
	phenol-d5	32	43-110	
	nitrobenzene-d5	31	36-110	
	2-fluorobiphenyl	35	44-110	
	2,4,6-tribromophenol	30	36-128	
69-SB05-00	2-fluorophenol	36	41-110	J/UJ all
	phenol-d5	36	43-110	
	2-fluorobiphenyl	35	44-110	
	2,4,6-tribromophenol	32	36-128	
69SB06-00	2-fluorophenol	27	41-110	J/UJ all
	phenol-d5	27	43-110	
	nitrobenzene-d5	29	36-110	
	2-fluorobiphenyl	34	44-110	
69SB09-00	2-fluorophenol	31	41-110	J/UJ all
	phenol-d5	32	43-110	
	nitrobenzene-d5	28	36-110	
	2-fluorobiphenyl	33	44-110	
69SB15-00	2-fluorophenol	35	41-110	J/UJ acid
	phenol-d5	33	43-110	
	2-fluorobiphenyl	41	44-110	
69SB16-00	2-fluorophenol	36	41-110	J/UJ acid
	phenol-d5	37	43-110	
	2-fluorobiphenyl	41	44-110	
69SB17-00	2-fluorophenol	37	41-110	J/UJ all
	phenol-d5	37	43-110	
	nitrobenzene-d5	35	36-110	
	2-fluorobiphenyl	40	44-110	
69SB18-00	2-fluorophenol	39	41-110	J/UJ acid
	phenol-d5	42	43-110	
69SB20-00	2-fluorophenol	37	41-110	J/UJ all
	phenol-d5	38	43-110	
	nitrobenzene-d5	32	36-110	
	2-fluorobiphenyl	36	44-110	
69SB21-00	2-fluorophenol	40	41-110	J/UJ acid
	phenol-d5	41	43-110	
	2-fluorobiphenyl	41	44-110	
69SB21-00D	2-fluorophenol	38	41-110	J/UJ all
	phenol-d5	39	43-110	
	nitrobenzene-d5	33	36-110	
	2-fluorobiphenyl	38	44-110	
69SB22-00	nitrobenzene-d5	35	36-110	J/UJ B/N
	2-fluorobiphenyl	40	44-110	

Matrix Spike Recoveries

SVOA

A matrix spike and matrix spike duplicate was submitted for sample 69SB21-00. The MS exhibited 0%, 1% and 3% recoveries and the MSD exhibited 1%, 2% and 11% for 2,4-dimethylphenol, 4,6-dinitro-2-methylphenol and hexachlorocyclopentadiene. These compounds were qualified as estimated (J/UJ) in sample 69SB21-00 and the associated field duplicate 69SB21-00D.

A matrix spike and matrix spike duplicate was submitted for sample 69SB01-00. The MS exhibited 124%, 249%, 206% and 441% recoveries and the MSD exhibited 120%, 296%, 248% and 469% for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and benzo(g,h,i)perylene. These compound positive results were qualified as estimated (J) in sample 69SB01-00 and the associated field duplicate 69SB01-00D.

Metals

The matrix spikes of sample 69SB21-00 exhibited non-compliant %Rs for one analyte that required qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS	Analytes	Samples	%R	Q Flag
69SB21-00	antimony	all samples	69%/68%	J/UJ

Serial Dilutions

Metals

The serial dilution of sample 69SB21-00 exhibited non-compliant %Ds for chromium and vanadium that required qualification in the field samples. A summary of this non-compliance and affected samples are noted in the following table.

SD	Analytes	Samples	RPD	Q Flag
69SB21-00	chromium	all samples	26.9%	J/UJ
	vanadium		48.3%	

Field Duplicates

SVOA

The field duplicate pair of samples 69SB01-00 and 69SB01-00D exhibited non-comparable results for benzo(a)anthracene with 165% RPD, benzo(a)pyrene with 125% RPD, benzo(b)fluoranthene with 128% RPD, chrysene with 162% RPD, fluoranthene with 179% RPD, phenanthrene with 188% RPD and pyrene with 175% RPD. The results for these compounds were qualified estimated (J).

Metals

The field duplicate pair of samples 69SB01-00 and 69SB01-00D exhibited non-comparable results for lead based on Region II guidelines. The field duplicate pair of samples 69SB21-00 and 69SB21-00D exhibited non-comparable results for copper, lead and vanadium based on Region II guidelines. The reported positive results for these analytes were qualified estimated J in the respective field duplicate pairs only.

Identification/Quantitation

SVOA

All samples were re-extracted out of holding time due to non-compliant surrogate and internal standard recoveries in the initial analysis. The re-extracted samples were not used due to similar results and exceeded holding times.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Laura Maschhoff
President

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
69SB09-00, 69SB02-00	all results	+/-	J/UJ
69SB18-00, 69SB16-00, 69SB14-00, 69SB20-00, 69SB21-00, 69SB17-00, 69SB01-00, 69SB21-00D, 69SB22-00	acrolein acetonitrile propionitrile isobutyl alcohol	+/-	J/R
69SB18-00, 69SB16-00, 69SB14-00, 69SB20-00, 69SB21-00, 69SB17-00, 69SB01-00, 69SB21-00D, 69SB22-00	acrolein acetonitrile isobutyl alcohol	+/-	J/R
69SB18-00, 69SB16-00, 69SB14-00, 69SB20-00, 69SB21-00, 69SB17-00, 69SB01-00, 69SB21-00D, 69SB22-00	propionitrile methacrylonitrile methyl methacrylate ethyl methacrylate trans-1,4-dichloro-2-butene bromomethane	+/-	J/UJ
69SB19-00	isobutyl alcohol	+/-	J/R
69SB19-00	acetone acetonitrile pentachloroethane	+/-	J/UJ
69SB01-00D, 69SB05-00	acrolein isobutyl alcohol	+/-	J/R
69SB01-00D, 69SB05-00	iodomethane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane	+/-	J/UJ
69SB02-00, 69SB03-00, 69SB06-00, 69SB09-00, 69SB13-00, 69SB15-00	acrolein isobutyl alcohol	+/-	J/R
69SB02-00, 69SB03-00, 69SB06-00, 69SB09-00, 69SB13-00, 69SB15-00	3-chloro-1-propene acrylonitrile pentachloroethane	+/-	J/UJ
69SB04-00	acrolein isobutyl alcohol acetone	+/-	J/R
69SB04-00	acetonitrile 3-chloro-1-propene acrylonitrile pentachloroethane chloromethane bromomethane	+/-	J/UJ
69SB10-00	isobutyl alcohol	+/-	J/R
69SB10-00	acetonitrile pentachloroethane	+/-	J/UJ
69SB19-00	isobutyl alcohol	+	U at reported value

Summary of Data Qualifications, continued

VOA

Sample ID	Compound	Results	Q flag
69SB03-00, 69SB06-00	acetone	+	U at reported value
69SB01-00, 69SB01-00D, 69SB05-00, 69SB17-00, 69SB19-00, 69SB21-00, 69SB22-00	2-butanone	+	U at reported value

SVOA

Sample ID	Compound	Results	Q flag
69SB09-00, 69SB02-00	all results	+/-	J/UJ
69SB01-00, 69SB01-00D, 69SB02-00, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB18-00, 69SB19-00	hexachlorophene	+/-	J/R
69SB01-00, 69SB01-00D, 69SB02-00, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB18-00, 69SB19-00	4-nitroquinoline-1-oxide	+/-	J/R
69SB01-00, 69SB01-00D, 69SB02-00, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB18-00, 69SB19-00	2,4-dinitrophenol 4,6-dinitro-2-methylphenol 3,3-dichlorobenzidine n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine 1,4-naphthoquinone pentachloronitrobenzene methapyrilene 7,12-dimethylbenz(a)anthracene aramite, total	+/-	J/UJ
69SB20-00, 69SB21-00, 69DB21-00D, 69SB22-00	4-nitroquinoline-1-oxide	+/-	J/R
69SB20-00, 69SB21-00, 69DB21-00D, 69SB22-00	4-nitroaniline 3,3-dichlorobenzidine sulfotepp	+/-	J/UJ
69SB03-00, 69SB04-00, 69SB05-00	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
69SB03-00, 69SB04-00, 69SB05-00	2,4-dinitrophenol 4-nitrophenol 4-nitroaniline 4,6-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene dinoseb a,a-dimethylphenethylamine phenacetin 4-aminobiphenyl methapyrilene 3,3-dimethylbenzidine 2-acetylaminofluorene aramite, total	+/-	J/UJ
69SB09-00	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69SB09-00	3-nitroaniline 4-nitroaniline 3,3-dichlorobenzidine 3,3-dimethylbenzidine	+/-	J/UJ
69SB17-00	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69SB17-00	3-nitroaniline 4-nitroaniline dibenzofuran 4-nitroaniline 3,3-dichlorobenzidine 3,3-dimethylbenzidine	+/-	J/UJ
69SB01-00D, 69SB06-00, 69SB10-00, 69SB13-00, 69SB14-00, 69SB15-00, 69SB16-00, 69SB19-00, 69SB03-00, 69SB17-00, 69SB20-00, 69SB21-00, 69SB21-00D, 69SB22-00	bis(2ethylhexyl)phthalate	+	U at reported value
69SB06-00, 69SB16-00, 69SB18-00, 69SB19-00	all compounds associated with: perylene-d12 chrysene-d12	+/-	J/UJ
69SB10-00	all compounds associated with: perylene-d12	+/-	J/UJ
69SB01-00, 69SB15-00, 69SB16-00, 69SB18-00, 69SB21-00	all acid compounds	+/-	J/UJ
69SB02-00, 69SB03-00, 69SB04-00, 69-SB05-00, 69SB06-00, 69SB09-00, 69SB17-00, 69SB20-00, 69SB21-00D	all results	+/-	J/UJ
69SB22-00	all base/neutral compounds	+/-	J/UJ
69SB21-00, 69SB21-00D	2,4-dimethylphenol, 4,6-dinitro-2-methylphenol hexachlorocyclopentadiene	+/-	J/UJ

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
69SB01-00, 69SB01-00D	benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene	+	J
69SB01-00, 69SB01-00D	benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, pyrene	+	J
all RE samples	all results	+/-	R

Metals

Sample ID	Analyte	Results	Q flag
69SB09-00, 69SB02-00	all results	+/-	J/UJ
all samples	cadmium	+/-	J/UJ
All samples except 69SB05-00	antimony	>MDL up to RL	U
69SB16-00, 69SB19-00, 69SB20-00, 69SB21-00	lead	> blank level & up to 10X blank level	J
all samples	antimony	+/-	J/UJ
all samples	chromium vanadium	+/-	J/UJ
69SB01-00, 69SB01-00D	lead	+	J
69SB21-00, 69SB21-00D	copper lead vanadium	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 36360-4

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36360-4, Test America-Savannah
NAPR SWMU 69, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU 36360-4. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006- SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	Metals
69SB23-00	680-363660-49	soil	X	X	X
69SB24-00	680-363660-50	soil	X	X	X
69SB27-00	680-363660-56	soil	X	X	X
69SB27-01	680-363660-57	soil	X	X	X
69SB27-05	680-363660-58	soil	X	X	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- GC/MS Tuning *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards
- CRDL Standards *
- Blanks
- Internal Standards *
- Surrogate Recoveries
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *

- Field Duplicates NA
- Identification/Quantitation
- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

VOA

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Blank contamination was noted in the method and QC blanks associated with samples in this batch. Qualifications were added to the data.

SVOA

The initial calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Blank contamination was noted in the method blank associated with samples in this batch. Qualifications were added to the data.

All samples exhibited non-compliant surrogate recoveries that resulted in qualifying all results as estimated. The samples were re-extracted and exhibited compliant surrogate recoveries. However the samples were re-extracted 17-18 days out of extraction holding time and therefore were not used in favor the of initial analysis.

Metals

The ICSAB standard exhibited a non-compliant recovery below the QC limit for the analyte cadmium. Based on Region II guidelines all positive and non-detect results for cadmium in the field samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spikes (sample 69SB21-00 from SDG SWMU36360-3) exhibited non-compliant %Rs for one analyte for which qualifications were required. Positive and non-detect results for antimony were flagged as estimated J/UJ in the samples.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 04/29-05/1/08 and samples were received at the laboratory 05/02/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/02/08	acrolein acetonitrile propionitrile isobutyl alcohol	0.0250 0.0406 0.0414 0.0126	69SB24-00, 69SB23-00	J/R

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/08/08	acrolein acetonitrile isobutyl alcohol	0.02689 0.03031 0.01971	69SB24-00, 69SB23-00	J/R
	acrylonitrile propionitrile methyl methacrylate ethyl methacrylate trans-1,4-dichloro-2-butene bromomethane	20.2% 53.5% 40.8% 28.1% 46.4% 24.9%		J/UJ
CC 05/08/08	isobutyl alcohol	0.01965	69SB27-00	J/R
	acetonitrile pentachloroethane	42.5% 25.2%		J/UJ
CC 05/09/08	acrolein isobutyl alcohol acetone	0.04896 0.02421 0.04602	69SB27-01	J/R
	iodomethane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane	21.1% 54.0% 25.6% 22..0% 32.1% 35.8%		J/UJ
CC 05/13/08	acrolein isobutyl alcohol acetone	0.03593 0.01701 0.04542	69SB27-05	J/R
	acetonitrile 3-chloro-1-propene acrylonitrile 2-chloro-1,3-butadiene propionitrile pentachloroethane	24.0% 24.1% 30.6% 21.8% 22.9% 20.9%		J/UJ

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/28/08	4-nitroquinoline-1-oxide	0.0276	all samples	J/R
CC 05/28/08	sulfotepp 4-nitroaniline 3,3-dichlorobenzidine	22.6% 31.1% 39.9%	all samples	J/UJ

Metals

The associated final ICSAB standard exhibited non-compliant recoveries less than the lower QC limit for the analyte cadmium (73%). Based on Region II guidelines, reported

positive and non-detect results for cadmium were qualified as estimated J/UJ in all samples.

Blanks

VOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blank	acetone	580J ug/Kg	2000 ug/Kg	2X RL
FB01	2-butanone	0.69J ug/L	10 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69SB27-05	acetone	U at reported value
69SB23-00, 69SB24-00, 69SB27-00	2-butanone	U at reported value

SVOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blank	bis(2-ethylhexyl)phthalate	580J ug/Kg	33 ug/Kg	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
all samples	bis(2-ethylhexyl)phthalate	U at reported value

Metals

Associated blanks exhibited contamination as noted in the following table. The

laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level	Q Flag
CCB	antimony	0.09983J ug/L	>MDL up to RL	U
FB01	lead	0.38 ug/L	> blank level & up to 10X blank level	J

* All associations were made based on provided QC blank tracking. Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69SB23-00, 69SB24-00, 69SB27-00, 69SB27-05	antimony	U

Surrogates

SVOA

The following samples exhibited slightly low recoveries for the surrogates listed in the table below, qualifications were applied as noted.

Sample ID	Non-compliant Surrogate	% Rec	% QC Limit	Qual
69SB23-00	2-fluorophenol	36	41-110	J/UJ all
	phenol-d5	38	43-110	
	nitrobenzene-d5	32	36-110	
	2-fluorobiphenyl	35	44-110	
69SB24-00	2-fluorophenol	36	41-110	J/UJ all
	phenol-d5	38	43-110	
	nitrobenzene-d5	28	36-110	
	2-fluorobiphenyl	33	44-110	
	2,4,6-tribromophenol	33	36-128	
69SB27-00	2-fluorophenol	38	41-110	J/UJ all
	phenol-d5	40	43-110	
	nitrobenzene-d5	33	36-110	
	2-fluorobiphenyl	37	44-110	

Sample ID	Non-compliant Surrogate	% Rec	% QC Limit	Qual
69SB27-01	2-fluorophenol	35	41-110	J/UJ all
	phenol-d5	38	43-110	
	nitrobenzene-d5	31	36-110	
	2-fluorobiphenyl	36	44-110	
69SB27-05	2-fluorophenol	31	41-110	J/UJ all
	phenol-d5	31	43-110	
	nitrobenzene-d5	30	36-110	
	2-fluorobiphenyl	25	44-110	
	2,4,6-tribromophenol	27	36-128	

Matrix Spike Recoveries

Metals

The matrix spikes of sample 69SB21-00 (from SDG SWMU36360-3) exhibited non-compliant %Rs for one analyte that required qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS	Analytes	Samples	%R	Q Flag
69SB21-00	antimony	all samples	69%/68%	J/UJ

Identification/Quantitation

SVOA

All samples were re-extracted out of holding time due to non-compliant surrogate recoveries in the initial analysis. The re-extracted samples were not used, in favor of the initial analysis, due to the number of days the holding time was exceeded.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Laura Maschhoff
President

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
69SB24-00, 69SB23-00	acrolein acetonitrile propionitrile isobutyl alcohol	+/-	J/R
69SB24-00, 69SB23-00	acrolein acetonitrile isobutyl alcohol	+/-	J/R
69SB24-00, 69SB23-00	acrylonitrile propionitrile methyl methacrylate ethyl methacrylate trans-1,4-dichloro-2-butene bromomethane	+/-	J/UJ
69SB27-00	isobutyl alcohol	+/-	J/R
69SB27-00	acetonitrile pentachloroethane	+/-	J/UJ
69SB27-01	acrolein isobutyl alcohol acetone	+/-	J/R
69SB27-01	iodomethane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane	+/-	J/UJ
69SB27-05	acrolein isobutyl alcohol acetone	+/-	J/R
69SB27-05	acetonitrile 3-chloro-1-propene acrylonitrile 2-chloro-1,3-butadiene propionitrile pentachloroethane	+/-	J/UJ
69SB27-05	acetone	+	U at reported value
69SB23-00, 69SB24-00, 69SB27-00	2-butanone	+	U at reported value

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
all samples	4-nitroquinoline-1-oxide	+/-	J/R
all samples	sulfotepp 4-nitroaniline 3,3-dichlorobenzidine	+/-	J/UJ
all samples	bis(2-ethylhexyl)phthalate	+	U at reported value
all samples	all results	+/-	J/UJ
69SB23-00RE, 69SB24-00RE, 69SB27-00RE, 69SB27-01RE, 69SB27-01RE	all results	+/-	R

Metals

Sample ID	Analyte	Results	Q flag
all samples	cadmium	+/-	J/UJ
69SB23-00, 69SB24-00, 69SB27-00, 69SB27-05	antimony	+ >MDL up to RL	U
all samples	antimony	+/-	J/UJ

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Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
-	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Field blanks are used to qualify data only if field blank results are greater than prep blank results.
Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL when the field blank result is greater than the RL - result is reported as non-detect at the reported concentration.
R -	Sample result is greater than the RL and less than the field blank value when the field blank result is greater than the RL.
J -	Sample result is greater than the field blank value but less than 10X the field blank value when field blank result is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 36360-5

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36360-5, Test America-Savannah
NAPR SWMU 69, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36360-5. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006- SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B and 7470A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	TMetals	DMetals
69TB02	680-36360-51	water	X			
69GW11	680-36360-52	water	X	X	X	X
69GW11D	680-36360-53	water	X	X	X	X
69GW08	680-36360-54	water	X	X	X	X
69GW07	680-36360-55	water	X	X	X	X
69GW11MS	680-36360-52MS	water	X	X	X	X
69GW11MSD	680-36360-52MSD	water	X	X	X	X

The following quality control samples were provided with this SDG: sample 69TB02-trip blank; and sample 69GW11D-field duplicate of sample 69GW11.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition
- Technical Holding Times *
- GC/MS Tuning *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards
- CRDL Standards *
- Blanks
- Internal Standards *

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- Surrogate Recoveries *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation
- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page. Please note that the reviewer added an F to the sample ID to indicate dissolved metals analysis when necessary.

VOA

All sample vials for sample 69TB02 were received at the laboratory with headspace. According to Region II guidelines when all the vials for a sample have air bubbles or the VOA vial analyzed had air bubbles, all positive results are qualified as estimated (J) and non-detected results are rejected (R).

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D, in the continuing calibrations, values some compounds were qualified as estimated.

SVOA

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Blank contamination was noted in the method and QC blanks associated with samples in this batch. Qualifications were added to the data.

All samples were re-extracted due to non-compliant LCS and MS/MSD recoveries. The re-extracted LCS and MS/MSD exhibited compliant recoveries; therefore the re-extracted sample batch was used.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium and silver. Based on Region II guidelines all positive and non-detect results for cadmium and silver in the field samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in the samples in this SDG.

The MS/MSD pair of sample 69GW11 exhibited non-compliant recoveries for the analyte mercury that were below the QC limits. All results for mercury in the total metals samples were qualified as estimated J/UJ.

The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in one of the samples. Based on Region II validation guidelines the reported results for cobalt required rejection in the samples. However, both results were flagged U due to blank contamination so the disparity in the results is likely due to this contamination. Therefore, the results were not rejected.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets.

Sample Condition

VOA

All sample vials for sample 69TB02 were received at the laboratory with headspace. According to Region II guidelines when all the vials for a sample have air bubbles or the VOA vial analyzed had air bubbles, all positive results are qualified as estimated (J) and non-detected results are rejected (R).

Technical Holding Times

According to chain of custody records, sampling was performed on 04/30-05/01/08 and samples were received at the laboratory 05/02/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 04/29/08	isobutyl alcohol	0.0443	all samples	J/R
CC 05/06/08	acetonitrile	27.9%	all samples	J/UJ
	2-chloro-1,3-butadiene	51.6%		
	isobutyl alcohol	40.6%		
	methyl methacrylate	23.7%		
	trans-1,4-dichloro-2-butene	39.1%		
	pentachloroethane	32.4%		
	chloromethane	21.8%		
	trichlorofluoromethane	32.5%		
	acetone	21.3%		
	carbon disulfide	22.9%		

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/14/08	4-nitroquinoline-1-oxide	0.02164	69GW11RE, 69GW11DRE, 69GW07RE	J/R
	hexachlorophene	0.04042		
	a,a-dimethylphenethylamine	43.2%		J/UJ
	phenacetin	25.4%		
	4-aminobiphenyl	23.4%		
	methapyrilene	28.0%		
	3,3-dimethylbenzidine	39.9%		
	2-acetylaminofluorene	41.1%		
	aramite, total	26.1%		
	2,4-dinitrophenol	30.6%		
	4-nitroaniline	23.5%		
	4,6-dinitro-2-methylphenol	21.5%		
	dibenzo(a,h)anthracene	23.8%		
	benzo(g,h,i)perylene	28.6%		
	dinoseb	27.7%		
	sulfotepp	42.3%		
	phorate	52.8%		
	disulfoton	31.0%		
IC 05/28/08	4-nitroquinoline-1-oxide	0.0276	69GW08RE	J/R
CC 05/30/08	4-nitroquinoline-1-oxide	0.02940	69GW08RE	J/R
	hexachlorophene	0.03491		
	4-nitroaniline	34.5%		J/UJ
	4,6-dinitro-2-methylphenol	20.7%		
	3,3'-dichlorobenzidine	27.1%		
	indeno(1,2,3-cd)pyrene	21.7%		
	benzo(g,h,i)perylene	21.6%		
	dinoseb	22.4%		
	3,3-dimethylbenzidine	56.1%		

ICSA/ICSAB Standards

Metals

The associated final ICSAB standard exhibited non-compliant recoveries less than the lower QC limit for the analyte cadmium (77%/72%) and silver (78%/78%). Based on Region II guidelines, reported positive and non-detect results for cadmium and silver were qualified as estimated J/UJ in all samples.

Blanks

SVOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blank	di-n-butylphthalate	0.13J ug/L	1 ug/L	2X RL
FB01	di-n-butylphthalate	1.2 ug/L	0.97 ug/L	2X RL
ER04	di-n-butylphthalate	0.32J ug/L	0.97 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69GW11RE, 69GW11DRE, 69GW08RE, 69GW07RE	di-n-butylphthalate	U at reported value

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level	Q Flag
PBW1 - dissolved	arsenic	0.8930J ug/L	>MDL up to RL	U
	chromium	0.9955J ug/L	>MDL up to RL	U
	cobalt	0.0663J ug/L	>MDL up to RL	U
PBW2 - total	arsenic	1.0655J ug/L	>MDL up to RL	U
	chromium	1.0350J ug/L	>MDL up to RL	U
CCB6 (total)	cobalt	0.009J ug/L	>MDL up to RL	U
FB01	copper	2.1J ug/L	>MDL up to RL	U

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
all samples	arsenic	U
all samples	chromium	U
69GW07F, 69GW08F, 69GW07, 69GW08	cobalt	U
69GW11F	copper	U

Matrix Spike Recoveries

Metals

The matrix spikes of sample 69GW11 exhibited non-compliant %Rs for one analyte that required qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS	Analytes	Samples	%R	Q Flag
69GW11	mercury	all total samples	72.7%/ 74.4%	J/UJ

Identification/Quantitation

SVOA

The LCS and MS/MSD associated with samples, 69GW08, 69GW07, 69GW11 and 69GW11D, exhibited non-compliant recoveries. These samples were re-extracted; the re-extracted batch exhibited compliant recoveries for the LCS and MS/MSD. Therefore, the initial analysis of these samples was not used in favor of the re-extraction.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Laura Maschhoff
President

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
69TB02	all results	+/-	J/R
all samples	isobutyl alcohol	+/-	J/R
all samples	acetonitrile 2-chloro-1,3-butadiene isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane chloromethane trichlorofluoromethane acetone carbon disulfide	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
69GW11RE, 69GW11DRE, 69GW07RE	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69GW11RE, 69GW11DRE, 69GW07RE	a,a-dimethylphenethylamine phenacetin 4-aminobiphenyl methapyrilene 3,3-dimethylbenzidine 2-acetylaminofluorene aramite, total 2,4-dinitrophenol 4-nitroaniline 4,6-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene dinoseb sulfotepp phorate disulfoton	+/-	J/UJ
69GW08RE	4-nitroquinoline-1-oxide	+/-	J/R
69GW08RE	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69GW08RE	4-nitroaniline 4,6-dinitro-2-methylphenol 3,3'-dichlorobenzidine indeno(1,2,3-cd)pyrene benzo(g,h,i)perylene dinoseb 3,3-dimethylbenzidine	+/-	J/UJ

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
69GW11RE, 69GW11DRE, 69GW08RE, 69GW07RE	di-n-butylphthalate	+	U at reported value
69GW08, 69GW07, 69GW11, 69GW11D, 69GW11MS, 69GW11MSD	all results	+/-	R

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all samples	cadmium silver	+/-	J/UJ
all samples	arsenic	>MDL up to RL	U
all samples	chromium	>MDL up to RL	U
69GW07F, 69GW08F, 69GW07, 69GW08	cobalt	>MDL up to RL	U
69GW11F	copper	>MDL up to RL	U
all total metals samples	mercury	+/-	J/UJ

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 36419-2

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36419-2, Test America-Savannah
NAPR SWMU 69, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36419-2. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006- SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B and 7470A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	TMetals	DMetals
69GW25	680-36419-5	water	X	X	X	X
69GW12	680-36419-6	water	X	X	X	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition
- Technical Holding Times *
- GC/MS Tuning *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- Internal Standards *
- Surrogate Recoveries *
- Laboratory Control Samples
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates NA
- Identification/Quantitation

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- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. Please note that the reviewer added an F to the sample ID to indicate dissolved metals analysis when necessary. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

All Fractions

All samples were received at the laboratory at an elevated temperature above 10°C. In accordance with Region II guidelines the samples were qualified as estimated (J/UJ).

VOA

The continuing calibration exhibited to high %D values that resulted in qualifying these compounds as estimated.

SVOA

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Blank contamination was noted in the method and QC blank associated with samples in this batch. Qualifications were added to the data.

The LCS exhibited low recovery for one compound that resulted in qualifying that compound as estimated in all samples.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium and silver. Based on Region II guidelines all positive and non-detect

results for cadmium and silver in the total metals samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in the samples in this SDG.

The serial dilution of sample 56GW03 (from SDG SWMU36419-1) analyzed for the dissolved metals exhibited a non-compliant %D for cobalt. All results for cobalt in the dissolved metals samples were qualified as estimated J/UJ.

The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in one of the samples. Based on Region II validation guidelines the reported results for cobalt were qualified as estimated in the sample.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 05/1/08 and samples were received at the laboratory 05/05/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Sample Condition

VOA, SVOA & Metals

All VOA & SVOA samples were received at the laboratory at an elevated temperature of 10.6°C. The metals samples were received at an elevated temperature of 12.8°C. In accordance with the Region II guidelines, stating that samples received above 10°C are to be qualified as estimated (J/UJ), qualifications were added to the data.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/09/08	pentachloroethane vinyl acetate	67.6% 28.9%	all samples	J/UJ

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/01/08	hexachlorophene	0.0466	all samples	J/R
CC 05/14/08	4-nitroquinoline-1-oxide hexachlorophene	0.03234 0.04782	all samples	J/R
	4-nitrophenol 2,4-dinitrotoluene 2,4-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine methapyrilene aramite, total	23.4% 21.9% 42.7% 23.8% 23.3% 24.0% 22.6% 32.5% 29.0% 29.1% 33.3%		J/UJ

ICSA/ICSAB Standards

Metals

The ICSAB standards associated with the total metals analysis exhibited non-compliant recoveries less than the lower QC limit for the analyte cadmium (78%) and silver (77%/74%). Based on Region II guidelines, reported positive and non-detect results for cadmium and silver were qualified as estimated J/UJ in all total metals samples.

Blanks

SVOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank

contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blank	di-n-butylphthalate	0.22J ug/L	1 ug/L	2X RL
ER04	di-n-butylphthalate	0.32J ug/L	1 ug/L	2X RL
FB01	di-n-butylphthalate	1.2J ug/L	1 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69GW25, 69GW12	di-n-butylphthalate	U at reported value

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level	Q Flag
PBW1 – total	tin	4.4210J ug/L	>MDL up to RL	U
FB01	copper	2.1J ug/L	>MDL up to RL	U

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69GW12	tin	U
69GW25, 69GW25F, 69GW12	copper	U

LCS

SVOA

The LCS associated with the samples exhibited low recovery (4%) for hexachlorocyclopentadiene; therefore, all samples were qualified as estimated (J/UJ) for this compounds.

Serial Dilutions

Metals

The serial dilution of sample 56GW03 (from SDG SWMU36419-1) analyzed for the dissolved metals exhibited a non-compliant %D for cobalt that required qualification in

the field samples. A summary of this non-compliance and affected samples are noted in the following table.

SD	Analytes	Samples	RPD	Q Flag
56GW03	cobalt	all dissolved samples	14.6%	J/UJ

Identification/Quantitation

Metals

Region II requires a detailed comparison of the results between the total and dissolved sample analyses. This comparison between total and dissolved results is made only when both of the following conditions are met: first, the dissolved concentration is greater than the total concentration, and 2nd, that the dissolved concentration is greater than or equal to 5X the MDL. The analyte cobalt met both of these conditions in samples 69GW25 and 69GW12. Therefore, based on the guidelines (>20%RPD results are qualified, >50%RPD results are rejected) the positive results reported for cadmium were qualified as estimated J in samples 69GW25 and 69GW25F due to an RPD of 34%.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
all samples	all results	+/-	J/UJ
all samples	pentachloroethane vinyl acetate	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
all samples	all results	+/-	J/UJ
all results	hexachlorophene	+/-	J/R
69GW25, 69GW12	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
69GW25, 69GW12	4-nitrophenol 2,4-dinitrotoluene 2,4-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine methapyrilene aramite, total	+/-	J/UJ
69GW25, 69GW12	di-n-butylphthalate	+	U at reported value
all samples	hexachlorocyclopentadiene	+/-	J/UJ

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all samples	all analytes	+/-	J/UJ
all total metals samples	cadmium silver	+/-	J/UJ
69GW12	tin	>MDL up to RL	U
69GW25, 69GW25F, 69GW12	copper	>MDL up to RL	U
all dissolved metals samples	cobalt	+/-	J/UJ
69GW25, 69GW25F	cobalt	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 36419-4

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

July 29, 2008
SDG# SWMU36419-4, Test America-Savannah
NAPR Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36419-4. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006- SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B, 7470A) or the organic methods for hydrocarbons (SW-846 methods 8015_DRO and 8015_GRO). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	DRO/GRO	GRO	Metals
ER01	680-36419-37	water	X	X	X		X
ER02	680-36419-38	water	X	X	X		X
ER03	680-36419-39	water	X	X	X		X
ER04	680-36419-40	water	X	X			X
ER05	680-36419-41	water	X	X			X
FB01	680-36419-42	water	X	X	X		X
FB02	680-36419-43	water	X	X	X		X
QATB01	680-36419-44	water	X			X	

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition
- Technical Holding Times
- GC/MS Tuning *
- GC Performance *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards
- CRDL Standards *
- Blanks *
- Internal Standards *
- Surrogate Recoveries *

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- Laboratory Control Samples *
- Matrix Spike Recoveries NA
- Matrix Duplicate RPDs NA
- Serial Dilutions *
- Field Duplicates NA
- Identification/Quantitation
- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. Please note that the reviewer added an F to the sample ID to indicate dissolved metals analysis when necessary. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

VOA

The continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

SVOA

One sample was re-extracted out of holding time due to non-compliant surrogate recoveries; qualifications were added to the data.

All samples were received at the laboratory at an elevated temperature above 10°C. In accordance with Region II guidelines the samples were qualified as estimated (J/UJ).

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in the qualification of non-detected values as rejected for those compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Two samples exhibited low internal standard area recoveries that resulted in qualifications to the associated compounds.

Two of the associated LCS exhibited non-compliant results that required one compound to be qualified as estimated.

DRO/GRO

Two DRO samples were received at the laboratory at an elevated temperature above 10°C. In accordance with Region II guidelines the samples FB01 and FB02 were qualified as estimated J/UJ.

Metals

All samples were received at the laboratory at an elevated temperature above 10°C. In accordance with Region II guidelines the samples were qualified as estimated J/UJ.

The associated ICSA/ICSAB standards exhibited non-compliant recoveries for the analytes silver and cadmium. These analytes were qualified as estimated in all samples.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets. Clarification questions were asked of the laboratory regarding the GRO/DRO fraction. A copy of these e-mail correspondences is included in the project file.

Technical Holding Times

According to chain of custody records, sampling was performed on 04/28-05/02/08 and samples were received at the laboratory 05/05/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements with the following exceptions.

SVOA

The re-extraction of sample ER04RE exceeded the extraction holding time; therefore all results were qualified as estimated (J/UJ).

Sample Condition

SVOA

All samples were received at the laboratory at an elevated temperature of 11.8°C. In accordance with the Region II guidelines, therefore all samples received above 10°C are qualified as estimated (J/UJ).

DRO/GRO

Two DRO samples were received at the laboratory at an elevated temperature of 11.8°C. In accordance with the Region II guidelines, therefore the DRO results in samples FB01 and FB02 were qualified as estimated J/UJ.

Metals

The metals samples were received in a cooler with a temperature of 11.8°C. All reported results in the samples in this SDG were qualified as estimated J/UJ.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/08/08	pentachloroethane vinyl acetate	67.2% 30.1%	ER01, ER02, ER03, ER04, ER05	J/UJ
CC 05/09/08	pentachloroethane vinyl acetate	67.6% 28.9%	FB02, QATB01	J/UJ
CC 05/11/08	pentachloroethane chloromethane bromomethane vinyl acetate	80.9% 24.1% 24.3% 25.0%	FB01	J/UJ

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/01/08	hexachlorophene	0.0466	ER01, ER02, ER03, ER05, FB01, FB02	J/R
CC 05/13/08	4-nitroquinoline-1-oxide hexachlorophene	0.03507 0.03126	ER01	J/R
	n-nitrosomorpholine hexachloropropene n-nitroso-di-n-butylamine methapyrilene 3,3-dimethylbenzidine aramite, total 4-nitrophenol 4,6-dinitro-2-methylphenol	23.2% 32.6% 28.6% 32.7% 45.6% 38.7% 23.5% 43.1%		J/UJ
CC 05/14/08	4-nitroquinoline-1-oxide hexachlorophene	0.03234 0.04782	ER02, ER03, ER05, FB01, FB02	J/R
	4-nitrophenol 2,4-dinitrotoluene 4,6-dinitro-2-methylphenol dibenz(a,h)anthracene benzo(g,h,i)perylene n-nitrosomorpholine hexachloropropene n-nitroso-di-n-butylamine methapyrilene aramite, total	23.4% 21.9% 42.7% 23.8% 23.3% 24.0% 32.5% 29.0% 29.1% 33.3%		J/UJ
IC 05/28/08	4-nitroquinoline-1-oxide	0.0276	ER04RE	J/R
CC 05/29/08	4-nitroquinoline-1-oxide hexachlorophene	0.02872 0.04644	ER04RE	J/R
	3-nitroaniline 4-nitrophenol 4-nitroaniline, 3,3-dimethylbenzidine	20.1% 20.5% 29.0% 46.5%		J/UJ

ICSA/ICSAB Standards

Metals

The ICSAB standards associated with the metals analysis exhibited non-compliant recoveries less than the lower QC limit for the analyte cadmium (78%) and silver (77%/74%). Based on Region II guidelines, reported positive and non-detect results for cadmium and silver were qualified as estimated J/UJ in all samples.

Internal Standards

SVOA

Sample ER05 exhibited a low recovery for internal standard perylene-d12; therefore all associated compounds were qualified as estimated (J/UJ).

Sample ER04RE exhibited an extremely low recovery for internal standard perylene-d12; therefore all associated compounds positive results were qualified as estimated (J) and non-detected compounds were qualified as rejected (R).

LCS

SVOA

The LCS associated for sample ER01 exhibited low recovery for hexachlorocyclopentadiene at 7%. The results for this compound were qualified as estimated (J/UJ) in sample ER01.

The LCS associated for samples ER02, ER03, ER05, FB01 and FB02 exhibited low recovery for hexachlorocyclopentadiene at 4%. The results for this compound were qualified as estimated (J/UJ) in these samples.

Identification/Quantitation

VOA

Sample FB02 was reanalyzed to confirm positive results in the initial analysis. The reanalysis exhibited concurring results. The reanalysis was not used in favor of the initial analysis.

SVOA

All samples were re-extracted out of holding time due to non-compliant LCS recoveries. The re-extracted samples were not used, except for sample ER04RE, due to exceeded holding times.

Sample ER04 was not used due to low surrogate recoveries. The sample was re-extracted and exhibited compliant surrogate recoveries; therefore the initial analysis was not used in favor of the re-extraction.

Sample ER04RERA was not used due to non-compliant internal standard recoveries.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
ER01, ER02, ER03, ER04, ER05	pentachloroethane vinyl acetate	+/-	J/UJ
FB02, QATB01	pentachloroethane vinyl acetate	+/-	J/UJ
FB01	pentachloroethane chloromethane bromomethane vinyl acetate	+/-	J/UJ
FB02RA	all results	+/-	R

SVOA

Sample ID	Compound	Results	Q flag
ER04RE	all results	+/-	J/UJ
all samples	all results	+/-	J/UJ
ER01, ER02, ER03, ER05, FB01, FB02	hexachlorophene	+/-	J/R
ER01	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
ER01	n-nitrosomorpholine hexachloropropene n-nitroso-di-n-butylamine methapyrilene 3,3-dimethylbenzidine aramite, total 4-nitrophenol 4,6-dinitro-2-methylphenol	+/-	J/UJ
ER02, ER03, ER05, FB01, FB02	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
ER02, ER03, ER05, FB01, FB02	4-nitrophenol 2,4-dinitrotoluene 4,6-dinitro-2-methylphenol dibenz(a,h)anthracene benzo(g,h,i)perylene n-nitrosomorpholine hexachloropropene n-nitroso-di-n-butylamine methapyrilene aramite, total	+/-	J/UJ
ER04RE	4-nitroquinoline-1-oxide	+/-	J/R
ER04RE	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
ER04RE	3-nitroaniline 4-nitrophenol 4-nitroaniline, 3,3-dimethylbenzidine	+/-	J/UJ

Summary of Data Qualifications, continued

SVOA

ER05	all compounds associated with: perylene-d12	+/-	J/UJ
ER04RE	all compounds associated with: perylene-d12	+/-	J/R
ER01, ER02, ER03, ER05, FB01, FB02	hexachlorocyclopentadiene	+/-	J/UJ
ER01RE, ER02RE, ER03RE, ER05RE, FB01RE, FB02RE	all results	+/-	R
ER04, ER04RERA	all results	+/-	R

DRO/GRO

Sample ID	Compound	Results	Q flag
FB01, FB02	DRO	+/-	J/UJ

Metals

Sample ID	Analyte	Results	Q flag
all samples	all analytes	+/-	J/UJ
all samples	cadmium silver	+/-	J/UJ

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.
Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 36426-7

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36426-7, Test America-Savannah
NAPR SWMU 69, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36426-7. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory, the Region II Standard Operating Procedures for the Validation of Organic Data Acquired Using SW-846 Methods (8260B-Rev 2, January 2006- SOP #HW-24 and 8270D-Rev 3, October 2006- SOP #HW-22), and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020B, 7470A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	VOA App IX	SVOA App IX	TMetals	DMetals
69GW26	680-36426-87	water	X	X	X	X
69GW27	680-36426-88	water	X	X	X	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- GC/MS Tuning *
- Initial/Continuing Calibrations
- ICSA/ICSAB Standards
- CRDL Standards *
- Blanks
- Internal Standards *
- Surrogate Recoveries *
- Laboratory Control Samples *
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates NA
- Identification/Quantitation

- Reporting Limits *
- Tentatively Identified Compounds NA

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. Please note that the reviewer added an F to the sample ID to indicate dissolved metals analysis when necessary. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

VOA

The continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

SVOA

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for these compounds. Due to high %D values, in the continuing calibrations, some compounds were qualified as estimated.

Blank contamination was noted in the method and QC blank associated with samples in this batch. Qualifications were added to the data.

Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analytes cadmium and silver. Based on Region II guidelines all positive and non-detect results for cadmium and silver in the total metals samples were qualified as estimated J/UJ.

Blank contamination was noted and qualification was required in the samples in this SDG.

The serial dilution of sample 56GW03 (from SDG SWMU36419-1) analyzed for the dissolved metals exhibited a non-compliant %D for the cobalt. All results for cobalt in the dissolved metals samples were qualified as estimated J/UJ.

The analyte cobalt exhibited non-comparable results between the total metals and dissolved metals analysis in one of the samples. Based on Region II validation guidelines the reported results for cobalt were qualified as estimated in the sample.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. Clarification questions were asked of the laboratory regarding the metals fraction. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 05/03/08 and samples were received at the laboratory 05/06/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/13/08	acrolein	0.02624	all samples	J/R
	dichlorodifluoromethane bromomethane vinyl acetate trans-1,3-dichloropropene acrylonitrile pentachloroethane	20.3% 39.5% 28.0% 20.9% 53.5% 76.0%		J/UJ

SVOA

Calibration standards exhibited RRFs and %Ds that were non-compliant. A summary of these non-compliances and affected samples are noted in the following table. Sample results are qualified as indicated.

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
IC 05/01/08	hexachlorophene	0.0466	all samples	J/R
CC 05/14/08	4-nitroquinoline-1-oxide hexachlorophene	0.03234 0.04782	all samples	J/R
	4-nitrophenol 2,4-dinitrotoluene 2,4-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine methapyrilene aramite, total	23.4% 21.9% 42.7% 23.8% 23.3% 24.0% 22.6% 32.5% 29.0% 29.1% 33.3%		J/UJ

ICSA/ICSAB Standards

Metals

The ICSAB standards associated with the total metals analysis exhibited non-compliant recoveries less than the lower QC limit for the analyte cadmium (78%) and silver (77%/74%). Based on Region II guidelines, reported positive and non-detect results for cadmium and silver were qualified as estimated J/UJ in all total metals samples.

Blanks

SVOA

The associated method and/or QC blanks exhibited contamination as noted in the following table. Compounds for which there was no action required, are not included in the following table. Please note that the laboratory reported non-detect results down to the MDL for this project. Therefore, the blank flagging actions were modified as follows to take this into consideration. Positive results greater than the MDL but less than the CRQL are qualified as U at the reported concentration when affected by blank contamination.

Blank ID	Compound	Concentration	Reporting Limit	Action Level
Method Blank	di-n-butylphthalate	0.19J ug/L	1 ug/L	2X RL
	bis(2-ethylhexyl)phthalate	0.73J	1	
ER05	di-n-butylphthalate	0.42J ug/L	1 ug/L	2X RL
FB01	di-n-butylphthalate	1.2J ug/L	1 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
69GW26, 69GW27	di-n-butylphthalate	U at reported value
69GW26, 69GW27	bis(2-ethylhexyl)phthalate	U at reported value

Metals

Associated blanks exhibited contamination as noted in the following table. The laboratory reported non-detect results to the MDL for this project. Therefore, the blank flagging actions were modified to take this into consideration.

Blank ID	Analyte	Concentration	Action Level	Q Flag
PBW1 – total	cobalt	0.0492J ug/L	>MDL up to RL	U
FB01	copper	2.1J ug/L	>MDL up to RL	U

Please note, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for CCB contamination.

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69GW27	cobalt	U
69GW26F, 69GW27, 69GW27F	copper	U

Serial Dilutions

Metals

The serial dilution of sample 56GW03 (from SDG SWMU36419-1) analyzed for the dissolved metals exhibited a non-compliant %D for cobalt that required qualification in the field samples. A summary of this non-compliance and affected samples are noted in the following table.

SD	Analytes	Samples	RPD	Q Flag
56GW03	cobalt	all dissolved samples	14.6%	J/UJ

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
all samples	acrolein	+/-	J/R
all samples	dichlorodifluoromethane bromomethane vinyl acetate trans-1,3-dichloropropene acrylonitrile pentachloroethane	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
all samples	hexachlorophene	+/-	J/R
all samples	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
all samples	4-nitrophenol 2,4-dinitrotoluene 2,4-dinitro-2-methylphenol dibenzo(a,h)anthracene benzo(g,h,i)perylene n-nitrosomorpholine n-nitrosopiperidine hexachloropropene n-nitroso-di-n-butylamine methapyrilene aramite, total	+/-	J/UJ
69GW26, 69GW27	di-n-butylphthalate	+	U at reported value
69GW26, 69GW27	bis(2-ethylhexyl)phthalate	+	U at reported value

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all total metals samples	cadmium silver	+/-	J/UJ
69GW27	cobalt	>MDL up to RL	U
69GW26F, 69GW27, 69GW27F	copper	>MDL up to RL	U
all dissolved metals samples	cobalt	+/-	J/UJ
69GW26,69GW26F	cobalt	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Organic Methods

NA	The sample result for the blank contaminant is greater than the RL (2X sample RL for common laboratory contaminants) when the blank value is less than the RL. The sample result for the blank contaminant is not qualified with any blank qualifiers.
U*	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is qualified as non-detect U at the reported concentration.
RL**	The sample result for the blank contaminant is less than the RL (2X sample RL for common laboratory contaminants) but greater than the MDL when the blank value is less than the RL. The sample result for the blank contaminant is changed to the RL and qualified as non-detect U.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the ICB/CCB/PB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

PUERTO RICAN CHEMIST CERTIFICATION

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36289-3,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224321

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Charriez 2214

Aug 30, 08

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36360-3,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224363

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Charriez

Lic. 2114

Jun 26, 08

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36360-4,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

ESTADO LIBRE ASOCIADO DE PUERTO RICO

A 1224362

Ortiz Charriez

Lic. 2314

Junio 26, 08

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36360-5,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224361

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Ortiz Chaves

Lic. 2

Junio, PR

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36419-2,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224377

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Charriez

Lic. 2114

Jun 26, 08

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36419-4,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224375

Lic Abraham Ortiz Chaparro

Lic 2

Jun 06, 09

ESTADO LIBRE ASOCIADO DE PUERTO RICO

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36426-7,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224387

Lic. Abraham Ortiz Charriez Lic. 234

Jun 6, 08

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2010 DATA VALIDATION REPORT SUMMARIES

TEST AMERICA SAVANNAH SDG 68060189-1

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 11, 2010

SDG# 68060189-1, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-1. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB101-00	680-60189-1	soil	X
69SB101-00D	680-60189-2	soil	X
69SB101-01	680-60189-3	soil	X
69SB101-02	680-60189-4	soil	X
69SB102-00	680-60189-5	soil	X
69SB102-01	680-60189-6	soil	X
69SB102-02	680-60189-7	soil	X
69SB103-00	680-60189-8	soil	X
69SB103-01	680-60189-9	soil	X
69SB103-02	680-60189-10	soil	X
69SB104-00	680-60189-11	soil	X
69SB104-01	680-60189-12	soil	X
69SB104-01D	680-60189-13	soil	X
69SB104-02	680-60189-14	soil	X
69SB105-00	680-60189-15	soil	X
69SB105-01	680-60189-16	soil	X
69SB105-02	680-60189-17	soil	X
69SB106-00	680-60189-18	soil	X
69SB106-01	680-60189-19	soil	X
69SB106-02	680-60189-20	soil	X
69SB101-00MS	680-60189-1MS	soil	X
69SB101-00MSD	680-60189-1MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spike pair exhibited non-compliant recoveries and qualification/rejection of some analytes was required.

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/3/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals by 6020 & 7471

Associated blanks exhibited contamination as noted in the following table. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level
CCB 680-177205/52	cadmium	0.0391J ug/L	RL
69FB01	zinc	9.1J ug/L	RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69SB102-00, 69SB103-00, 69SB106-00	cadmium	U at RL
all samples >MDL but <RL	zinc	U at RL

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for three analytes, requiring qualification/rejection in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69-SB101-00	barium	all samples	56/49	J/UJ
	chromium		184/200	J
	vanadium		346/291	R

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. These field duplicate pairs and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB101-00, 69SB101-00D	barium chromium	52 40	J
69SB104-01, 69SB104-01D	barium cobalt copper zinc	54 77 67 57	J
	lead	3.22	R

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
69SB102-00, 69SB103-00, 69SB106-00	cadmium	+J	U at RL
all samples >MDL but <RL	zinc	+J	U at RL
all samples	barium	+/-	J/UJ
all samples	chromium	+	J
all samples	vanadium	+/-	R
69SB101-00, 69SB101-00D	barium chromium	+	J
69SB104-01, 69SB104-01D	barium cobalt copper zinc	+	J
	lead	+	R

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-2

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 11, 2010

SDG# 68060189-2, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-2. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB107-00	680-60189-21	soil	X
69SB107-01	680-60189-22	soil	X
69SB107-02	680-60189-23	soil	X
69SB107-02D	680-60189-24	soil	X
69SB108-00	680-60189-25	soil	X
69SB108-01	680-60189-26	soil	X
69SB108-02	680-60189-27	soil	X
69SB109-00	680-60189-28	soil	X
69SB109-01	680-60189-29	soil	X
69SB109-02	680-60189-30	soil	X
69SB110-00	680-60189-31	soil	X
69SB110-01	680-60189-32	soil	X
69SB110-02	680-60189-33	soil	X
69SB111-00	680-60189-34	soil	X
69SB111-00D	680-60189-35	soil	X
69SB111-01	680-60189-36	soil	X
69SB111-02	680-60189-37	soil	X
69SB112-00	680-60189-38	soil	X
69SB112-01	680-60189-39	soil	X
69SB112-02	680-60189-40	soil	X
69SB107-02MS	680-60189-23MS	soil	X
69SB107-02MSD	680-60189-23MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

The associated matrix spike pair exhibited non-compliant recoveries and qualification of one analyte was required.

The serial dilution exhibited one analyte with a high %D and qualification in the samples was required.

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/3/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for one analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69SB107-00	antimony	all samples	63/68	J/UJ

Serial Dilutions

Metals by 6020 & 7471

The serial dilution analysis submitted in this SDG exhibited a non-compliant %D for one analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

SD	Analytes	Samples	%D	Q Flag
69SB107-02	vanadium	all samples	12	J/UJ

Field Duplicates

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. These field duplicate pairs and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB107-02, 69SB107-02D	arsenic copper	113 46	J
69SB111-00, 69SB111-00D	arsenic	38	J
	lead	3.22	R

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
all samples	antimony	+/-	J/UJ
all samples	vanadium	+/-	J/UJ
69SB107-02, 69SB107-02D	arsenic copper	+	J
69SB111-00, 69SB111-00D	arsenic	+	J
	lead	+	R

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-3

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 11, 2010

SDG# 68060189-3, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-3. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB113-00	680-60189-41	soil	X
69SB113-01	680-60189-42	soil	X
69SB113-02	680-60189-43	soil	X
69SB114-00	680-60189-44	soil	X
69SB114-01	680-60189-45	soil	X
69SB114-01D	680-60189-46	soil	X
69SB114-02	680-60189-47	soil	X
69SB115-00	680-60189-48	soil	X
69SB115-01	680-60189-49	soil	X
69SB115-02	680-60189-50	soil	X
69SB116-00	680-60189-51	soil	X
69SB116-01	680-60189-52	soil	X
69SB116-02	680-60189-53	soil	X
69SB117-00	680-60189-54	soil	X
69SB117-01	680-60189-55	soil	X
69SB117-02	680-60189-56	soil	X
69SB117-02D	680-60189-57	soil	X
69SB118-00	680-60189-58	soil	X
69SB118-01	680-60189-59	soil	X
69SB118-02	680-60189-60	soil	X
69SB114-01MS	680-60189-45MS	soil	X
69SB114-01MSD	680-60189-45MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

The associated matrix spike pair exhibited non-compliant recoveries and qualification/rejection of some analytes was required.

The serial dilution exhibited one analyte with a high %D and qualification in the samples was required.

One of the field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for three analytes, requiring qualification/rejection in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69-SB114-01	copper	all samples	195/156	J
	lead		144/159	
	zinc		368/226	R

Serial Dilutions

Metals by 6020 & 7471

The serial dilution analysis submitted in this SDG exhibited a non-compliant %D for one analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

SD	Analytes	Samples	%D	Q Flag
69SB114-01	vanadium	all samples	11	J/UJ

Field Duplicates

Metals by 6020 & 7471

One of the field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. This field duplicate pair and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB114-01, 69SB114-01D	barium	36	J
	cobalt	44	
	copper	81	
	lead	1.2	
	nickel	41	
	vanadium	57	
	zinc	56	

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
all samples	copper lead	+	J
all samples	zinc	+/-	R
all samples	vanadium	+/-	J/UJ
69SB114-01, 69SB114-01D	barium cobalt copper lead nickel vanadium zinc	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-4

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 13, 2010

SDG# 68060189-4, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-4. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB119-00	680-60189-61	soil	X
69SB119-01	680-60189-62	soil	X
69SB119-02	680-60189-63	soil	X
69SB120-00	680-60189-64	soil	X
69SB120-01	680-60189-65	soil	X
69SB120-02	680-60189-66	soil	X
69SB121-00	680-60189-67	soil	X
69SB121-00D	680-60189-68	soil	X
69SB121-01	680-60189-69	soil	X
69SB121-02	680-60189-70	soil	X
69SB122-00	680-60189-71	soil	X
69SB122-01	680-60189-72	soil	X
69SB122-02	680-60189-73	soil	X
69SB123-00	680-60189-74	soil	X
69SB123-01	680-60189-75	soil	X
69SB123-02	680-60189-76	soil	X
69SB124-00	680-60189-77	soil	X
69SB124-01	680-60189-78	soil	X
69SB124-01D	680-60189-79	soil	X
69SB124-02	680-60189-80	soil	X
69SB121-00MS	68060189-67MS	soil	X
69SB121-00MSD	68060189-67MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spike pair exhibited non-compliant recoveries and qualification/rejection of some analytes was required.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/4-5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals by 6020 & 7471

Associated blanks exhibited contamination as noted in the following table. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level
ICB	mercury	0.0914J ug/L	RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
all samples >MDL but <RL	mercury	U at RL

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for three analytes, requiring qualification/rejection in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69-SB121-00	zinc	all samples	14/15	J/UJ
	mercury		66/64	
	lead		-44/-60	R

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
all samples >MDL but <RL	mercury	+J	U at RL
all samples	zinc mercury	+/-	J/UJ
all samples	lead	+/-	R

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-5

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 11, 2010

SDG# 68060189-5, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-5. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB125-00	680-60189-81	soil	X
69SB125-01	680-60189-82	soil	X
69SB125-02	680-60189-83	soil	X
69SB126-00	680-60189-84	soil	X
69SB126-01	680-60189-85	soil	X
69SB126-02	680-60189-86	soil	X
69SB127-00	680-60189-87	soil	X
69SB127-01	680-60189-88	soil	X
69SB127-02	680-60189-89	soil	X
69SB127-02D	680-60189-90	soil	X
69SB128-00	680-60189-91	soil	X
69SB128-01	680-60189-92	soil	X
69SB128-02	680-60189-93	soil	X
69SB129-00	680-60189-94	soil	X
69SB129-01	680-60189-95	soil	X
69SB129-02	680-60189-96	soil	X
69SB130-00	680-60189-97	soil	X
69SB130-01	680-60189-98	soil	X
69SB130-02	680-60189-99	soil	X
69SB131-00	680-60189-100	soil	X
69SB127-02MS	680-60189-89MS	soil	X
69SB127-02MSD	680-60189-89MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spike pair exhibited non-compliant recoveries and qualification/rejection of some analytes was required.

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals by 6020 & 7471

Associated blanks exhibited contamination as noted in the following table. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level
69FB01	zinc	9.1J ug/L	RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69SB127-02D	zinc	U at RL

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for three analytes, requiring qualification/rejection in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69-SB127-02	antimony	all samples	43/50	J/UJ
	chromium		73/73	
	barium		6/-1	R

Field Duplicates

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. This field duplicate pairs and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB127-02, 69SB127-02D	barium	60	J
	cobalt	75	
	copper	118	
	lead	2.28	
	chromium	6.2	R
	vanadium	145	
69SB131-00*/69SB131-00D	barium	53	J
	cadmium	76	
	chromium	67	
	copper	41	
	lead	84	
	vanadium	51	

***Please note that the field sample was analyzed in SDG 68060189-5**

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
69SB127-02D	zinc	+J	U at RL
all samples	antimony chromium	+/-	J/UJ
all samples	barium	+/-	R
69SB127-02, 69SB127-02D	barium cobalt copper lead	+	J
	chromium vanadium	+	R
69SB131-00	barium cadmium chromium copper lead vanadium	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-6

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 11, 2010

SDG# 68060189-6, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-6. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB131-00D	680-60189-101	soil	X
69SB131-01	680-60189-102	soil	X
69SB131-02	680-60189-103	soil	X
69SB132-00	680-60189-104	soil	X
69SB132-01	680-60189-105	soil	X
69SB132-02	680-60189-106	soil	X
69SB133-00	680-60189-107	soil	X
69SB133-01	680-60189-108	soil	X
69SB133-02	680-60189-109	soil	X
69SB134-00	680-60189-110	soil	X
69SB134-01	680-60189-111	soil	X
69SB134-01D	680-60189-112	soil	X
69SB134-02	680-60189-113	soil	X
69SB135-00	680-60189-114	soil	X
69SB135-01	680-60189-115	soil	X
69SB135-02	680-60189-116	soil	X
69SB136-00	680-60189-117	soil	X
69SB136-01	680-60189-118	soil	X
69SB136-02	680-60189-119	soil	X
69SB137-00	680-60189-120	soil	X
69SB134-01MS	680-60189-110MS	soil	X
69SB134-01MSD	680-60189-110MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spike pair exhibited non-compliant recoveries and qualification/rejection of some analytes was required.

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for one analyte requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69SB134-01	antimony	all samples	59/43	J/UJ

Matrix Duplicates

Metals by 6020 & 7471

The matrix duplicate analysis submitted in this SDG exhibited non-compliant RPDs for two analytes requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MD	Analytes	Samples	RPD	Q Flag
69SB134-01	barium cobalt	all samples	74 47	J/UJ

Field Duplicates

Metals by 6020 & 7471

The field duplicate pair exhibited non-compliant field duplicate reproducibility for the following analytes. This field duplicate pair and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB134-01/69SB134-01D	barium	70	J
69SB131-00*/69SB131-00D	barium cadmium chromium copper lead vanadium	53 76 67 41 84 51	J

***Please note that the field sample was analyzed in SDG 68060189-5**

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
all samples	antimony	+/-	J/UJ
all samples	barium cobalt	+/-	J/UJ
69SB134-01/69SB134-01D	barium	+	J
69SB131-00D	barium cadmium chromium copper lead vanadium	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-7

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 13, 2010

SDG# 68060189-7, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-7. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB137-01	680-60189-121	soil	X
69SB137-02	680-60189-122	soil	X
69SB137-02D	680-60189-123	soil	X
69SB138-00	680-60189-124	soil	X
69SB138-01	680-60189-125	soil	X
69SB138-02	680-60189-126	soil	X
69SB139-00	680-60189-127	soil	X
69SB139-01	680-60189-128	soil	X
69SB139-02	680-60189-129	soil	X
69SB140-00	680-60189-130	soil	X
69SB140-01	680-60189-131	soil	X
69SB140-02	680-60189-132	soil	X
69SB141-00	680-60189-133	soil	X
69SB141-00D	680-60189-134	soil	X
69SB141-01	680-60189-135	soil	X
69SB141-02	680-60189-136	soil	X
69SB142-00	680-60189-137	soil	X
69SB142-01	680-60189-138	soil	X
69SB142-02	680-60189-139	soil	X
69SB143-00	680-60189-140	soil	X
69SB141-00MS	680-60189-133MS	soil	X
69SB141-00MSD	680-60189-133MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

The associated matrix spike pair exhibited non-compliant recoveries and qualification of some analytes was required.

The serial dilution exhibited one non-compliant %D and qualification was required.

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/3-4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for three analytes, requiring qualification/rejection in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69SB141-00	chromium copper lead	all samples	134/132 148/143 136/145	J
	mercury		71/73	J/UJ

Serial Dilutions

Metals by 6020 & 7471

The serial dilution analysis submitted in this SDG exhibited a non-compliant %D for one analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

SD	Analytes	Samples	%D	Q Flag
69SB141-00	vanadium	all samples	15	J/UJ

Field Duplicates

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. This field duplicate pairs and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB137-02, 69SB137-02D	copper vanadium	42 49	J
69SB141-00, 69SB141-00D	copper cobalt lead nickel vanadium zinc	79 50 115 36 46 71	J

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
all samples	chromium copper lead	+	J
all samples	mercury	+/-	J/UJ
all samples	vanadium	+/-	J/UJ
69SB137-02, 69SB137-02D	copper vanadium	+	J
69SB141-00, 69SB141-00D	copper cobalt lead nickel vanadium zinc	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-8

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 13, 2010

SDG# 68060189-8, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-8. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB143-01	680-60189-141	soil	X
69SB143-02	680-60189-142	soil	X
69SB144-00	680-60189-143	soil	X
69SB144-01	680-60189-144	soil	X
69SB144-01D	680-60189-145	soil	X
69SB144-02	680-60189-146	soil	X
69SB145-00	680-60189-147	soil	X
69SB145-01	680-60189-148	soil	X
69SB145-02	680-60189-149	soil	X
69SB146-00	680-60189-150	soil	X
69SB146-01	680-60189-151	soil	X
69SB146-02	680-60189-152	soil	X
69SB147-00	680-60189-153	soil	X
69SB147-01	680-60189-154	soil	X
69SB147-02	680-60189-155	soil	X
69SB147-02D	680-60189-156	soil	X
69SB148-00	680-60189-157	soil	X
69SB148-01	680-60189-158	soil	X
69SB148-02	680-60189-159	soil	X
69SB149-00	680-60189-160	soil	X
69SB147-02MS	680-60189-156MS	soil	X
69SB147-02MSD	680-60189-156MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spike pair exhibited non-compliant recoveries and qualification/rejection of some analytes was required.

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/3-4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals by 6020 & 7471

Associated blanks exhibited contamination as noted in the following table. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level
MB 680-177094/23A	zinc	3.88J mg/Kg	RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69SB146-01, 69SB146-02	zinc	U at RL

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for two analytes, requiring qualification/rejection in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69SB147-02	copper	all samples	154/126	J
	mercury		546/516	R

Field Duplicates

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. This field duplicate pairs and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB144-01, 69SB144-01D	copper vanadium	40 67	J
69SB147-02/69SB147-02D	chromium copper lead	45 112 41	J
	cobalt vanadium	-1.68 140	R

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
69SB146-01, 69SB146-02	zinc	+J	U at RL
all samples	copper	+	J
all samples	mercury	+/-	R
69SB144-01, 69SB144-01D	copper vanadium	+	J
69SB147-02/69SB147-02D	chromium copper lead	+	J
	cobalt vanadium	+	R

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-9

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

September 13, 2010

SDG# 68060189-9, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-9. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7470A/7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB149-01	680-60189-161	soil	X
69SB149-02	680-60189-162	soil	X
69SB150-00	680-60189-163	soil	X
69SB150-01	680-60189-164	soil	X
69SB150-02	680-60189-165	soil	X
69SB151-00	680-60189-166	soil	X
69SB151-00D	680-60189-167	soil	X
69SB151-01	680-60189-168	soil	X
69SB151-02	680-60189-169	soil	X
69SB152-00	680-60189-170	soil	X
69SB152-01	680-60189-171	soil	X
69SB152-02	680-60189-172	soil	X
69ER01	680-60189-173	water	X
69ER02	680-60189-174	water	X
69ER03	680-60189-175	water	X
69FB01	680-60189-176	water	X
69SB152-02MS	680-60189-172MS	soil	X
69SB152-02MSD	680-60189-172MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spike pair exhibited non-compliant recoveries and qualification of some analytes was required.

The associated matrix duplicate exhibited a non-compliant RPD for which qualifications were required.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required. A clarification question regarding the internal standards was asked of the laboratory and a response was provided. A copy of the e-mail correspondence is included in the validation worksheets.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/3-5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

Metals by 6020 & 7471

Associated blanks exhibited contamination as noted in the following table. Please see the Glossary of Qualification Flags and Abbreviations for details.

Blank ID	Analyte	Concentration	Action Level
69FB01	zinc	9.1J ug/L	RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
69SB149-02	zinc	U at RL

Matrix Spikes

Metals by 6020 & 7471

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for two analytes, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69SB152-02	antimony mercury	all field samples	38/29 75/59	J

Matrix Duplicates

Metals by 6020 & 7471

The matrix duplicate analysis submitted in this SDG exhibited a non-compliant RPD for one analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MD	Analytes	Samples	RPD	Q Flag
69SB152-02	vanadium	all field samples	38	J

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
69SB149-02	zinc	+J	U at RL
all field samples	antimony mercury	+/-	J/UJ
all field samples	vanadium	+/-	J/UJ

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-10

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

February 18, 2011

SDG# 68060189-1, Job # 680-60189-10; TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-1, Job # 680-60189-10. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. The samples were analyzed for vanadium only. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic method in this SDG (SW-846 method 6020). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB101-00	680-60189-1	soil	X
69SB101-00D	680-60189-2	soil	X
69SB101-01	680-60189-3	soil	X
69SB101-02	680-60189-4	soil	X
69SB102-00	680-60189-5	soil	X
69SB102-01	680-60189-6	soil	X
69SB102-02	680-60189-7	soil	X
69SB103-00	680-60189-8	soil	X
69SB103-01	680-60189-9	soil	X
69SB103-02	680-60189-10	soil	X
69SB104-00	680-60189-11	soil	X
69SB104-01	680-60189-12	soil	X
69SB104-01D	680-60189-13	soil	X
69SB104-02	680-60189-14	soil	X
69SB105-00	680-60189-15	soil	X
69SB105-01	680-60189-16	soil	X
69SB105-02	680-60189-17	soil	X
69SB106-00	680-60189-18	soil	X
69SB106-01	680-60189-19	soil	X
69SB106-02	680-60189-20	soil	X
69SB101-00MS	680-60189-1MS	soil	X
69SB101-00MSD	680-60189-1MSD	soil	X

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The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/3/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Extraction was performed on the 175th day.

Metals by 6020 & 7471

One of the field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analyte. These field duplicate pair/analyte was flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB101-00, 69SB101-00D	vanadium	43	J

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Vanadium by 6020

Sample ID	Analyte	Results	Q flag
69SB101-00, 69SB101-00D	vanadium	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-11

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

February 18, 2011

SDG# 68060189-1, Job # 68060189-11, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-1, Job # 68060189-11. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment for zinc only. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB113-00	680-60189-41	soil	X
69SB113-01	680-60189-42	soil	X
69SB113-02	680-60189-43	soil	X
69SB114-00	680-60189-44	soil	X
69SB114-01	680-60189-45	soil	X
69SB114-01D	680-60189-46	soil	X
69SB114-02	680-60189-47	soil	X
69SB115-00	680-60189-48	soil	X
69SB115-01	680-60189-49	soil	X
69SB115-02	680-60189-50	soil	X
69SB116-00	680-60189-51	soil	X
69SB116-01	680-60189-52	soil	X
69SB116-02	680-60189-53	soil	X
69SB117-00	680-60189-54	soil	X
69SB117-01	680-60189-55	soil	X
69SB117-02	680-60189-56	soil	X
69SB117-02D	680-60189-57	soil	X
69SB118-00	680-60189-58	soil	X
69SB118-01	680-60189-59	soil	X
69SB118-02	680-60189-60	soil	X
69SB114-01MS	680-60189-45MS	soil	X
69SB114-01MSD	680-60189-45MSD	soil	X

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The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020

One of the field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/4/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. Extraction was performed on the 176th day.

Field Duplicates

Zinc by 6020

One of the field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analyte. This field duplicate pair/analyte was flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SB114-01, 69SB114-01D	zinc	18 (absolute difference)	J

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
69SB114-01, 69SB114-01D	zinc	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-12

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

February 18, 2011

SDG# 68060189-1, Job # 680-60189-12, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-1, Job # 680-60189-12. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. This SDG was analyzed for lead only. Region II has not developed a validation checklist SOP for the method used to assess the inorganic methods in this SDG (SW-846 method 6020). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB119-00	680-60189-61	soil	X
69SB119-01	680-60189-62	soil	X
69SB119-02	680-60189-63	soil	X
69SB120-00	680-60189-64	soil	X
69SB120-01	680-60189-65	soil	X
69SB120-02	680-60189-66	soil	X
69SB121-00	680-60189-67	soil	X
69SB121-00D	680-60189-68	soil	X
69SB121-01	680-60189-69	soil	X
69SB121-02	680-60189-70	soil	X
69SB122-00	680-60189-71	soil	X
69SB122-01	680-60189-72	soil	X
69SB122-02	680-60189-73	soil	X
69SB123-00	680-60189-74	soil	X
69SB123-01	680-60189-75	soil	X
69SB123-02	680-60189-76	soil	X
69SB124-00	680-60189-77	soil	X
69SB124-01	680-60189-78	soil	X
69SB124-01D	680-60189-79	soil	X
69SB124-02	680-60189-80	soil	X
69SB121-00MS	68060189-67MS	soil	X
69SB121-00MSD	68060189-67MSD	soil	X

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The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020

The associated matrix spike pair exhibited non-compliant recoveries and qualification of one analyte was required.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/4-5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. These samples were prepared on the 173rd & 174th days.

Matrix Spikes

Lead by 6020

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for the target analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69-SB121-00	lead	all samples	56/56	J/UJ

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Lead by 6020

Sample ID	Analyte	Results	Q flag
all samples	lead	+/-	J/UJ

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68060189-13

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

February 18, 2011

SDG# 68060189-1, Job # 680-60189-13, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68060189-1, Job # 680-60189-13. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SB125-00	680-60189-81	soil	X
69SB125-01	680-60189-82	soil	X
69SB125-02	680-60189-83	soil	X
69SB126-00	680-60189-84	soil	X
69SB126-01	680-60189-85	soil	X
69SB126-02	680-60189-86	soil	X
69SB127-00	680-60189-87	soil	X
69SB127-01	680-60189-88	soil	X
69SB127-02	680-60189-89	soil	X
69SB127-02D	680-60189-90	soil	X
69SB128-00	680-60189-91	soil	X
69SB128-01	680-60189-92	soil	X
69SB128-02	680-60189-93	soil	X
69SB129-00	680-60189-94	soil	X
69SB129-01	680-60189-95	soil	X
69SB129-02	680-60189-96	soil	X
69SB130-00	680-60189-97	soil	X
69SB130-01	680-60189-98	soil	X
69SB130-02	680-60189-99	soil	X
69SB131-00	680-60189-100	soil	X
69SB127-02MS	680-60189-89MS	soil	X
69SB127-02MSD	680-60189-89MSD	soil	X

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The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020

The associated matrix spike pair exhibited non-compliant recoveries and qualification of one analyte was required.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/5/10 and samples were received at the laboratory 8/7/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements. The samples were prepared on the 173rd day.

Matrix Spikes

Barium by 6020

The matrix spike pair analysis submitted in this SDG exhibited non-compliant %Rs for the target analyte, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

MS/MSD	Analytes	Samples	%R	Q Flag
69-SB127-02	barium	all samples	137/139	J

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Barium by 6020

Sample ID	Analyte	Results	Q flag
all samples	barium	+	J

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

TEST AMERICA SAVANNAH SDG 68062912-1

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

December 20, 2010

SDG# 68062912-1, TestAmerica, Savannah
NAPR SWMU 69; Ceiba, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 68062912-1. The data validation was performed in accordance with the SW-846 methods utilized by the laboratory and professional judgment. Region II has not developed a validation checklist SOP for the methods used to assess the inorganic methods in this SDG (SW-846 methods 6020 and 7471A). Therefore, alternative worksheets were provided. Region II flagging conventions were used. All areas of concern are discussed in the body of the report and a summary of data qualification is provided.

Sample ID	Lab ID	Matrix	APP IX Metals
69SD01	680-62912-1	soil	X
69SD01D	680-62912-2	soil	X
69SD02	680-62912-3	soil	X
69SD02D	680-62912-4	soil	X
69SD03	680-62912-5	soil	X
69SD04	680-62912-6	soil	X
69SD05	680-62912-7	soil	X
69SD06	680-62912-8	soil	X
69SD07	680-62912-9	soil	X
69SD08	680-62912-18	soil	X
69SD09	680-62912-10	soil	X
69SD10	680-62912-11	soil	X
69SD11	680-62912-12	soil	X
69SD12	680-62912-13	soil	X
69SD13	680-62912-14	soil	X
69SD14	680-62912-15	soil	X
69FB-SD	680-62912-16	water	X
69ER-SD	680-62912-17	water	X
69SD02MS	680-62912-3MS	soil	X
69SD02MSD	680-62912-3MSD	soil	X

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- ICP-MS Tuning *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks *
- ICP-MS Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries *
- Matrix Duplicate RPDs *
- Serial Dilutions
- Field Duplicates
- Identification/Quantitation
- Reporting Limits *

* - indicates that qualifications were not required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page.

Metals by 6020 & 7471

Many of the samples exhibited percent solids that were below 50%. All reported results in these samples were qualified as estimated J/UJ.

The serial dilution of sample 69SD02 exhibited several analytes with %Ds greater than 10%. These analytes were qualified as estimated J/UJ in all field samples.

One of the field duplicate pairs exhibited non-compliant reproducibility and qualifications were applied.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 11/5/10 and samples were received at the laboratory 11/6/10. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Metals by 6020 & 7471

The serial dilution analysis submitted in this SDG exhibited non-compliant %Ds for four analytes, requiring qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table.

SD	Analytes	Samples	%D	Q Flag
69SD02	barium	all field samples	20	J/UJ
	cobalt		21	
	copper		22	
	vanadium		18	

Field Duplicates

Metals by 6020 & 7471

The field duplicate pairs exhibited non-compliant field duplicate reproducibility for the following analytes. This field duplicate pairs and analytes were flagged as noted in the table below based on Region II guidelines.

Sample ID	Analyte	RPD or Absolute Difference	Q Flag
69SD01/69SD01D	chromium	36	J
	lead	114	

Identification/Quantitation

Metals by 6020 & 7471

The majority of the samples exhibited high moisture content. A summary of these non-compliances and affected samples are noted in the following table.

Sample ID	Analytes	%Solids	Q Flag
69SD01	all	49.6	J/UJ
69SD01D		48.6	
69SD02		42.3	
69SD02D		44.1	
69SD03		43.7	
69SD06		44.7	
69SD07		35.1	
69SD09		47.9	
69SD10		29.2	
69SD08		41.4	

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,

Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Metals by 6020 & 7471

Sample ID	Analyte	Results	Q flag
all field samples	barium cobalt copper vanadium	+/-	J/UJ
69SD01/69SD01D	chromium lead	+	J
69SD01, 69SD01D, 69SD02, 69SD02D, 69SD03, 69SD06, 69SD07, 69SD09, 69SD10, 69SD08	all analytes	+/-	J/UJ

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
N	analyte has been tentatively identified
JN	analyte has been tentatively identified, estimated value
R	result is rejected; the presence or absence of the analyte cannot be verified

Method/Preparation/Field QC Blank Qualification Flags (Q-Flags)

Inorganic Methods

ICB/CCB/PB Action:

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U*/ RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.
R -	Sample result is greater than the RL and less than the ICB/CCB/PB value when the ICB/CCB/PB value is greater than the RL.
J -	Sample result is greater than the ICB/CCB/PB value but less than 10X the ICB/CCB/PB value when ICB/CCB/PB value is greater than the RL.
J/UJ -	Sample result is less than 10X RL when blank result is below the negative RL.

Field QC Blank action:

Note – Use field blanks to qualify data only if field blank results are greater than prep blank results.

Do not use rinsate blank associated with soils to qualify water samples and vice versa.

No Action -	The sample result is greater than the RL and greater than ten times (10X) the blank value.
U* / RL** -	The sample result is greater than or equal to the MDL but less than or equal to the RL, result is reported as non-detect at the reported concentration or at the RL, when the FB result is less or greater than the RL.

Glossary of Qualification Flags and Abbreviations, continued

R -	Sample result is greater than the RL and less than the FB value when the FB value is greater than the RL.
J -	Sample result is greater than the FB value but less than 10X the FB value when FB value is greater than the RL.

* This guideline is used when the laboratory is reporting non-detects to the MDL. ** This guideline is used when the laboratory is reporting non-detects to the RL.

General Abbreviations

RL	reporting limit
IDL	instrument detection limit
MDL	method detection limit
CRDL	contract required detection limit
CRQL	contract required quantitation limit
+	positive result
-	non-detect result

PUERTO RICAN CHEMIST CERTIFICATION

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-1,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1327550

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Quartiez

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-2,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

ESTADO LIBRE ASOCIADO DE PUERTO RICO

A 1327549

Lic Abraham Ortiz Charriez

Sept 4, 10

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-3,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1327540

Lic Abraham Ortiz Chaurez

Lic. 821

Sept 6, 16

ESTADO LIBRE ASOCIADO DE PUERTO RICO

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-4,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1327539

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Chaviez

Lic. 2314

Sept 2, 10

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-5,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1327548

Lic. Abraham Ortiz Chaparro

Lic. 2344

Sept 4, 10

ESTADO LIBRE ASOCIADO DE PUERTO RICO

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-6,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1327538

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Guarnier

Sept 4, 12

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-7,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

ESTADO LIBRE ASOCIADO DE PUERTO RICO

A 1292248

Lic. Abraham Ortiz Chaparro

Lic. 2114

Sept 4, 10

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-8,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

ESTADO LIBRE ASOCIADO DE PUERTO RICO

A 1292247

Lic. Abraham Ortiz Chaparro

Lic. 17

Sept 14, 10

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-60189-9,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

ESTADO LIBRE ASOCIADO DE PUERTO RICO

A 1292246

Lic Abraham Ortiz Chavez

Sept 4, 10

QUIMICO LICENCIADO

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-62912-1,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1327545

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Chaparro

QUIMICO LICENCIADO

Dec 8, 10

APPENDIX D
DATA USED IN THE ECOLOGICAL RISK ASSESSMENT

2008 CORRECTIVE MEASURES STUDY INVESTIGATION DATA USED IN THE ERA

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.57 U	2.7 UJ	1.6 U	0.88 U	0.51 U	1.9 U
1,1,1-Trichloroethane	0.52 U	2.4 UJ	1.4 U	0.8 U	0.46 U	1.7 U
1,1,2,2-Tetrachloroethane	1.2 U	5.8 UJ	3.4 U	1.9 U	1.1 U	4.1 U
1,1,2-Trichloroethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U
1,1-Dichloroethane	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U
1,1-Dichloroethene	0.48 U	2.2 UJ	1.3 U	0.74 U	0.43 U	1.6 U
1,2,3-Trichloropropane	1.2 U	5.8 UJ	3.4 U	1.9 U	1.1 U	4.1 U
1,2-Dibromo-3-Chloropropane	2.5 U	12 UJ	6.9 U	3.9 U	2.2 U	8.2 U
1,2-Dichloroethane	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U
1,2-Dichloropropane	0.98 U	4.6 UJ	2.7 U	1.5 U	0.88 U	3.2 U
2-Butanone (MEK)	20 U	11 UJ	6.6 U	3.7 U	28 U	7.9 U
2-Chloro-1,3-butadiene	0.51 U	2.4 UJ	1.4 U	0.78 U	0.46 U	1.7 U
2-Hexanone	1.9 UJ	8.7 UJ	5.2 U	2.9 U	1.7 U	6.1 U
3-Chloro-1-propene	1.3 U	6.2 UJ	3.7 UJ	2.1 UJ	1.2 UJ	4.4 UJ
4-Methyl-2-pentanone (MIBK)	2.6 U	12 UJ	7.1 U	4 U	2.3 U	8.5 U
Acetone	190	18 UJ	11 U	6.1 R	260	33 U
Acetonitrile	40 R	190 UJ	110 U	62 UJ	36 U	130 U
Acrolein	17 R	79 R	47 R	26 R	15 R	56 R
Acrylonitrile	20 U	95 UJ	57 UJ	32 UJ	18 U	67 UJ
Benzene	0.7 U	3.3 UJ	1.9 U	1.1 U	0.63 U	2.3 U
Bromoform	0.98 U	4.6 UJ	2.7 U	1.5 U	0.88 U	3.2 U
Bromomethane	1.4 UJ	6.6 UJ	3.9 U	2.2 UJ	1.3 U	4.7 U
Carbon disulfide	0.45 U	2.1 UJ	1.3 U	0.7 U	0.41 U	1.5 U
Carbon tetrachloride	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U
Chlorobenzene	0.65 U	3 UJ	1.8 U	1 U	0.58 U	2.1 U
Chlorodibromomethane	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U
Chloroethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U
Chloroform	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U
Chloromethane	0.63 U	2.9 UJ	1.7 U	0.98 UJ	0.57 U	2.1 U
cis-1,3-Dichloropropene	0.77 U	3.6 UJ	2.1 U	1.2 U	0.69 U	2.5 U
Dibromomethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U
Dichlorobromomethane	0.74 U	3.4 UJ	2 U	1.1 U	0.66 U	2.4 U
Dichlorodifluoromethane	0.79 U	3.7 UJ	2.2 U	1.2 U	0.71 U	2.6 U
Ethyl methacrylate	2 UJ	9.1 UJ	5.4 U	3 U	1.8 U	6.4 U
Ethylbenzene	0.67 U	3.1 UJ	1.8 U	1 U	0.6 U	2.2 J
Ethylene Dibromide	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U
Iodomethane	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 UJ	2.9 U
Isobutyl alcohol	61 R	290 R	170 R	95 R	55 R	200 R
Methacrylonitrile	21 UJ	99 UJ	59 U	33 U	19 UJ	70 U
Methyl methacrylate	3.3 UJ	15 UJ	9.1 U	5.1 U	3 UJ	11 U
Methylene Chloride	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U
Pentachloroethane	2 U	9.1 UJ	5.4 UJ	3 UJ	1.8 UJ	6.4 UJ
Propionitrile	12 U	87 UJ	52 U	29 U	17 U	61 U
Styrene	0.59 U	2.7 UJ	1.6 U	0.91 U	0.53 U	1.9 U
Tetrachloroethene	0.65 U	3 UJ	1.8 U	1 U	0.58 U	2.1 U
Toluene	0.7 U	3.3 J	1.9 U	1.1 U	0.63 U	2.5 J

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	0.86 U	4 UJ	2.4 U	1.3 U	0.77 U	2.8 U
trans-1,3-Dichloropropene	0.77 U	3.6 UJ	2.1 U	1.2 U	0.69 U	2.5 U
trans-1,4-Dichloro-2-butene	2.8 UJ	13 UJ	7.6 U	4.3 U	2.5 UJ	9.1 U
Trichloroethene	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U
Trichlorofluoromethane	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U
Vinyl acetate	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U
Vinyl chloride	0.52 U	2.4 UJ	1.4 U	0.8 U	0.46 U	1.7 U
Xylenes, Total	2 U	9.5 UJ	6.1 J	3.2 U	1.8 U	14 J
Semi-Volatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ
1,2,4,5-Tetrachlorobenzene	9.5 U	13 UJ	9.9 UJ	8.6 UJ	26 J	9.2 UJ
1,2,4-Trichlorobenzene	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ
1,2-Dichlorobenzene	11 U	14 UJ	11 UJ	9.6 UJ	14 UJ	10 UJ
1,3,5-Trinitrobenzene	26 U	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ
1,3-Dichlorobenzene	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ
1,3-Dinitrobenzene	5.9 U	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ	5.7 UJ
1,4-Dichlorobenzene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ
1,4-Dioxane	12 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ
1,4-Naphthoquinone	5.9 UJ	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ	5.7 UJ
2,2'-oxybis[1-chloropropane]	9.5 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ	9.2 UJ
2,3,4,6-Tetrachlorophenol	6.4 UJ	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ	6.1 UJ
2,4,5-Trichlorophenol	10 UJ	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ
2,4,6-Trichlorophenol	12 UJ	16 UJ	12 UJ	11 UJ	16 UJ	12 UJ
2,4-Dichlorophenol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ
2,4-Dimethylphenol	26 UJ	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ
2,4-Dinitrophenol	130 UJ	170 UJ	130 UJ	110 UJ	160 UJ	120 UJ
2,4-Dinitrotoluene	8.9 U	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ
2,6-Dichlorophenol	9.7 UJ	13 UJ	10 UJ	8.8 UJ	13 UJ	9.3 UJ
2,6-Dinitrotoluene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ
2-Acetylaminofluorene	7.7 U	11 UJ	8 UJ	7 UJ	10 UJ	7.4 UJ
2-Chloronaphthalene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ
2-Chlorophenol	10 UJ	14 UJ	10 UJ	9 UJ	13 UJ	9.6 UJ
2-Methylnaphthalene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	9.2 J	2.5 UJ
2-Methylphenol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ
2-Naphthylamine	30 U	41 UJ	31 UJ	27 UJ	39 UJ	29 UJ
2-Nitroaniline	9.8 U	13 UJ	10 UJ	8.9 UJ	13 UJ	9.5 UJ
2-Nitrophenol	11 UJ	15 UJ	11 UJ	10 UJ	14 UJ	11 UJ
2-Picoline	18 U	25 UJ	19 UJ	16 UJ	24 UJ	18 UJ
2-Toluidine	14 U	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ
3 & 4 Methylphenol	11 UJ	15 UJ	11 UJ	10 UJ	14 UJ	11 UJ
3,3'-Dichlorobenzidine	14 UJ	19 UJ	14 UJ	13 UJ	18 UJ	13 UJ
3,3'-Dimethylbenzidine	270 U	370 UJ	280 UJ	250 UJ	350 UJ	260 UJ
3-Methylcholanthrene	9.2 U	13 UJ	9.6 UJ	8.4 UJ	12 UJ	8.9 UJ
3-Nitroaniline	6.8 U	9.3 UJ	7.1 UJ	6.2 UJ	8.9 UJ	6.6 UJ
4,6-Dinitro-2-methylphenol	8.8 UJ	12 UJ	9.1 UJ	8 UJ	11 UJ	8.5 UJ
4-Aminobiphenyl	20 U	27 UJ	20 UJ	18 UJ	26 UJ	19 UJ

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ
4-Chloro-3-methylphenol	11 UJ	16 UJ	12 UJ	10 UJ	15 UJ	11 UJ
4-Chloroaniline	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ
4-Chlorophenyl phenyl ether	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ
4-Nitroaniline	12 U	16 UJ	12 UJ	11 UJ	15 UJ	11 UJ
4-Nitrophenol	50 UJ	68 UJ	52 UJ	45 UJ	65 UJ	48 UJ
4-Nitroquinoline-1-oxide	17 R	23 R	17 R	15 R	22 R	16 R
7,12-Dimethylbenz(a)anthracene	14 UJ	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ
Acenaphthene	0.86 U	1.2 UJ	0.9 UJ	0.78 UJ	10 J	0.83 UJ
Acenaphthylene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	11 J	2.5 UJ
Acetophenone	13 U	18 UJ	14 UJ	12 UJ	17 UJ	13 UJ
alpha,alpha-Dimethyl phenethylamine	89 U	120 UJ	93 UJ	81 UJ	120 UJ	86 UJ
Aniline	9.5 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ	9.2 UJ
Anthracene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	34 J	2.5 UJ
Aramite, Total	17 UJ	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ
Benzo[a]anthracene	73 J	10 J	2.7 UJ	8.3 J	460 J	5.5 J
Benzo[a]pyrene	69 J	22 J	1 UJ	13 J	530 J	0.96 UJ
Benzo[b]fluoranthene	160 J	50 J	1.2 UJ	20 J	1300 J	28 J
Benzo[g,h,i]perylene	57 J	38 J	2.7 UJ	30 J	1400 J	23 J
Benzo[k]fluoranthene	1.5 U	2.1 UJ	1.6 UJ	14 J	2 UJ	1.5 UJ
Benzyl alcohol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ
Bis(2-chloroethoxy)methane	10 U	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ
Bis(2-chloroethyl)ether	8.6 U	12 UJ	9 UJ	7.8 UJ	11 UJ	8.3 UJ
Bis(2-ethylhexyl) phthalate	110	230 J	64 UJ	170 J	1000 J	47 UJ
Butyl benzyl phthalate	11 U	15 UJ	11 UJ	86 J	300 J	11 UJ
Chrysene	170 J	30 J	9 J	30 J	1000 J	16 J
Diallate	15 U	20 UJ	15 UJ	13 UJ	19 UJ	14 UJ
Dibenz(a,h)anthracene	19	6.3 J	0.93 UJ	8.1 J	220 J	5 UJ
Dibenzofuran	6.4 U	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ	6.1 UJ
Diethyl phthalate	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ
Dimethyl phthalate	9.7 U	13 UJ	10 UJ	8.8 UJ	13 UJ	9.3 UJ
Di-n-butyl phthalate	38 U	52 UJ	39 UJ	34 UJ	49 UJ	36 UJ
Di-n-octyl phthalate	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ
Dinoseb	26 U	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ
Ethyl methanesulfonate	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ
Fluoranthene	300 J	27 J	3.1 J	21 J	1100 J	14 J
Fluorene	6.4 J	1.6 UJ	1.2 UJ	1.1 UJ	14 J	1.1 UJ
Hexachlorobenzene	10 U	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ
Hexachlorobutadiene	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ
Hexachlorocyclopentadiene	21 U	29 UJ	22 UJ	19 UJ	28 UJ	20 UJ
Hexachloroethane	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ
Hexachlorophene	1300 R	1700 R	1300 R	1100 R	1600 R	1200 R
Hexachloropropene	11 UJ	15 UJ	11 UJ	9.9 UJ	14 UJ	11 UJ
Indeno[1,2,3-cd]pyrene	37	21 J	1.9 UJ	22 J	1400 J	11 J
Isophorone	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ
Isosafrole	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)						
Methapyrilene	14 UJ	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ
Methyl methanesulfonate	14 U	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ
Naphthalene	0.91 U	1.2 UJ	0.94 UJ	0.82 UJ	3.4 J	0.88 UJ
Nitrobenzene	10 U	14 UJ	11 UJ	9.5 UJ	14 UJ	10 UJ
N-Nitro-o-toluidine	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ
N-Nitrosodiethylamine	18 U	25 UJ	19 UJ	16 UJ	24 UJ	18 UJ
N-Nitrosodimethylamine	15 U	20 UJ	15 UJ	13 UJ	19 UJ	14 UJ
N-Nitrosodi-n-butylamine	14 UJ	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ
N-Nitrosodi-n-propylamine	9.8 U	13 UJ	10 UJ	8.9 UJ	13 UJ	9.5 UJ
N-Nitrosodiphenylamine	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ
N-Nitrosomethylethylamine	8.6 U	12 UJ	9 UJ	7.8 UJ	11 UJ	8.3 UJ
N-Nitrosomorpholine	10 UJ	14 UJ	10 UJ	9 UJ	13 UJ	9.6 UJ
N-Nitrosopiperidine	13 UJ	18 UJ	13 UJ	12 UJ	17 UJ	12 UJ
N-Nitrosopyrrolidine	13 U	18 UJ	14 UJ	12 UJ	18 UJ	13 UJ
p-Dimethylamino azobenzene	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ
Pentachlorobenzene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	13 J	9 UJ
Pentachloronitrobenzene	8.9 UJ	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ
Pentachlorophenol	13 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ
Phenacetin	7.1 U	9.7 UJ	7.4 UJ	6.4 UJ	9.3 UJ	6.9 UJ
Phenanthrene	170 J	4.9 J	2.7 UJ	8.6 J	270 J	5.4 J
Phenol	7.3 U	9.9 UJ	7.5 UJ	6.6 UJ	9.5 UJ	7 UJ
p-Phenylene diamine	240 U	330 UJ	250 UJ	220 UJ	320 UJ	230 UJ
Pronamide	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ
Pyrene	290 J	30 J	4 J	22 J	1200 J	17 J
Pyridine	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ
Safrole, Total	13 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ
Metals (mg/kg)						
Antimony	0.24 UJ	0.3 UJ	0.18 UJ	0.15 UJ	2 J	0.23 UJ
Arsenic	2	3 J	4.6	1.6	5.4	2.1
Barium	29	38 J	21	18	800	42
Beryllium	0.098 J	0.12 J	0.066 J	0.099 J	0.35	0.16
Cadmium	1.3 J	3.5 J	0.68 J	0.61 J	36 J	0.87 J
Chromium	58 J	42 J	33 J	15 J	89 J	24 J
Cobalt	14	13 J	9.5	12	17	9.6
Copper	50	47 J	28	36	130	73
Lead	59 J	41 J	20	7.7	520	15
Mercury	0.026 J	0.022 J	0.011 J	0.16	0.12	0.13
Nickel	17	13 J	8.7	4	34	6.1
Selenium	0.34 J	0.36 J	0.18 U	1.8	0.72 J	0.81
Silver	0.056 J	0.08 J	0.024 U	0.19 J	0.54	0.065 J
Thallium	0.17 U	0.23 UJ	0.18 U	0.15 U	0.22 U	0.16 U
Tin	5.5 U	7.6 UJ	6.1 U	5.1 U	9 J	5.2 U
Vanadium	140 J	140 J	110 J	170 J	100 J	230 J
Zinc	51	83 J	23	34	650	41

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB09	69SB10	69SB11	69SB12
Sample ID	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00	69SB12-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.42 U	0.5 U	4.8 UJ	0.85 U	0.78 U	0.53 U
1,1,1-Trichloroethane	0.38 U	0.46 U	4.3 UJ	0.77 U	0.71 U	0.48 U
1,1,2,2-Tetrachloroethane	0.93 U	1.1 U	10 UJ	1.9 U	1.7 U	1.2 U
1,1,2-Trichloroethane	0.79 U	0.95 U	8.9 UJ	1.6 U	1.5 U	1 U
1,1-Dichloroethane	0.33 U	0.39 U	3.7 UJ	0.66 U	0.61 U	0.41 U
1,1-Dichloroethene	0.36 U	0.43 U	4 UJ	0.72 U	0.66 U	0.45 U
1,2,3-Trichloropropane	0.93 U	1.1 U	10 UJ	1.9 U	1.7 U	1.2 U
1,2-Dibromo-3-Chloropropane	1.9 U	2.2 U	21 UJ	3.7 U	3.4 UJ	2.3 UJ
1,2-Dichloroethane	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U	0.83 U
1,2-Dichloropropane	0.73 U	0.87 U	8.2 UJ	1.5 U	1.3 U	0.91 U
2-Butanone (MEK)	1.8 U	2.1 U	20 UJ	3.6 U	6 UJ	3.7 U
2-Chloro-1,3-butadiene	0.38 UJ	0.45 UJ	4.2 UJ	0.76 U	0.69 U	0.47 U
2-Hexanone	1.4 U	1.7 U	16 UJ	2.8 U	2 J	1.7 U
3-Chloro-1-propene	0.99 R	1.2 R	11 UJ	2 U	1.8 UJ	1.2 UJ
4-Methyl-2-pentanone (MIBK)	1.9 U	2.3 U	22 UJ	3.8 U	3.5 U	2.4 U
Acetone	9.1 J	29 J	33 UJ	5.8 U	13 J	24 R
Acetonitrile	30 UJ	36 UJ	330 UJ	60 UJ	55 U	37 U
Acrolein	13 R	15 R	140 R	25 U	23 R	16 R
Acrylonitrile	15 UJ	18 UJ	170 UJ	31 U	28 U	19 U
Benzene	0.52 U	0.62 U	5.9 UJ	1 U	0.96 U	0.66 U
Bromoform	0.73 U	0.87 U	8.2 UJ	1.5 U	1.3 U	0.91 U
Bromomethane	1.1 UJ	1.3 UJ	12 UJ	2.1 U	2 UJ	1.3 UJ
Carbon disulfide	0.34 U	0.4 U	3.8 UJ	0.68 U	0.62 U	0.42 U
Carbon tetrachloride	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U	0.83 U
Chlorobenzene	0.48 U	0.58 U	5.4 UJ	0.97 U	0.89 U	0.61 U
Chlorodibromomethane	0.33 U	0.39 U	3.7 UJ	0.66 U	0.61 U	0.41 U
Chloroethane	0.79 U	0.95 U	8.9 UJ	1.6 U	1.5 U	1 U
Chloroform	0.33 U	0.39 U	3.7 UJ	0.66 U	0.61 U	0.41 U
Chloromethane	0.47 U	0.56 U	5.3 UJ	0.94 U	0.87 U	0.59 U
cis-1,3-Dichloropropene	0.57 U	0.69 U	6.5 UJ	1.2 U	1.1 U	0.72 U
Dibromomethane	0.79 U	0.95 U	8.9 UJ	1.6 U	1.5 U	1 U
Dichlorobromomethane	0.55 U	0.65 U	6.2 UJ	1.1 U	1 U	0.69 U
Dichlorodifluoromethane	0.59 U	0.7 U	6.6 UJ	1.2 U	1.1 U	0.74 U
Ethyl methacrylate	1.5 U	1.7 U	16 UJ	2.9 U	2.7 U	1.8 U
Ethylbenzene	0.5 U	0.59 U	6.2 J	1 U	0.91 U	0.62 U
Ethylene Dibromide	0.99 U	1.2 U	11 UJ	2 U	1.8 U	1.2 U
Iodomethane	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U	0.83 U
Isobutyl alcohol	46 R	54 R	510 R	92 R	84 R	57 R
Methacrylonitrile	16 U	19 U	180 UJ	32 U	29 UJ	20 UJ
Methyl methacrylate	2.4 U	2.9 U	27 UJ	4.9 U	4.5 UJ	3.1 UJ
Methylene Chloride	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U	0.83 U
Pentachloroethane	1.5 U	1.7 U	16 UJ	2.9 UJ	2.7 U	1.8 U
Propionitrile	14 UJ	17 UJ	160 UJ	28 U	26 U	17 U
Styrene	0.44 U	0.52 U	4.9 UJ	0.88 U	0.8 U	0.55 U
Tetrachloroethene	0.48 U	0.58 U	5.4 UJ	0.97 U	0.89 U	0.61 U
Toluene	0.52 U	0.62 U	5.9 UJ	1 U	0.96 U	0.66 U

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB09	69SB10	69SB11	69SB12
Sample ID	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00	69SB12-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	0.64 U	0.77 U	7.2 UJ	1.3 U	1.2 U	0.8 U
trans-1,3-Dichloropropene	0.57 U	0.69 U	6.5 UJ	1.2 U	1.1 U	0.72 U
trans-1,4-Dichloro-2-butene	2 U	2.4 U	23 UJ	4.1 U	3.8 UJ	2.6 UJ
Trichloroethene	0.66 U	0.79 U	7.4 UJ	1.3 U	1.2 U	0.83 U
Trichlorofluoromethane	0.99 U	1.2 U	11 UJ	2 U	1.8 U	1.2 U
Vinyl acetate	0.99 UJ	1.2 UJ	11 UJ	2 U	1.8 UJ	1.2 UJ
Vinyl chloride	0.38 U	0.46 U	4.3 UJ	0.77 U	0.71 U	0.48 U
Xylenes, Total	1.5 U	1.8 U	28 J	12 J	2.8 U	1.9 U
Semi-Volatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	8.2 U	9.5 U	27 UJ	9.8 U	8.7 U	8.8 U
1,2,4,5-Tetrachlorobenzene	7 U	8.1 U	23 UJ	8.3 U	29 J	7.5 U
1,2,4-Trichlorobenzene	8.2 U	9.5 U	27 UJ	9.8 U	8.7 U	8.8 U
1,2-Dichlorobenzene	7.8 U	9 U	26 UJ	9.2 U	8.3 U	8.3 U
1,3,5-Trinitrobenzene	19 U	22 U	62 UJ	22 U	20 U	20 U
1,3-Dichlorobenzene	6.6 U	7.7 U	22 UJ	7.9 U	7.1 U	7.1 U
1,3-Dinitrobenzene	4.3 U	5 U	14 UJ	5.2 U	4.6 U	4.6 U
1,4-Dichlorobenzene	6.9 U	8 U	23 UJ	8.2 U	7.3 U	7.4 U
1,4-Dioxane	8.9 U	10 U	29 UJ	11 U	9.5 U	9.5 U
1,4-Naphthoquinone	4.3 U	5 U	14 UJ	5.2 UJ	4.6 U	4.6 U
2,2'-oxybis[1-chloropropane]	7 U	8.1 U	23 UJ	8.3 U	7.4 U	7.5 U
2,3,4,6-Tetrachlorophenol	4.7 U	5.4 U	15 UJ	5.5 U	5 U	5 U
2,4,5-Trichlorophenol	7.5 U	8.7 U	25 UJ	9 U	8 U	8.1 U
2,4,6-Trichlorophenol	8.8 U	10 U	29 UJ	10 U	9.3 U	9.4 U
2,4-Dichlorophenol	9 U	10 U	30 UJ	11 U	9.6 U	9.6 U
2,4-Dimethylphenol	19 U	22 U	62 UJ	22 U	20 U	20 U
2,4-Dinitrophenol	92 UJ	110 UJ	300 UJ	110 UJ	98 UJ	99 UJ
2,4-Dinitrotoluene	6.5 UJ	7.6 U	22 UJ	7.8 U	7 U	7 U
2,6-Dichlorophenol	7.1 U	8.2 U	23 UJ	8.5 U	7.6 U	7.6 U
2,6-Dinitrotoluene	6.9 U	8 U	23 UJ	8.2 U	7.3 U	7.4 U
2-Acetylaminofluorene	5.7 U	6.5 U	19 UJ	6.7 U	6 U	6.1 U
2-Chloronaphthalene	6.9 U	8 U	23 UJ	8.2 U	7.3 U	7.4 U
2-Chlorophenol	7.3 U	8.5 U	24 UJ	8.7 U	7.8 U	7.8 U
2-Methylnaphthalene	1.9 U	2.2 U	6.2 UJ	2.2 U	2.3 J	2 U
2-Methylphenol	9 U	10 U	30 UJ	11 U	9.6 U	9.6 U
2-Naphthylamine	22 U	26 UJ	73 UJ	26 U	24 UJ	24 UJ
2-Nitroaniline	7.2 U	8.3 U	24 UJ	8.6 U	7.7 U	7.7 U
2-Nitrophenol	8.1 U	9.4 U	27 UJ	9.6 U	8.6 U	8.7 U
2-Picoline	13 U	15 U	44 UJ	16 U	14 U	14 U
2-Toluidine	10 U	12 U	34 UJ	12 U	11 U	11 U
3 & 4 Methylphenol	8.1 U	9.4 U	27 UJ	9.6 U	8.6 U	8.7 U
3,3'-Dichlorobenzidine	10 U	12 U	34 UJ	12 UJ	11 UJ	11 U
3,3'-Dimethylbenzidine	200 U	230 UJ	660 UJ	240 U	210 UJ	210 UJ
3-Methylcholanthrene	6.8 U	7.8 U	22 UJ	8.1 U	7.2 U	7.2 U
3-Nitroaniline	5 U	5.8 U	16 UJ	5.9 U	5.3 U	5.3 U
4,6-Dinitro-2-methylphenol	6.4 UJ	7.4 UJ	21 UJ	7.7 UJ	6.9 UJ	6.9 UJ
4-Aminobiphenyl	14 U	17 U	48 UJ	17 U	15 U	15 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB09	69SB10	69SB11	69SB12
Sample ID	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00	69SB12-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U	8.4 U
4-Chloro-3-methylphenol	8.3 U	9.6 U	27 UJ	9.9 U	8.9 U	8.9 U
4-Chloroaniline	6.6 U	7.7 U	22 UJ	7.9 U	7.1 U	7.1 U
4-Chlorophenyl phenyl ether	6.9 U	8 U	23 UJ	8.2 U	7.3 U	7.4 U
4-Nitroaniline	8.5 UJ	9.9 U	28 UJ	10 U	9.1 U	9.2 U
4-Nitrophenol	37 UJ	42 U	120 UJ	44 U	39 U	39 U
4-Nitroquinoline-1-oxide	12 R	14 R	40 R	15 R	13 R	13 R
7,12-Dimethylbenz(a)anthracene	10 U	12 U	34 UJ	12 UJ	11 U	11 U
Acenaphthene	0.63 U	0.73 U	5.4 J	0.75 U	0.67 U	0.68 U
Acenaphthylene	1.9 U	2.2 U	9.8 J	2.2 U	2 U	2 U
Acetophenone	9.5 U	11 U	31 UJ	11 U	10 U	10 U
alpha,alpha-Dimethyl phenethylamine	65 U	76 U	220 UJ	78 U	70 U	70 U
Aniline	7 U	8.1 U	23 UJ	8.3 U	7.4 U	7.5 U
Anthracene	1.9 U	2.2 U	22 J	2.2 U	3.8 J	2 U
Aramite, Total	12 U	14 UJ	40 UJ	15 UJ	13 UJ	13 UJ
Benzo[a]anthracene	1.9 U	2.2 U	200 J	2.2 U	14 J	2 U
Benzo[a]pyrene	0.73 U	0.85 U	330 J	4.5 J	51 J	0.78 U
Benzo[b]fluoranthene	0.84 U	0.98 U	900 J	7.8 J	91 J	0.9 U
Benzo[g,h,i]perylene	1.9 U	2.2 U	340 J	2.2 UJ	190	2 U
Benzo[k]fluoranthene	1.1 U	1.3 U	3.7 UJ	1.3 UJ	140	1.2 U
Benzyl alcohol	8.9 U	10 U	29 UJ	11 U	9.5 U	9.5 U
Bis(2-chloroethoxy)methane	7.5 U	8.7 U	25 UJ	9 U	8 U	8.1 U
Bis(2-chloroethyl)ether	6.3 U	7.3 U	21 UJ	7.5 U	6.7 U	6.8 U
Bis(2-ethylhexyl) phthalate	14 J	9.4 J	260 J	18 U	760 J	28 U
Butyl benzyl phthalate	8 U	9.2 U	98 J	9.5 U	180 J	8.6 U
Chrysene	0.68 U	0.78 U	520 J	6.1 J	66	0.72 U
Diallate	11 U	12 U	35 UJ	13 U	11 U	11 U
Dibenz(a,h)anthracene	0.65 U	0.76 U	65 J	0.78 UJ	28 J	0.7 U
Dibenzofuran	4.7 U	5.4 U	15 UJ	5.5 U	5 U	5 U
Diethyl phthalate	12 U	14 U	40 UJ	15 U	13 U	13 U
Dimethyl phthalate	7.1 U	8.2 U	23 UJ	8.5 U	7.6 U	7.6 U
Di-n-butyl phthalate	28 U	32 U	92 UJ	33 U	30 U	30 U
Di-n-octyl phthalate	3.7 U	4.2 U	12 UJ	4.4 UJ	26 J	3.9 U
Dinoseb	19 U	22 U	62 UJ	22 U	20 U	20 U
Ethyl methanesulfonate	12 U	14 U	40 UJ	15 U	13 U	13 U
Fluoranthene	1.9 U	2.2 U	700 J	3.1 J	27	2 U
Fluorene	0.85 U	0.99 U	6.7 UJ	1 U	0.91 U	0.92 U
Hexachlorobenzene	7.5 U	8.7 U	25 UJ	9 U	8 U	8.1 U
Hexachlorobutadiene	10 U	12 U	33 UJ	12 U	11 U	11 U
Hexachlorocyclopentadiene	16 U	18 U	51 UJ	18 U	17 U	17 U
Hexachloroethane	8.2 U	9.5 U	27 UJ	9.8 U	8.7 U	8.8 U
Hexachlorophene	920 R	1100 R	3000 R	1100 R	980 R	990 R
Hexachloropropene	8 UJ	9.2 UJ	26 UJ	9.5 UJ	8.5 UJ	8.6 UJ
Indeno[1,2,3-cd]pyrene	1.3 UJ	1.5 UJ	170 J	1.6 UJ	94 J	1.4 UJ
Isophorone	6.9 U	8 U	23 UJ	8.2 U	7.3 U	7.4 U
Isosafrole	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U	8.4 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB09	69SB10	69SB11	69SB12
Sample ID	69SB07-00	69SB08-00	69SB09-00	69SB10-00	69SB11-00	69SB12-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)						
Methapyrilene	10 UJ	12 UJ	34 UJ	12 UJ	11 UJ	11 UJ
Methyl methanesulfonate	10 U	12 U	34 UJ	12 U	11 U	11 U
Naphthalene	0.66 U	0.77 U	2.2 UJ	0.79 U	1.1 J	0.71 U
Nitrobenzene	7.6 U	8.9 U	25 UJ	9.1 U	8.2 U	8.2 U
N-Nitro-o-toluidine	6.6 U	7.7 U	22 UJ	7.9 U	7.1 U	7.1 U
N-Nitrosodiethylamine	13 U	15 U	44 UJ	16 U	14 U	14 U
N-Nitrosodimethylamine	11 U	13 U	36 UJ	13 U	12 U	12 U
N-Nitrosodi-n-butylamine	10 UJ	12 UJ	33 UJ	12 UJ	11 UJ	11 UJ
N-Nitrosodi-n-propylamine	7.2 U	8.3 U	24 UJ	8.6 U	7.7 U	7.7 U
N-Nitrosodiphenylamine	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U	8.4 U
N-Nitrosomethylethylamine	6.3 U	7.3 U	21 UJ	7.5 U	6.7 U	6.8 U
N-Nitrosomorpholine	7.3 UJ	8.5 UJ	24 UJ	8.7 UJ	7.8 UJ	7.8 UJ
N-Nitrosopiperidine	9.4 U	11 UJ	31 UJ	11 UJ	10 UJ	10 UJ
N-Nitrosopyrrolidine	9.9 U	11 UJ	33 UJ	12 U	11 UJ	11 UJ
p-Dimethylamino azobenzene	7.9 U	9.1 U	26 UJ	9.4 U	8.4 U	8.4 U
Pentachlorobenzene	6.9 U	8 U	23 UJ	8.2 U	7.3 U	7.4 U
Pentachloronitrobenzene	6.5 U	7.6 U	22 UJ	7.8 UJ	7 U	7 U
Pentachlorophenol	9.2 U	11 U	30 UJ	11 U	9.8 U	9.9 U
Phenacetin	5.2 U	6 U	17 UJ	6.2 U	5.6 U	5.6 U
Phenanthrene	1.9 UJ	2.2 U	160 J	2.2 U	20	2 U
Phenol	5.3 U	6.2 U	18 UJ	6.3 U	5.7 U	5.7 U
p-Phenylene diamine	180 U	210 U	590 UJ	210 U	190 U	190 U
Pronamide	10 U	12 U	33 UJ	12 U	11 U	11 U
Pyrene	1.9 U	2.2 U	690 J	4.2 J	41	2 U
Pyridine	12 U	14 U	40 UJ	15 U	13 U	13 U
Safrole, Total	9.2 U	11 U	30 UJ	11 U	9.8 U	9.9 U
Metals (mg/kg)						
Antimony	0.21 U	0.094 U	0.83 UJ	0.18 UJ	0.48 U	0.18 U
Arsenic	4.6	1.6	3.9 J	4	4.9 J	4.8
Barium	18	17	61 J	34	21	14
Beryllium	0.07 J	0.19	0.17 J	0.099 J	0.045 J	0.05 J
Cadmium	0.65 J	0.039 UJ	18 J	0.41 J	4.4 J	0.051 J
Chromium	21	24	38 J	25 J	34	39
Cobalt	6	5.7	12 J	10	6.5	14
Copper	16	82	130 J	42	23	32
Lead	8.9	2.8	250 J	6.8	220	0.71
Mercury	0.0099 J	0.057	0.077 J	0.044	0.017 J	0.0098 J
Nickel	7.1	5.9	14 J	8	9.3	12
Selenium	0.14 J	0.79	0.67 J	0.35 J	0.22 J	0.14 J
Silver	0.022 J	0.037 J	0.25 J	0.037 J	0.084 U	0.018 U
Thallium	0.12 U	0.15 U	0.42 UJ	0.15 U	0.13 U	0.13 U
Tin	4 U	5 U	14 UJ	4.9 U	4.3 U	4.4 U
Vanadium	58	280	92 J	110 J	53	87
Zinc	16	34	270 J	27	67	11

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	1.2 U	1.1 U	1.3 U	0.65 U	0.41 U	0.74 U
1,1,1-Trichloroethane	1.1 U	0.96 U	1.1 U	0.59 U	0.37 U	0.67 U
1,1,2,2-Tetrachloroethane	2.6 U	2.3 U	2.7 U	1.4 U	0.9 U	1.6 U
1,1,2-Trichloroethane	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
1,1-Dichloroethane	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
1,1-Dichloroethene	1 U	0.89 U	1.1 U	0.55 U	0.35 U	0.62 U
1,2,3-Trichloropropane	2.6 U	2.3 U	2.7 U	1.4 U	0.9 U	1.6 U
1,2-Dibromo-3-Chloropropane	5.3 U	4.6 U	5.5 U	2.9 U	1.8 U	3.2 U
1,2-Dichloroethane	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
1,2-Dichloropropane	2.1 U	1.8 U	2.2 U	1.1 U	0.71 U	1.3 U
2-Butanone (MEK)	5.1 U	4.5 U	5.3 U	2.8 U	22 U	3.1 U
2-Chloro-1,3-butadiene	1.1 U	0.94 U	1.1 U	0.58 U	0.37 U	0.66 U
2-Hexanone	4 U	3.5 U	4.1 U	2.1 U	1.4 U	2.4 U
3-Chloro-1-propene	2.8 UJ	2.5 U	2.9 UJ	1.5 U	0.97 U	1.7 U
4-Methyl-2-pentanone (MIBK)	5.5 U	4.8 U	5.7 U	3 U	1.9 U	3.3 U
Acetone	8.3 U	170	8.6 U	41 J	110	40 J
Acetonitrile	85 U	74 R	88 U	46 R	29 R	52 R
Acrolein	36 R	31 R	37 R	19 R	12 R	22 R
Acrylonitrile	43 UJ	38 U	45 UJ	23 U	15 U	27 U
Benzene	1.5 U	1.3 U	1.6 U	0.81 U	0.51 U	0.91 U
Bromoform	2.1 U	1.8 U	2.2 U	1.1 U	0.71 U	1.3 U
Bromomethane	3 U	2.6 UJ	3.1 U	1.6 UJ	1 UJ	1.8 UJ
Carbon disulfide	0.96 U	0.84 U	1 U	0.52 U	0.33 U	0.59 U
Carbon tetrachloride	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Chlorobenzene	1.4 U	1.2 U	1.4 U	0.75 U	0.47 U	0.84 U
Chlorodibromomethane	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
Chloroethane	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
Chloroform	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
Chloromethane	1.3 U	1.2 U	1.4 U	0.72 U	0.46 U	0.82 U
cis-1,3-Dichloropropene	1.6 U	1.4 U	1.7 U	0.89 U	0.56 U	1 U
Dibromomethane	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
Dichlorobromomethane	1.6 U	1.4 U	1.6 U	0.85 U	0.54 U	0.96 U
Dichlorodifluoromethane	1.7 U	1.5 U	1.7 U	0.91 U	0.58 U	1 U
Ethyl methacrylate	4.2 U	3.6 UJ	4.3 U	2.2 UJ	1.4 UJ	2.5 UJ
Ethylbenzene	1.4 U	1.2 U	1.5 U	0.77 U	0.48 U	0.87 U
Ethylene Dibromide	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Iodomethane	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Isobutyl alcohol	130 R	110 R	140 R	70 R	45 R	80 R
Methacrylonitrile	45 U	40 UJ	47 U	25 UJ	16 UJ	28 UJ
Methyl methacrylate	7 U	6.1 UJ	7.3 U	3.8 UJ	2.4 UJ	4.3 UJ
Methylene Chloride	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Pentachloroethane	4.2 UJ	3.6 U	4.3 UJ	2.2 U	1.4 U	2.5 U
Propionitrile	40 U	35 R	41 U	21 R	14 R	24 R
Styrene	1.2 U	1.1 U	1.3 U	0.67 U	0.43 U	0.76 U
Tetrachloroethene	1.4 U	1.2 U	1.4 U	0.75 U	0.47 U	0.84 U
Toluene	1.5 U	1.3 U	1.6 U	0.81 U	0.51 U	0.91 U

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	1.8 U	1.6 U	1.9 U	0.99 U	0.63 U	1.1 U
trans-1,3-Dichloropropene	1.6 U	1.4 U	1.7 U	0.89 U	0.56 U	1 U
trans-1,4-Dichloro-2-butene	5.9 U	59 J	6.1 U	3.2 UJ	2 UJ	3.6 UJ
Trichloroethene	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Trichlorofluoromethane	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Vinyl acetate	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Vinyl chloride	1.1 U	0.96 U	1.1 U	0.59 U	0.37 U	0.67 U
Xylenes, Total	4.9 J	3.8 U	4.5 U	2.3 U	1.5 U	2.7 U
Semi-Volatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
1,2,4,5-Tetrachlorobenzene	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
1,2,4-Trichlorobenzene	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
1,2-Dichlorobenzene	8.7 U	11 U	10 U	8.1 U	9.9 UJ	9.4 U
1,3,5-Trinitrobenzene	21 U	26 U	25 U	20 U	24 UJ	23 U
1,3-Dichlorobenzene	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
1,3-Dinitrobenzene	4.9 U	5.9 U	5.7 U	4.5 U	5.5 UJ	5.2 U
1,4-Dichlorobenzene	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
1,4-Dioxane	10 U	12 U	12 U	9.3 U	11 UJ	11 U
1,4-Naphthoquinone	4.9 UJ	5.9 UJ	5.7 UJ	4.5 UJ	5.5 UJ	5.2 UJ
2,2'-oxybis[1-chloropropane]	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
2,3,4,6-Tetrachlorophenol	5.2 U	6.4 U	6.1 UJ	4.9 UJ	5.9 UJ	5.6 UJ
2,4,5-Trichlorophenol	8.5 U	10 U	9.9 UJ	7.9 UJ	9.6 UJ	9.1 UJ
2,4,6-Trichlorophenol	9.8 U	12 U	11 UJ	9.2 UJ	11 UJ	11 UJ
2,4-Dichlorophenol	10 U	12 U	12 UJ	9.4 UJ	11 UJ	11 UJ
2,4-Dimethylphenol	21 U	26 U	25 UJ	20 UJ	24 UJ	23 UJ
2,4-Dinitrophenol	100 UJ	130 UJ	120 UJ	96 UJ	120 UJ	110 UJ
2,4-Dinitrotoluene	7.4 U	9 U	8.5 U	6.8 U	8.4 UJ	7.9 U
2,6-Dichlorophenol	8 U	9.7 U	9.3 UJ	7.4 UJ	9.1 UJ	8.6 UJ
2,6-Dinitrotoluene	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
2-Acetylaminofluorene	6.4 U	7.8 U	7.4 U	5.9 U	7.2 UJ	6.9 U
2-Chloronaphthalene	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
2-Chlorophenol	8.2 U	10 U	9.6 UJ	7.7 UJ	9.3 UJ	8.9 U
2-Methylnaphthalene	2.1 U	2.6 U	2.5 U	2 U	2.4 UJ	2.3 U
2-Methylphenol	10 U	12 U	12 UJ	9.4 UJ	11 UJ	11 UJ
2-Naphthylamine	25 U	30 U	29 U	23 U	28 UJ	27 U
2-Nitroaniline	8.1 U	9.9 U	9.4 U	7.5 U	9.2 UJ	8.7 U
2-Nitrophenol	9.1 U	11 U	11 UJ	8.5 UJ	10 UJ	9.8 UJ
2-Picoline	15 U	18 U	17 U	14 U	17 UJ	16 U
2-Toluidine	12 U	14 U	13 U	11 U	13 UJ	12 U
3 & 4 Methylphenol	9.1 U	11 U	11 UJ	8.5 UJ	10 UJ	9.8 UJ
3,3'-Dichlorobenzidine	11 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
3,3'-Dimethylbenzidine	220 U	270 U	260 U	210 U	250 UJ	240 U
3-Methylcholanthrene	7.6 U	9.3 U	8.8 U	7.1 U	8.6 UJ	8.2 U
3-Nitroaniline	5.6 U	6.8 U	6.5 U	5.2 U	6.4 UJ	6 U
4,6-Dinitro-2-methylphenol	7.2 UJ	8.8 UJ	8.4 UJ	6.7 UJ	8.2 UJ	7.8 UJ
4-Aminobiphenyl	16 U	20 U	19 U	15 U	18 UJ	17 U

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)						
4-Bromophenyl phenyl ether	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
4-Chloro-3-methylphenol	9.4 U	11 U	11 UJ	8.7 UJ	11 UJ	10 UJ
4-Chloroaniline	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
4-Chlorophenyl phenyl ether	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
4-Nitroaniline	9.6 U	12 U	11 U	8.9 U	11 UJ	10 U
4-Nitrophenol	41 U	50 U	48 UJ	38 UJ	47 UJ	44 UJ
4-Nitroquinoline-1-oxide	14 R	17 R	16 R	13 R	16 R	15 R
7,12-Dimethylbenz(a)anthracene	12 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
Acenaphthene	0.71 U	0.87 U	3 J	0.66 U	0.81 UJ	0.79 J
Acenaphthylene	2.1 U	2.6 U	2.5 U	2 U	2.4 UJ	2.3 U
Acetophenone	11 U	13 U	12 U	10 U	12 UJ	12 U
alpha,alpha-Dimethyl phenethylamine	74 U	90 U	85 U	68 U	84 UJ	79 U
Aniline	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
Anthracene	2.1 U	2.6 U	16	2 U	2.4 UJ	7.3 J
Aramite, Total	14 UJ	17 UJ	16 UJ	13 UJ	16 UJ	15 UJ
Benzo[a]anthracene	2.1 U	2.6 U	90	2 U	11 J	140 J
Benzo[a]pyrene	28	40	100	0.77 UJ	28 J	280 J
Benzo[b]fluoranthene	50	60	230	0.88 UJ	73 J	570 J
Benzo[g,h,i]perylene	39	39	99	2 UJ	76 J	290 J
Benzo[k]fluoranthene	1.2 U	1.5 U	1.4 U	1.2 UJ	1.4 UJ	1.3 UJ
Benzyl alcohol	10 U	12 U	12 UJ	9.3 UJ	11 UJ	11 UJ
Bis(2-chloroethoxy)methane	8.5 U	10 U	9.9 U	7.9 U	9.6 UJ	9.1 U
Bis(2-chloroethyl)ether	7.1 U	8.7 U	8.3 U	6.6 U	8.1 UJ	7.7 U
Bis(2-ethylhexyl) phthalate	47 U	80 U	52 U	27 U	57 UJ	110 J
Butyl benzyl phthalate	110	11 U	21 J	8.3 U	16 J	51
Chrysene	55	38	180	0.71 U	26 J	290 J
Diallate	12 U	15 U	14 U	11 U	14 UJ	13 U
Dibenz(a,h)anthracene	9.9	9 J	39	0.68 U	8.6 J	75 J
Dibenzofuran	5.2 U	6.4 U	6.1 U	4.9 U	5.9 UJ	5.6 U
Diethyl phthalate	14 U	17 U	16 U	13 U	16 UJ	15 U
Dimethyl phthalate	8 U	9.7 U	9.3 U	7.4 U	9.1 UJ	8.6 U
Di-n-butyl phthalate	31 U	38 U	36 U	29 U	35 UJ	34 U
Di-n-octyl phthalate	4.1 U	5 U	4.8 U	3.8 UJ	4.7 UJ	4.4 UJ
Dinoseb	21 U	26 U	25 U	20 U	24 UJ	23 U
Ethyl methanesulfonate	14 U	17 U	16 U	13 U	16 UJ	15 U
Fluoranthene	14	24	340	2 U	18 J	160
Fluorene	0.96 U	1.2 U	4.3 J	0.89 U	1.1 UJ	1 U
Hexachlorobenzene	8.5 U	10 U	9.9 U	7.9 U	9.6 UJ	9.1 U
Hexachlorobutadiene	11 U	14 U	13 U	11 U	13 UJ	12 U
Hexachlorocyclopentadiene	17 U	21 U	20 U	16 U	20 UJ	19 U
Hexachloroethane	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
Hexachlorophene	1000 R	1300 R	1200 R	960 R	1200 R	1100 R
Hexachloropropene	9 UJ	11 UJ	10 UJ	8.3 UJ	10 UJ	9.7 UJ
Indeno[1,2,3-cd]pyrene	17	21	52	1.4 UJ	23 J	190 J
Isophorone	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
Isosafrole	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U

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SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)						
Methapyrilene	12 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
Methyl methanesulfonate	12 U	14 U	13 U	11 U	13 UJ	12 U
Naphthalene	0.75 U	0.91 U	0.87 U	0.7 U	0.85 UJ	0.81 U
Nitrobenzene	8.6 U	10 U	10 U	8 U	9.8 UJ	9.3 U
N-Nitro-o-toluidine	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
N-Nitrosodiethylamine	15 U	18 U	17 U	14 U	17 UJ	16 U
N-Nitrosodimethylamine	12 U	15 U	14 U	11 U	14 UJ	13 U
N-Nitrosodi-n-butylamine	11 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
N-Nitrosodi-n-propylamine	8.1 U	9.9 U	9.4 U	7.5 U	9.2 UJ	8.7 U
N-Nitrosodiphenylamine	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
N-Nitrosomethylethylamine	7.1 U	8.7 U	8.3 U	6.6 U	8.1 UJ	7.7 U
N-Nitrosomorpholine	8.2 UJ	10 UJ	9.6 UJ	7.7 UJ	9.3 UJ	8.9 UJ
N-Nitrosopiperidine	11 UJ	13 UJ	12 UJ	9.9 UJ	12 UJ	11 UJ
N-Nitrosopyrrolidine	11 U	14 U	13 U	10 U	13 UJ	12 U
p-Dimethylamino azobenzene	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
Pentachlorobenzene	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
Pentachloronitrobenzene	7.4 UJ	9 UJ	8.5 UJ	6.8 UJ	8.4 UJ	7.9 UJ
Pentachlorophenol	10 U	13 U	12 UJ	9.6 UJ	12 UJ	11 UJ
Phenacetin	5.9 U	7.1 U	6.8 U	5.5 U	6.7 UJ	6.3 U
Phenanthrene	3.8 J	6.1 J	110	2 U	4.2 J	21
Phenol	6 U	7.3 U	7 U	5.6 UJ	6.8 UJ	6.5 UJ
p-Phenylene diamine	200 U	240 U	230 U	190 U	230 UJ	220 U
Pronamide	11 U	14 U	13 U	10 U	13 UJ	12 U
Pyrene	24	30	320	2 U	23 J	200 J
Pyridine	14 U	17 U	16 U	13 U	16 UJ	15 U
Safrole, Total	10 U	13 U	12 U	9.6 U	12 UJ	11 U
Metals (mg/kg)						
Antimony	0.19 UJ	0.38 UJ	0.58 UJ	0.23 UJ	0.31 UJ	0.26 UJ
Arsenic	3.7	3.2	3.3	4	4.5	4.2
Barium	26	76	30	19	22	22
Beryllium	0.065 J	0.18	0.088 J	0.037 J	0.079 J	0.042 J
Cadmium	0.96 J	4.1 J	1.4 J	0.082 J	2.2 J	1.3 J
Chromium	23 J	26 J	17 J	34 J	35 J	31 J
Cobalt	8.4	13	6.4	8.2	9.8	7.5
Copper	33	68	36	16	42	23
Lead	36	73	34	0.93	48	12
Mercury	0.023 J	0.039	0.036	0.0066 J	0.032	0.021 J
Nickel	7.8	10	5	10	12	9
Selenium	0.25 J	0.3 J	0.34 J	0.13 U	0.25 J	0.18 J
Silver	0.046 J	0.25 J	0.1 J	0.021 J	0.11 J	0.027 J
Thallium	0.14 U	0.17 U	0.16 U	0.13 U	0.16 U	0.16 U
Tin	4.5 U	5.6 U	5.3 U	4.4 U	5.2 U	5.2 U
Vanadium	78 J	99 J	46 J	96 J	110 J	86 J
Zinc	30	130	140	9	65	20

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)							
1,1,1,2-Tetrachloroethane	0.46 U	0.35 U	0.79 U	0.68 U	0.39 U	0.44 U	0.66 U
1,1,1-Trichloroethane	0.42 U	0.31 U	0.72 U	0.61 U	0.36 U	0.4 U	0.59 U
1,1,2,2-Tetrachloroethane	1 U	0.76 U	1.7 U	1.5 U	0.86 U	0.96 U	1.4 U
1,1,2-Trichloroethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U
1,1-Dichloroethane	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U
1,1-Dichloroethene	0.39 U	0.29 U	0.67 U	0.57 U	0.33 U	0.37 U	0.55 U
1,2,3-Trichloropropane	1 U	0.76 U	1.7 U	1.5 U	0.86 U	0.96 U	1.4 U
1,2-Dibromo-3-Chloropropane	2 U	1.5 U	3.5 U	3 U	1.7 U	1.9 U	2.9 U
1,2-Dichloroethane	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
1,2-Dichloropropane	0.8 U	0.6 U	1.4 U	1.2 U	0.67 U	0.76 U	1.1 U
2-Butanone (MEK)	5.5 U	1.5 U	15 U	19 U	12 U	6.2 U	19 U
2-Chloro-1,3-butadiene	0.41 U	0.31 U	0.71 U	0.6 U	0.35 U	0.39 U	0.58 U
2-Hexanone	1.5 U	1.1 U	2.6 U	2.2 U	1.3 U	1.4 U	2.1 U
3-Chloro-1-propene	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
4-Methyl-2-pentanone (MIBK)	2.1 U	1.6 U	3.6 U	7.7 J	1.8 U	2 U	3 U
Acetone	41 J	42	130	150	75	50	220
Acetonitrile	33 UJ	24 R	56 R	47 R	28 R	31 R	46 UJ
Acrolein	14 U	10 R	24 R	20 R	12 R	13 R	19 U
Acrylonitrile	17 U	12 U	29 U	24 U	14 UJ	16 UJ	24 U
Benzene	0.57 U	0.43 U	0.98 U	0.99 J	0.48 U	0.54 U	0.81 U
Bromoform	0.8 U	0.6 U	1.4 U	1.2 U	0.67 U	0.76 U	1.1 U
Bromomethane	1.2 U	0.87 UJ	2 UJ	1.7 UJ	0.98 UJ	1.1 UJ	1.6 U
Carbon disulfide	0.37 U	0.28 U	0.63 U	0.54 U	0.31 U	0.35 U	0.52 U
Carbon tetrachloride	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Chlorobenzene	0.53 U	0.4 U	0.91 U	0.77 U	0.45 U	0.5 U	0.75 U
Chlorodibromomethane	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U
Chloroethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U
Chloroform	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U
Chloromethane	0.51 U	0.39 U	0.88 U	0.75 U	0.43 U	0.49 U	0.73 U
cis-1,3-Dichloropropene	0.63 U	0.47 U	1.1 U	0.92 U	0.53 U	0.6 U	0.89 U
Dibromomethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U
Dichlorobromomethane	0.6 U	0.45 U	1 U	0.88 U	0.51 U	0.57 U	0.85 U
Dichlorodifluoromethane	0.65 U	0.48 U	1.1 U	0.94 U	0.55 U	0.61 U	0.91 U
Ethyl methacrylate	1.6 U	1.2 UJ	2.7 UJ	2.3 UJ	1.3 UJ	1.5 UJ	2.3 U
Ethylbenzene	0.54 U	0.41 U	0.93 U	0.79 U	0.46 U	0.51 U	0.77 U
Ethylene Dibromide	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
Iodomethane	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Isobutyl alcohol	56 R	37 R	86 R	73 R	42 R	47 R	71 R
Methacrylonitrile	17 U	13 UJ	30 UJ	25 UJ	15 U	16 U	25 U
Methyl methacrylate	2.7 U	2 UJ	4.6 UJ	3.9 UJ	2.3 UJ	2.5 UJ	3.8 U
Methylene Chloride	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Pentachloroethane	1.6 UJ	1.2 U	2.7 U	2.3 U	1.3 U	1.5 U	2.3 UJ
Propionitrile	15 U	11 R	26 R	22 R	13 R	14 R	21 U
Styrene	0.48 U	0.36 U	0.82 U	0.7 U	0.4 U	0.45 U	0.68 U
Tetrachloroethene	0.53 U	0.4 U	0.91 U	0.77 U	0.45 U	0.5 U	0.75 U
Toluene	0.57 U	0.53 J	0.98 U	0.83 U	0.48 U	0.54 U	0.81 U

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)							
trans-1,2-Dichloroethene	0.7 U	0.53 U	1.2 U	1 U	0.59 U	0.67 U	0.99 U
trans-1,3-Dichloropropene	0.63 U	0.47 U	1.1 U	0.92 U	0.53 U	0.6 U	0.89 U
trans-1,4-Dichloro-2-butene	2.2 U	1.7 UJ	3.8 UJ	3.3 UJ	1.9 UJ	2.1 UJ	3.2 U
Trichloroethene	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Trichlorofluoromethane	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
Vinyl acetate	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
Vinyl chloride	0.42 U	0.31 U	0.72 U	0.61 U	0.36 U	0.4 U	0.59 U
Xylenes, Total	1.7 U	1.2 U	2.9 U	2.4 U	1.4 U	1.6 U	2.4 U
Semi-Volatile Organic Compounds (ug/kg)							
1,1'-Biphenyl	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
1,2,4,5-Tetrachlorobenzene	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
1,2,4-Trichlorobenzene	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
1,2-Dichlorobenzene	8.1 U	9.8 UJ	8.9 UJ	8.2 UJ	9.3 UJ	8.3 UJ	8.9 UJ
1,3,5-Trinitrobenzene	20 U	24 UJ	22 UJ	20 UJ	23 UJ	20 UJ	22 UJ
1,3-Dichlorobenzene	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ
1,3-Dinitrobenzene	4.5 U	5.4 UJ	5 UJ	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ
1,4-Dichlorobenzene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
1,4-Dioxane	9.2 U	11 UJ	10 UJ	9.4 UJ	11 UJ	9.4 UJ	10 UJ
1,4-Naphthoquinone	4.5 UJ	5.4 UJ	5 UJ	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ
2,2'-oxybis[1-chloropropane]	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
2,3,4,6-Tetrachlorophenol	4.8 U	5.9 UJ	5.4 UJ	4.9 U	5.6 UJ	5 UJ	5.3 UJ
2,4,5-Trichlorophenol	7.8 U	9.5 UJ	8.7 UJ	8 U	9.1 UJ	8 UJ	8.6 UJ
2,4,6-Trichlorophenol	9.1 U	11 UJ	10 UJ	9.3 U	11 UJ	9.3 UJ	10 UJ
2,4-Dichlorophenol	9.3 U	11 UJ	10 UJ	9.5 U	11 UJ	9.5 UJ	10 UJ
2,4-Dimethylphenol	20 U	24 UJ	22 UJ	20 U	23 UJ	20 UJ	22 UJ
2,4-Dinitrophenol	96 UJ	120 UJ	110 UJ	97 U	110 UJ	98 UJ	110 UJ
2,4-Dinitrotoluene	6.8 U	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
2,6-Dichlorophenol	7.4 U	8.9 UJ	8.2 UJ	7.5 U	8.5 UJ	7.5 UJ	8.1 UJ
2,6-Dinitrotoluene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
2-Acetylaminofluorene	5.9 U	7.1 UJ	6.5 UJ	6 UJ	6.8 UJ	6 UJ	6.5 UJ
2-Chloronaphthalene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
2-Chlorophenol	7.6 U	9.2 UJ	8.4 UJ	7.7 U	8.8 UJ	7.8 UJ	8.4 UJ
2-Methylnaphthalene	2 U	2.4 UJ	2.2 UJ	2 UJ	2.3 UJ	2 UJ	2.2 UJ
2-Methylphenol	9.3 U	11 UJ	10 UJ	9.5 U	11 UJ	9.5 UJ	10 UJ
2-Naphthylamine	23 U	28 UJ	25 UJ	23 UJ	27 UJ	24 UJ	25 UJ
2-Nitroaniline	7.5 U	9.1 UJ	8.3 UJ	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ
2-Nitrophenol	8.4 U	10 UJ	9.3 UJ	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ
2-Picoline	14 U	17 UJ	15 UJ	14 UJ	16 UJ	14 UJ	15 UJ
2-Toluidine	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
3 & 4 Methylphenol	8.4 U	10 UJ	9.3 UJ	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ
3,3'-Dichlorobenzidine	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
3,3'-Dimethylbenzidine	210 U	250 UJ	230 UJ	210 UJ	240 UJ	210 UJ	230 UJ
3-Methylcholanthrene	7 U	8.5 UJ	7.8 UJ	7.2 UJ	8.1 UJ	7.2 UJ	7.8 UJ
3-Nitroaniline	5.2 U	6.3 UJ	5.7 UJ	5.3 UJ	6 UJ	5.3 UJ	5.7 UJ
4,6-Dinitro-2-methylphenol	6.7 UJ	8.1 UJ	7.4 UJ	6.8 U	7.7 UJ	6.8 UJ	7.4 UJ
4-Aminobiphenyl	15 U	18 UJ	17 UJ	15 UJ	17 UJ	15 UJ	17 UJ

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)							
4-Bromophenyl phenyl ether	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
4-Chloro-3-methylphenol	8.6 U	10 UJ	9.6 UJ	8.8 U	10 UJ	8.8 UJ	9.5 UJ
4-Chloroaniline	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ
4-Chlorophenyl phenyl ether	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
4-Nitroaniline	8.9 U	11 UJ	9.8 UJ	9 UJ	10 UJ	9.1 UJ	9.8 UJ
4-Nitrophenol	38 U	46 UJ	42 UJ	39 U	44 UJ	39 UJ	42 UJ
4-Nitroquinoline-1-oxide	13 R	15 R	14 R	13 R	15 R	13 R	14 R
7,12-Dimethylbenz(a)anthracene	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Acenaphthene	0.66 U	0.8 UJ	0.73 UJ	0.67 UJ	1.8 J	0.67 UJ	0.72 UJ
Acenaphthylene	2 U	2.4 UJ	2.2 UJ	2 UJ	2.3 UJ	2 UJ	2.2 UJ
Acetophenone	9.9 U	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	11 UJ
alpha,alpha-Dimethyl phenethylamine	68 U	82 UJ	75 UJ	69 UJ	79 UJ	70 UJ	75 UJ
Aniline	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
Anthracene	2 U	2.4 UJ	2.2 UJ	2 UJ	6 J	2 UJ	2.2 UJ
Aramite, Total	13 UJ	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Benzo[a]anthracene	2 UJ	2.4 UJ	4.8 J	8 J	140 J	8 J	2.2 UJ
Benzo[a]pyrene	2.8 J	3.3 UJ	18 J	17 J	160 J	13 J	1.5 UJ
Benzo[b]fluoranthene	5.6 J	5.5 UJ	29 J	36 J	380 J	29 J	1.6 UJ
Benzo[g,h,i]perylene	7.8 J	14 UJ	35	26 J	220 J	26 J	3.2 UJ
Benzo[k]fluoranthene	1.2 UJ	2.9 J	2.8 UJ	1.2 UJ	1.3 UJ	1.2 UJ	1.8 UJ
Benzyl alcohol	9.2 U	11 UJ	10 UJ	9.4 U	11 UJ	9.4 UJ	10 UJ
Bis(2-chloroethoxy)methane	7.8 U	9.5 UJ	8.7 UJ	8 UJ	9.1 UJ	8 UJ	8.6 UJ
Bis(2-chloroethyl)ether	6.6 U	8 UJ	7.3 UJ	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ
Bis(2-ethylhexyl) phthalate	45 UJ	24 UJ	29 U	34 UJ	48 UJ	36 UJ	21 UJ
Butyl benzyl phthalate	8.3 U	10 UJ	9.2 UJ	18 J	34 J	72 J	9.1 UJ
Chrysene	3.9 J	4.2 UJ	15	21 J	210 J	12 J	0.78 UJ
Diallate	11 U	13 UJ	12 UJ	11 UJ	13 UJ	11 UJ	12 UJ
Dibenz(a,h)anthracene	0.68 UJ	0.82 UJ	3.4 J	4.5 UJ	33 J	3 J	1.8 UJ
Dibenzofuran	4.8 U	5.9 UJ	5.4 UJ	4.9 UJ	5.6 UJ	5 UJ	5.3 UJ
Diethyl phthalate	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Dimethyl phthalate	7.4 U	8.9 UJ	8.2 UJ	7.5 UJ	8.5 UJ	7.5 UJ	8.1 UJ
Di-n-butyl phthalate	29 U	35 UJ	32 UJ	29 UJ	33 UJ	29 UJ	32 UJ
Di-n-octyl phthalate	3.8 UJ	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ
Dinoseb	20 U	24 UJ	22 UJ	20 UJ	23 UJ	20 UJ	22 UJ
Ethyl methanesulfonate	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Fluoranthene	2.1 J	4.3 UJ	14 J	21 J	280 J	17 J	2.2 UJ
Fluorene	0.89 U	1.1 UJ	0.98 UJ	0.92 UJ	1.3 J	0.91 UJ	0.98 UJ
Hexachlorobenzene	7.8 U	9.5 UJ	8.7 UJ	8 UJ	9.1 UJ	8 UJ	8.6 UJ
Hexachlorobutadiene	10 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Hexachlorocyclopentadiene	16 U	20 UJ	18 UJ	16 UJ	19 UJ	17 UJ	18 UJ
Hexachloroethane	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
Hexachlorophene	960 R	1200 UJ	1100 UJ	970 UJ	1100 UJ	980 UJ	1100 UJ
Hexachloropropene	8.3 UJ	10 UJ	9.2 UJ	8.5 UJ	9.6 UJ	8.5 UJ	9.1 UJ
Indeno[1,2,3-cd]pyrene	1.4 UJ	4.2 UJ	15 J	13 J	92 J	8.6 J	1.5 UJ
Isophorone	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
Isosafrole	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Semi-Volatile Organic Compounds (ug/kg)							
Methapyrilene	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Methyl methanesulfonate	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Naphthalene	0.69 U	0.84 UJ	0.76 UJ	0.7 UJ	0.8 UJ	0.75 J	0.76 UJ
Nitrobenzene	8 U	9.6 UJ	8.8 UJ	8.1 UJ	9.2 UJ	8.1 UJ	8.8 UJ
N-Nitro-o-toluidine	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ
N-Nitrosodiethylamine	14 U	17 UJ	15 UJ	14 UJ	16 UJ	14 UJ	15 UJ
N-Nitrosodimethylamine	11 U	14 UJ	12 UJ	12 UJ	13 UJ	12 UJ	12 UJ
N-Nitrosodi-n-butylamine	10 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
N-Nitrosodi-n-propylamine	7.5 U	9.1 UJ	8.3 UJ	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ
N-Nitrosodiphenylamine	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
N-Nitrosomethylethylamine	6.6 U	8 UJ	7.3 UJ	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ
N-Nitrosomorpholine	7.6 UJ	9.2 UJ	8.4 UJ	7.7 UJ	8.8 UJ	7.8 UJ	8.4 UJ
N-Nitrosopiperidine	9.8 UJ	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	11 UJ
N-Nitrosopyrrolidine	10 U	12 UJ	11 UJ	10 UJ	12 UJ	10 UJ	11 UJ
p-Dimethylamino azobenzene	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
Pentachlorobenzene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
Pentachloronitrobenzene	6.8 UJ	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
Pentachlorophenol	9.6 U	12 UJ	11 UJ	9.7 U	11 UJ	9.8 UJ	11 UJ
Phenacetin	5.4 U	6.6 UJ	6 UJ	5.5 UJ	6.3 UJ	5.5 UJ	6 UJ
Phenanthrene	2 U	2.4 UJ	5 U	5.8 J	34 J	2.4 J	2.2 UJ
Phenol	5.5 U	6.7 UJ	6.1 UJ	5.6 UJ	6.4 UJ	5.7 UJ	6.1 UJ
p-Phenylene diamine	180 U	220 UJ	200 UJ	190 UJ	210 UJ	190 UJ	200 UJ
Pronamide	10 U	13 UJ	11 UJ	11 UJ	12 UJ	11 UJ	11 UJ
Pyrene	2.4 J	2.8 J	10 J	20 J	300 J	16 J	2.2 UJ
Pyridine	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Safrole, Total	9.6 U	12 UJ	11 UJ	9.7 UJ	11 UJ	9.8 UJ	11 UJ
Metals (mg/kg)							
Antimony	0.096 UJ	0.18 UJ	0.24 UJ	0.17 UJ	0.35 UJ	0.22 UJ	0.09 UJ
Arsenic	2.7	1.5	3.7	2.5	3.4	3.7	1.4
Barium	14	15	26	17	410	66	90
Beryllium	0.045 J	0.038 J	0.067 J	0.051 J	0.047 J	0.056 J	0.26
Cadmium	0.2 J	0.29 J	0.8 J	0.61 J	1.7 J	0.69 J	0.13 J
Chromium	44 J	85 J	23 J	60 J	26	26	19
Cobalt	9.2	17	6	12	6.9	6.7	18
Copper	24	41	46 J	32	24	20	85
Lead	2.9	4.3	7.1 J	9.6	37	17	3.8
Mercury	0.012 J	0.022 J	0.026	0.011 J	0.0088 J	0.0087 J	0.056
Nickel	13	25	7.1	17	8.6	8.4	8.3
Selenium	0.13 J	0.16 U	0.58	0.13 U	0.19 J	0.16 J	0.52 J
Silver	0.017 U	0.021 U	0.044 J	0.028 J	0.053 J	0.062 J	0.054 J
Thallium	0.13 U	0.16 U	0.15 U	0.13 U	0.15 U	0.14 U	0.14 U
Tin	4.2 U	5.3 U	5 U	4.5 U	4.9 U	4.6 U	4.8 U
Vanadium	82 J	140 J	120 J	140 J	62	70	210
Zinc	25	20	13	36	69	22	50

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12	69SB27
Sample ID	69SB07-01	69SB08-01	69SB11-01	69SB12-01	69SB27-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0
Volatile Organic Compounds (ug/kg)					
1,1,1,2-Tetrachloroethane	0.71 U	0.7 U	0.69 U	0.69 U	0.65 U
1,1,1-Trichloroethane	0.65 U	0.63 U	0.62 U	0.62 U	0.59 U
1,1,2,2-Tetrachloroethane	1.6 U	1.5 U	1.5 U	1.5 U	1.4 U
1,1,2-Trichloroethane	1.3 U	1.3 U	1.3 U	1.3 U	1.2 U
1,1-Dichloroethane	0.56 U	0.54 U	0.54 U	0.54 U	0.51 U
1,1-Dichloroethene	0.6 U	0.59 U	0.58 U	0.58 U	0.55 U
1,2,3-Trichloropropane	1.6 U	1.5 U	1.5 U	1.5 U	1.4 U
1,2-Dibromo-3-Chloropropane	3.1 U	3 U	3 UJ	3 UJ	2.8 U
1,2-Dichloroethane	1.1 U	1.1 U	1.1 UJ	1.1 UJ	1 U
1,2-Dichloropropane	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U
2-Butanone (MEK)	3 U	2.9 U	4.5 UJ	2.9 UJ	2.7 U
2-Chloro-1,3-butadiene	0.64 UJ	0.62 UJ	0.61 UJ	0.61 UJ	0.58 U
2-Hexanone	2.3 U	2.3 U	2.3 UJ	2.3 UJ	2.1 U
3-Chloro-1-propene	1.7 R	1.6 R	1.6 U	1.6 U	1.5 UJ
4-Methyl-2-pentanone (MIBK)	3.2 U	3.2 U	3.1 U	3.1 U	3 U
Acetone	9 J	28 J	26 J	10 J	47 J
Acetonitrile	50 UJ	49 UJ	48 U	48 U	46 U
Acrolein	21 R	21 R	20 R	20 R	19 R
Acrylonitrile	26 UJ	25 UJ	25 UJ	25 UJ	23 U
Benzene	0.88 U	0.86 U	0.85 U	0.85 U	0.8 U
Bromoform	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U
Bromomethane	1.8 UJ	1.7 UJ	1.7 UJ	1.7 UJ	1.6 U
Carbon disulfide	0.57 U	0.55 U	0.55 U	0.55 U	0.59 J
Carbon tetrachloride	1.1 U	1.1 U	1.1 U	1.1 U	1 U
Chlorobenzene	0.81 U	0.79 U	0.79 U	0.78 U	0.74 U
Chlorodibromomethane	0.56 U	0.54 U	0.54 U	0.54 U	0.51 U
Chloroethane	1.3 U	1.3 U	1.3 U	1.3 U	1.2 U
Chloroform	0.56 U	0.54 U	0.54 U	0.54 U	0.51 U
Chloromethane	0.79 U	0.77 U	0.76 U	0.76 U	0.72 U
cis-1,3-Dichloropropene	0.97 U	0.95 U	0.94 U	0.93 U	0.89 U
Dibromomethane	1.3 U	1.3 U	1.3 U	1.3 U	1.2 U
Dichlorobromomethane	0.92 U	0.9 U	0.89 U	0.89 U	0.84 U
Dichlorodifluoromethane	0.99 U	0.97 U	0.96 U	0.95 U	0.91 U
Ethyl methacrylate	2.5 U	2.4 U	2.4 UJ	2.4 UJ	2.2 U
Ethylbenzene	0.84 U	0.82 U	0.81 U	0.8 U	0.76 U
Ethylene Dibromide	1.7 U	1.6 U	1.6 U	1.6 U	1.5 U
Iodomethane	1.1 U	1.1 U	1.1 UJ	1.1 UJ	1 UJ
Isobutyl alcohol	77 R	75 R	74 R	74 R	70 R
Methacrylonitrile	27 U	26 U	26 UJ	26 UJ	24 UJ
Methyl methacrylate	4.1 U	4 U	4 UJ	4 UJ	3.8 UJ
Methylene Chloride	1.1 U	1.1 U	1.1 U	1.1 U	1 U
Pentachloroethane	2.5 U	2.4 U	2.4 U	2.4 U	2.2 UJ
Propionitrile	23 UJ	23 UJ	23 U	23 U	21 U
Styrene	0.74 U	0.72 U	0.71 U	0.71 U	0.67 U
Tetrachloroethene	0.81 U	0.79 U	0.79 U	0.78 U	0.74 U
Toluene	0.88 U	0.86 U	0.85 U	0.85 U	0.8 U

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12	69SB27
Sample ID	69SB07-01	69SB08-01	69SB11-01	69SB12-01	69SB27-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0
Volatile Organic Compounds (ug/kg)					
trans-1,2-Dichloroethene	1.1 U	1.1 U	1 U	1 U	0.99 U
trans-1,3-Dichloropropene	0.97 U	0.95 U	0.94 U	0.93 U	0.89 U
trans-1,4-Dichloro-2-butene	3.5 U	3.4 U	3.3 U	3.3 U	3.2 UJ
Trichloroethene	1.1 U	1.1 U	1.1 U	1.1 U	1 U
Trichlorofluoromethane	1.7 U	1.6 U	1.6 U	1.6 U	1.5 U
Vinyl acetate	1.7 UJ	1.6 UJ	1.6 UJ	1.6 UJ	1.5 U
Vinyl chloride	0.65 U	0.63 U	0.62 U	0.62 U	0.59 U
Xylenes, Total	2.6 U	2.5 U	2.5 U	2.5 U	2.3 U
Semi-Volatile Organic Compounds (ug/kg)					
1,1'-Biphenyl	9.6 UJ	9.5 U	9.5 U	9.6 U	9.1 UJ
1,2,4,5-Tetrachlorobenzene	8.1 UJ	8.1 U	8.1 U	8.2 U	7.8 UJ
1,2,4-Trichlorobenzene	9.6 UJ	9.5 U	9.5 U	9.6 U	9.1 UJ
1,2-Dichlorobenzene	9 UJ	9 U	9 U	9.1 U	8.6 UJ
1,3,5-Trinitrobenzene	22 UJ	22 U	22 U	22 U	21 UJ
1,3-Dichlorobenzene	7.8 UJ	7.7 U	7.7 U	7.8 U	7.4 UJ
1,3-Dinitrobenzene	5 UJ	5 U	5 U	5.1 U	4.8 UJ
1,4-Dichlorobenzene	8 UJ	8 U	8 U	8 U	7.6 UJ
1,4-Dioxane	10 UJ	10 U	10 U	10 U	9.9 UJ
1,4-Naphthoquinone	5 UJ	5 U	5 U	5.1 U	4.8 UJ
2,2'-oxybis[1-chloropropane]	8.1 UJ	8.1 U	8.1 U	8.2 U	7.8 UJ
2,3,4,6-Tetrachlorophenol	5.4 UJ	5.4 U	5.4 U	5.4 U	5.2 UJ
2,4,5-Trichlorophenol	8.8 UJ	8.8 U	8.7 U	8.8 U	8.4 UJ
2,4,6-Trichlorophenol	10 UJ	10 U	10 U	10 U	9.7 UJ
2,4-Dichlorophenol	10 UJ	10 U	10 U	10 U	10 UJ
2,4-Dimethylphenol	22 UJ	22 U	22 U	22 U	21 UJ
2,4-Dinitrophenol	110 UJ	110 U	110 U	110 UJ	100 UJ
2,4-Dinitrotoluene	7.6 UJ	7.6 U	7.6 U	7.6 U	7.3 UJ
2,6-Dichlorophenol	8.3 UJ	8.2 U	8.2 U	8.3 U	7.9 UJ
2,6-Dinitrotoluene	8 UJ	8 U	8 U	8 U	7.6 UJ
2-Acetylaminofluorene	6.6 UJ	6.6 U	6.6 U	6.6 U	6.3 UJ
2-Chloronaphthalene	8 UJ	8 U	8 U	8 U	7.6 UJ
2-Chlorophenol	8.5 UJ	8.5 U	8.5 U	8.6 U	8.1 UJ
2-Methylnaphthalene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
2-Methylphenol	10 UJ	10 U	10 U	10 U	10 UJ
2-Naphthylamine	26 UJ	26 UJ	26 UJ	26 UJ	25 UJ
2-Nitroaniline	8.4 UJ	8.4 U	8.4 U	8.4 U	8 UJ
2-Nitrophenol	9.4 UJ	9.4 U	9.4 U	9.5 U	9 UJ
2-Picoline	16 UJ	15 U	15 U	16 U	15 UJ
2-Toluidine	12 UJ	12 U	12 U	12 U	11 UJ
3 & 4 Methylphenol	9.4 UJ	9.4 U	9.4 U	9.5 U	9 UJ
3,3'-Dichlorobenzidine	12 UJ	12 U	12 U	12 UJ	11 UJ
3,3'-Dimethylbenzidine	230 UJ	230 UJ	230 UJ	230 U	220 UJ
3-Methylcholanthrene	7.9 UJ	7.9 U	7.8 U	7.9 UJ	7.5 UJ
3-Nitroaniline	5.8 UJ	5.8 U	5.8 U	5.8 U	5.6 UJ
4,6-Dinitro-2-methylphenol	7.5 UJ	7.5 UJ	7.5 UJ	7.5 UJ	7.2 UJ
4-Aminobiphenyl	17 UJ	17 U	17 U	17 U	16 UJ

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12	69SB27
Sample ID	69SB07-01	69SB08-01	69SB11-01	69SB12-01	69SB27-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0
Semi-Volatile Organic Compounds (ug/kg)					
4-Bromophenyl phenyl ether	9.2 UJ	9.1 U	9.1 U	9.2 U	8.8 UJ
4-Chloro-3-methylphenol	9.7 UJ	9.7 U	9.6 U	9.7 U	9.3 UJ
4-Chloroaniline	7.8 UJ	7.7 U	7.7 U	7.8 U	7.4 UJ
4-Chlorophenyl phenyl ether	8 UJ	8 U	8 U	8 U	7.6 UJ
4-Nitroaniline	9.9 UJ	9.9 U	9.9 U	10 U	9.5 UJ
4-Nitrophenol	43 UJ	42 UJ	42 UJ	43 U	41 UJ
4-Nitroquinoline-1-oxide	14 R	14 R	14 R	14 R	14 R
7,12-Dimethylbenz(a)anthracene	12 UJ	12 U	12 U	12 UJ	11 UJ
Acenaphthene	0.74 UJ	0.73 U	0.73 U	0.74 U	0.7 UJ
Acenaphthylene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
Acetophenone	11 UJ	11 U	11 U	11 U	11 UJ
alpha,alpha-Dimethyl phenethylamine	76 UJ	76 U	76 U	76 U	73 UJ
Aniline	8.1 UJ	8.1 U	8.1 U	8.2 U	7.8 UJ
Anthracene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
Aramite, Total	14 UJ	14 UJ	14 UJ	14 UJ	14 UJ
Benzo[a]anthracene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
Benzo[a]pyrene	0.85 UJ	0.85 U	0.85 U	0.86 UJ	0.81 UJ
Benzo[b]fluoranthene	0.98 UJ	0.98 U	0.98 U	0.98 UJ	0.94 UJ
Benzo[g,h,i]perylene	2.2 UJ	2.2 U	2.2 U	2.2 UJ	2.1 UJ
Benzo[k]fluoranthene	1.3 UJ	1.3 U	1.3 U	1.3 UJ	1.2 UJ
Benzyl alcohol	10 UJ	10 U	10 U	10 U	9.9 UJ
Bis(2-chloroethoxy)methane	8.8 UJ	8.8 U	8.7 U	8.8 U	8.4 UJ
Bis(2-chloroethyl)ether	7.4 UJ	7.3 U	7.3 U	7.4 U	7 UJ
Bis(2-ethylhexyl) phthalate	47 UJ	18 U	32 U	20 U	22 UJ
Butyl benzyl phthalate	9.3 UJ	9.3 U	9.2 U	9.3 U	8.9 UJ
Chrysene	0.79 UJ	0.79 U	0.78 U	0.79 UJ	0.75 UJ
Diallate	12 UJ	12 U	12 U	12 U	12 UJ
Dibenz(a,h)anthracene	0.76 UJ	0.76 U	0.76 U	0.76 UJ	0.73 UJ
Dibenzofuran	5.4 UJ	5.4 U	5.4 U	5.4 U	5.2 UJ
Diethyl phthalate	14 UJ	14 U	14 U	14 U	14 UJ
Dimethyl phthalate	8.3 UJ	8.2 U	8.2 U	8.3 U	7.9 UJ
Di-n-butyl phthalate	32 UJ	32 U	32 U	32 U	31 UJ
Di-n-octyl phthalate	4.3 UJ	4.2 U	4.2 U	4.3 UJ	4.1 UJ
Dinoseb	22 UJ	22 U	22 U	22 U	21 UJ
Ethyl methanesulfonate	14 UJ	14 U	14 U	14 U	14 UJ
Fluoranthene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
Fluorene	0.99 UJ	0.99 U	0.99 U	1 U	0.95 UJ
Hexachlorobenzene	8.8 UJ	8.8 U	8.7 U	8.8 U	8.4 UJ
Hexachlorobutadiene	12 UJ	12 U	12 U	12 U	11 UJ
Hexachlorocyclopentadiene	18 UJ	18 U	18 U	18 U	17 UJ
Hexachloroethane	9.6 UJ	9.5 U	9.5 U	9.6 U	9.1 UJ
Hexachlorophene	1100 UJ	1100 R	1100 R	1100 R	1000 UJ
Hexachloropropene	9.3 UJ	9.3 UJ	9.2 UJ	9.3 UJ	8.9 UJ
Indeno[1,2,3-cd]pyrene	1.6 UJ	1.5 U	1.5 U	1.6 UJ	1.5 UJ
Isophorone	8 UJ	8 U	8 U	8 UJ	7.6 UJ
Isosafrole	9.2 UJ	9.1 U	9.1 U	9.2 U	8.8 UJ

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SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
CORRECTIVE MEASURES STUDY REPORT
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12	69SB27
Sample ID	69SB07-01	69SB08-01	69SB11-01	69SB12-01	69SB27-01
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0	1.0-3.0
Semi-Volatile Organic Compounds (ug/kg)					
Methapyrilene	12 UJ	12 UJ	12 UJ	12 UJ	11 UJ
Methyl methanesulfonate	12 UJ	12 U	12 U	12 U	11 UJ
Naphthalene	0.78 UJ	0.77 U	0.77 U	0.78 U	0.74 UJ
Nitrobenzene	8.9 UJ	8.9 U	8.9 U	8.9 U	8.5 UJ
N-Nitro-o-toluidine	7.8 UJ	7.7 U	7.7 U	7.8 U	7.4 UJ
N-Nitrosodiethylamine	16 UJ	15 U	15 U	16 U	15 UJ
N-Nitrosodimethylamine	13 UJ	13 U	13 U	13 U	12 UJ
N-Nitrosodi-n-butylamine	12 UJ	12 UJ	12 UJ	12 UJ	11 UJ
N-Nitrosodi-n-propylamine	8.4 UJ	8.4 U	8.4 U	8.4 U	8 UJ
N-Nitrosodiphenylamine	9.2 UJ	9.1 U	9.1 U	9.2 U	8.8 UJ
N-Nitrosomethylethylamine	7.4 UJ	7.3 U	7.3 U	7.4 U	7 UJ
N-Nitrosomorpholine	8.5 UJ	8.5 UJ	8.5 UJ	8.6 UJ	8.1 UJ
N-Nitrosopiperidine	11 UJ	11 UJ	11 UJ	11 UJ	10 UJ
N-Nitrosopyrrolidine	11 UJ	11 U	11 U	12 UJ	11 UJ
p-Dimethylamino azobenzene	9.2 UJ	9.1 U	9.1 U	9.2 U	8.8 UJ
Pentachlorobenzene	8 UJ	8 U	8 U	8 U	7.6 UJ
Pentachloronitrobenzene	7.6 UJ	7.6 U	7.6 U	7.6 U	7.3 UJ
Pentachlorophenol	11 UJ	11 U	11 U	11 U	10 UJ
Phenacetin	6.1 UJ	6.1 U	6 U	6.1 U	5.8 UJ
Phenanthrene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
Phenol	6.2 UJ	6.2 U	6.2 U	6.2 U	5.9 UJ
p-Phenylene diamine	210 UJ	210 U	210 U	210 U	200 UJ
Pronamide	12 UJ	12 U	12 U	12 U	11 UJ
Pyrene	2.2 UJ	2.2 U	2.2 U	2.2 U	2.1 UJ
Pyridine	14 UJ	14 U	14 U	14 U	14 UJ
Safrole, Total	11 UJ	11 U	11 U	11 U	10 UJ
Metals (mg/kg)					
Antimony	0.096 U	0.096 U	0.089 U	0.094 U	0.085 UJ
Arsenic	1.3	2	0.84	1.3	0.85
Barium	18	73	120	96	64
Beryllium	0.18	0.16	0.27	0.26	0.26
Cadmium	0.035 UJ	0.051 J	0.037 UJ	0.2 J	0.035 UJ
Chromium	25	29	18	17	20
Cobalt	7.9	8.1	17	27	13
Copper	72 J	87	97	110	88
Lead	2.5	3.4	2.8	3	2.7
Mercury	0.11	0.06	0.024	0.049	0.067
Nickel	5.7	4.6	10	11	9.6
Selenium	0.58	1.2	0.17 J	0.32 J	0.37 J
Silver	0.068 J	0.03 J	0.053 U	0.084 U	0.057 J
Thallium	0.14 U	0.15 U	0.14 U	0.15 U	0.14 U
Tin	4.6 U	5 U	4.7 U	5 U	4.6 U
Vanadium	250	380	170	240	180
Zinc	29	26	76	82	64

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Volatile Organic Compounds (ug/L)				
1,1,1,2-Tetrachloroethane	0.29 U	0.29 U	0.29 U	0.29 UJ
1,1,1-Trichloroethane	0.39 U	0.39 U	0.39 U	0.39 UJ
1,1,2,2-Tetrachloroethane	0.26 U	0.26 U	0.26 U	0.26 UJ
1,1,2-Trichloroethane	0.51 U	0.51 U	0.51 U	0.51 UJ
1,1-Dichloroethane	0.32 U	0.32 U	0.32 U	0.32 UJ
1,1-Dichloroethene	0.36 U	0.36 U	0.36 U	0.36 UJ
1,2,3-Trichloropropane	0.42 U	0.42 U	0.42 U	0.42 UJ
1,2-Dibromo-3-Chloropropane	0.48 U	0.48 U	0.48 U	0.48 UJ
1,2-Dichloroethane	0.31 U	0.31 U	0.31 U	0.31 UJ
1,2-Dichloropropane	0.36 U	0.36 U	0.36 U	0.36 UJ
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.6 UJ
2-Chloro-1,3-butadiene	0.35 UJ	0.35 UJ	0.35 UJ	0.35 UJ
2-Hexanone	0.68 U	0.68 U	0.68 U	0.68 UJ
3-Chloro-1-propene	0.46 U	0.46 U	0.46 U	0.46 UJ
4-Methyl-2-pentanone (MIBK)	0.6 U	0.6 U	0.6 U	0.6 UJ
Acetone	5 UJ	5 UJ	5 UJ	5 UJ
Acetonitrile	15 UJ	15 UJ	15 UJ	15 UJ
Acrolein	18 U	18 U	18 U	18 UJ
Acrylonitrile	3.8 U	3.8 U	3.8 U	3.8 UJ
Benzene	0.32 U	0.32 U	0.32 U	0.32 UJ
Bromoform	0.41 U	0.41 U	0.41 U	0.41 UJ
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 UJ
Carbon disulfide	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ
Carbon tetrachloride	0.27 U	0.27 U	0.27 U	0.27 UJ
Chlorobenzene	0.34 U	0.34 U	0.34 U	0.34 UJ
Chlorodibromomethane	0.3 U	0.3 U	0.3 U	0.3 UJ
Chloroethane	1 U	1 U	1 U	1 UJ
Chloroform	0.29 U	0.29 U	0.29 U	0.29 UJ
Chloromethane	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ
cis-1,3-Dichloropropene	0.37 U	0.37 U	0.37 U	0.37 UJ
Dibromomethane	0.29 U	0.29 U	0.29 U	0.29 UJ
Dichlorobromomethane	0.34 U	0.34 U	0.34 U	0.34 UJ
Dichlorodifluoromethane	0.33 U	0.33 U	0.33 U	0.33 UJ
Ethyl methacrylate	1 U	1 U	1 U	1 UJ
Ethylbenzene	0.3 U	0.3 U	0.3 U	0.3 UJ
Ethylene Dibromide	0.3 U	0.3 U	0.3 U	0.3 UJ
Iodomethane	1 U	1 U	1 U	1 UJ
Isobutyl alcohol	19 R	19 R	19 R	19 UJ
Methacrylonitrile	6.6 U	6.6 U	6.6 U	6.6 UJ
Methyl methacrylate	0.38 UJ	0.38 UJ	0.38 UJ	0.38 UJ
Methylene Chloride	1 U	1 U	1 U	1 UJ
Pentachloroethane	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 U	9.2 U	9.2 U	9.2 UJ
Styrene	0.36 U	0.36 U	0.36 U	0.36 UJ
Tetrachloroethene	0.28 U	0.28 U	0.28 U	0.28 UJ
Toluene	0.31 U	0.31 U	0.31 U	0.31 UJ

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Volatile Organic Compounds (ug/L)				
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.3 U	0.3 UJ
trans-1,3-Dichloropropene	0.27 U	0.27 U	0.27 U	0.27 UJ
trans-1,4-Dichloro-2-butene	0.83 UJ	0.83 UJ	0.83 UJ	0.83 UJ
Trichloroethene	0.4 U	0.4 U	0.4 U	0.4 UJ
Trichlorofluoromethane	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ
Vinyl acetate	0.62 U	0.62 U	0.62 U	0.62 UJ
Vinyl chloride	0.2 U	0.2 U	0.2 U	0.2 UJ
Xylenes, Total	0.87 U	0.87 U	0.87 U	0.87 UJ
Semi-Volatile Organic Compounds (ug/L)				
1,1'-Biphenyl	0.17 U	0.17 U	0.17 U	0.17 UJ
1,2,4,5-Tetrachlorobenzene	0.23 U	0.23 U	0.23 U	0.23 UJ
1,2,4-Trichlorobenzene	0.13 U	0.13 U	0.13 U	0.13 UJ
1,2-Dichlorobenzene	0.13 U	0.13 U	0.13 U	0.13 UJ
1,3,5-Trinitrobenzene	0.2 U	0.2 U	0.2 U	0.2 UJ
1,3-Dichlorobenzene	0.12 U	0.12 U	0.12 U	0.12 UJ
1,3-Dinitrobenzene	0.22 U	0.22 U	0.22 U	0.22 UJ
1,4-Dichlorobenzene	0.12 U	0.12 U	0.15 U	0.12 UJ
1,4-Dioxane	0.49 U	0.49 U	0.49 U	0.49 UJ
1,4-Naphthoquinone	0.16 U	0.16 U	0.16 U	0.16 UJ
2,2'-oxybis[1-chloropropane]	0.097 U	0.097 U	0.097 U	0.097 UJ
2,3,4,6-Tetrachlorophenol	0.29 U	0.29 U	0.29 U	0.29 UJ
2,4,5-Trichlorophenol	0.16 U	0.16 U	0.16 U	0.16 UJ
2,4,6-Trichlorophenol	0.16 U	0.16 U	0.16 U	0.16 UJ
2,4-Dichlorophenol	0.15 U	0.15 U	0.15 U	0.15 UJ
2,4-Dimethylphenol	0.4 U	0.4 U	0.4 U	0.4 UJ
2,4-Dinitrophenol	2.4 UJ	2.4 U	2.4 UJ	2.4 UJ
2,4-Dinitrotoluene	0.17 U	0.17 U	0.17 U	0.17 UJ
2,6-Dichlorophenol	0.21 U	0.21 U	0.21 U	0.21 UJ
2,6-Dinitrotoluene	0.15 U	0.15 U	0.15 U	0.15 UJ
2-Acetylaminofluorene	0.19 UJ	0.19 U	0.19 UJ	0.19 UJ
2-Chloronaphthalene	0.12 U	0.12 U	0.12 U	0.12 UJ
2-Chlorophenol	0.15 U	0.15 U	0.15 U	0.15 UJ
2-Methylnaphthalene	0.022 U	0.022 U	0.022 U	0.022 UJ
2-Methylphenol	0.15 U	0.15 U	0.15 U	0.15 UJ
2-Naphthylamine	1.1 U	1.1 U	1.1 U	1.1 UJ
2-Nitroaniline	0.14 U	0.14 U	0.14 U	0.14 UJ
2-Nitrophenol	0.17 U	0.17 U	0.17 U	0.17 UJ
2-Picoline	0.57 U	0.57 U	0.57 U	0.57 UJ
2-Toluidine	0.32 U	0.32 U	0.32 U	0.32 UJ
3 & 4 Methylphenol	0.15 U	0.15 U	0.15 U	0.15 UJ
3,3'-Dichlorobenzidine	3.7 U	3.7 UJ	3.7 U	3.7 UJ
3,3'-Dimethylbenzidine	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ
3-Methylcholanthrene	0.2 U	0.2 U	0.2 U	0.2 UJ
3-Nitroaniline	0.28 U	0.28 U	0.28 U	0.28 UJ
4,6-Dinitro-2-methylphenol	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ
4-Aminobiphenyl	0.68 UJ	0.68 U	0.68 UJ	0.68 UJ

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Semi-Volatile Organic Compounds (ug/L)				
4-Bromophenyl phenyl ether	0.16 U	0.16 U	0.16 U	0.16 UJ
4-Chloro-3-methylphenol	0.16 U	0.16 U	0.16 U	0.16 UJ
4-Chloroaniline	0.4 U	0.4 U	0.4 U	0.4 UJ
4-Chlorophenyl phenyl ether	0.15 U	0.15 U	0.15 U	0.15 UJ
4-Nitroaniline	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ
4-Nitrophenol	0.18 U	0.18 U	0.18 U	0.18 UJ
4-Nitroquinoline-1-oxide	0.26 R	0.26 R	0.26 R	0.26 R
7,12-Dimethylbenz(a)anthracene	0.2 U	0.2 U	0.2 U	0.2 UJ
Acenaphthene	0.019 U	0.019 U	0.019 U	0.019 UJ
Acenaphthylene	0.049 U	0.049 U	0.049 U	0.049 UJ
Acetophenone	0.19 U	0.19 U	0.19 U	0.19 UJ
alpha,alpha-Dimethyl phenethylamine	1.3 UJ	1.3 U	1.3 UJ	1.3 UJ
Aniline	0.4 U	0.4 U	0.4 U	0.4 UJ
Anthracene	0.021 U	0.021 U	0.021 U	0.021 UJ
Aramite, Total	0.49 UJ	0.49 U	0.49 UJ	0.49 UJ
Benzo[a]anthracene	0.025 U	0.025 U	0.025 U	0.025 UJ
Benzo[a]pyrene	0.024 U	0.024 U	0.024 U	0.024 UJ
Benzo[b]fluoranthene	0.036 U	0.036 U	0.036 U	0.036 UJ
Benzo[g,h,i]perylene	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ
Benzo[k]fluoranthene	0.019 U	0.019 U	0.019 U	0.019 UJ
Benzyl alcohol	0.16 U	0.16 U	0.16 U	0.16 UJ
Bis(2-chloroethoxy)methane	0.15 U	0.15 U	0.15 U	0.15 UJ
Bis(2-chloroethyl)ether	0.14 U	0.14 U	0.14 U	0.14 UJ
Bis(2-ethylhexyl) phthalate	0.34 U	0.34 U	0.34 U	0.34 UJ
Butyl benzyl phthalate	0.17 U	0.17 U	0.17 U	0.17 UJ
Chrysene	0.027 U	0.027 U	0.027 U	0.027 UJ
Diallate	0.19 U	0.19 U	0.19 U	0.19 UJ
Dibenz(a,h)anthracene	0.023 U	0.023 U	0.023 U	0.023 UJ
Dibenzofuran	0.097 U	0.097 U	0.097 U	0.097 UJ
Diethyl phthalate	0.18 U	0.18 U	0.18 U	0.18 UJ
Dimethyl phthalate	0.17 U	0.17 U	0.17 U	0.17 UJ
Di-n-butyl phthalate	0.26 U	0.21 U	0.19 U	0.44 UJ
Di-n-octyl phthalate	0.097 U	0.097 U	0.097 U	0.097 UJ
Dinoseb	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ
Ethyl methanesulfonate	0.23 U	0.23 U	0.23 U	0.23 UJ
Fluoranthene	0.049 U	0.049 U	0.049 U	0.049 UJ
Fluorene	0.018 U	0.018 U	0.018 U	0.018 UJ
Hexachlorobenzene	0.16 U	0.16 U	0.16 U	0.16 UJ
Hexachlorobutadiene	0.13 U	0.13 U	0.13 U	0.13 UJ
Hexachlorocyclopentadiene	0.49 U	0.49 U	0.49 U	0.49 UJ
Hexachloroethane	0.15 U	0.15 U	0.15 U	0.15 UJ
Hexachlorophene	49 R	49 R	49 R	49 R
Hexachloropropene	0.12 U	0.12 U	0.12 U	0.12 UJ
Indeno[1,2,3-cd]pyrene	0.022 U	0.022 UJ	0.022 U	0.022 UJ
Isophorone	0.15 U	0.15 U	0.15 U	0.15 UJ
Isosafrole	0.3 U	0.3 U	0.3 U	0.3 UJ

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Semi-Volatile Organic Compounds (ug/L)				
Methapyrilene	0.26 UJ	0.26 U	0.26 UJ	0.26 UJ
Methyl methanesulfonate	0.46 U	0.46 U	0.46 U	0.46 UJ
Naphthalene	0.049 U	0.049 U	0.049 U	0.049 UJ
Nitrobenzene	0.14 U	0.14 U	0.14 U	0.14 UJ
N-Nitro-o-toluidine	0.24 U	0.24 U	0.24 U	0.24 UJ
N-Nitrosodiethylamine	0.32 U	0.32 U	0.32 U	0.32 UJ
N-Nitrosodimethylamine	0.19 U	0.19 U	0.19 U	0.19 UJ
N-Nitrosodi-n-butylamine	0.18 U	0.18 U	0.18 U	0.18 UJ
N-Nitrosodi-n-propylamine	0.13 U	0.13 U	0.13 U	0.13 UJ
N-Nitrosodiphenylamine	0.17 U	0.17 U	0.17 U	0.17 UJ
N-Nitrosomethylethylamine	0.28 U	0.28 U	0.28 U	0.28 UJ
N-Nitrosomorpholine	0.19 U	0.19 U	0.19 U	0.19 UJ
N-Nitrosopiperidine	0.22 U	0.22 U	0.22 U	0.22 UJ
N-Nitrosopyrrolidine	0.25 U	0.25 U	0.25 U	0.25 UJ
p-Dimethylamino azobenzene	0.6 U	0.6 U	0.6 U	0.6 UJ
Pentachlorobenzene	0.27 U	0.27 U	0.27 U	0.27 UJ
Pentachloronitrobenzene	0.3 U	0.3 U	0.3 U	0.3 UJ
Pentachlorophenol	0.18 U	0.18 U	0.18 U	0.18 UJ
Phenacetin	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ
Phenanthrene	0.017 U	0.017 U	0.017 U	0.017 UJ
Phenol	0.14 U	0.14 U	0.14 U	0.14 UJ
p-Phenylene diamine	2.4 U	2.4 U	2.4 U	2.4 UJ
Pronamide	0.25 U	0.25 U	0.25 U	0.25 UJ
Pyrene	0.026 U	0.026 U	0.026 U	0.026 UJ
Pyridine	0.22 U	0.22 U	0.22 U	0.22 UJ
Safrole, Total	0.23 U	0.23 U	0.23 U	0.23 UJ
Total Metals (ug/L)				
Antimony	0.36 U	0.36 U	0.36 U	0.36 UJ
Arsenic	1.7 U	1.5 U	1.7 U	0.43 J
Barium	23	23	570	580 J
Beryllium	0.065 U	0.065 U	0.065 U	0.065 UJ
Cadmium	0.12 J	0.12 UJ	0.12 UJ	0.16 J
Chromium	1.3 U	1.4 U	1.3 U	0.6 UJ
Cobalt	0.24 U	0.32 U	11	9.9 J
Copper	1.2 U	1.2 U	1.2 U	1.4 UJ
Lead	0.15 U	0.15 U	0.15 U	0.15 UJ
Mercury	0.08 R	0.08 R	0.08 R	0.08 UJ
Nickel	0.47 J	0.44 J	0.55 J	0.52 J
Selenium	0.6 U	0.6 U	0.6 U	0.6 UJ
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 U	0.55 U	0.55 U	0.55 UJ
Tin	0.9 U	0.9 U	0.9 U	0.98 UJ
Vanadium	6.9	5.7	6.6	4.8 J
Zinc	7.7 J	6.5 U	6.5 U	7.2 J

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12
Sample ID	69GW07	69GW08	69GW11	69GW12
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008
Dissolved Metals (ug/L)				
Antimony	0.36 U	0.36 U	0.36 U	0.36 UJ
Arsenic	1.5 U	1.3 U	1.4 U	0.32 J
Barium	23	23	540	570 J
Beryllium	0.065 U	0.065 U	0.065 U	0.065 UJ
Cadmium	0.14 J	0.12 UJ	0.12 UJ	0.16 J
Chromium	1.1 U	1.2 U	1.3 U	0.6 UJ
Cobalt	0.41 U	0.43 U	11	12 J
Copper	1.2 U	1.2 U	1.5 U	1.2 UJ
Lead	0.15 U	0.15 U	0.15 U	0.15 UJ
Mercury	0.08 U	0.08 U	0.08 U	0.08 UJ
Nickel	0.42 J	0.42 J	0.67 J	0.78 J
Selenium	0.6 U	0.6 U	0.6 U	0.6 UJ
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 U	0.55 U	0.55 U	0.55 UJ
Tin	0.9 U	0.9 U	0.9 U	0.9 UJ
Vanadium	6.1	5.4	6.6	4.2 J
Zinc	6.5 U	6.5 U	6.5 U	7.2 J

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L)			
1,1,1,2-Tetrachloroethane	0.29 UJ	0.29 U	0.29 U
1,1,1-Trichloroethane	0.39 UJ	0.39 U	0.39 U
1,1,2,2-Tetrachloroethane	0.26 UJ	0.26 U	0.26 U
1,1,2-Trichloroethane	0.51 UJ	0.51 U	0.51 U
1,1-Dichloroethane	0.32 UJ	0.32 U	0.32 U
1,1-Dichloroethene	0.36 UJ	0.36 U	0.36 U
1,2,3-Trichloropropane	0.42 UJ	0.42 U	0.42 U
1,2-Dibromo-3-Chloropropane	0.48 UJ	0.48 U	0.48 U
1,2-Dichloroethane	0.31 UJ	0.31 U	0.31 U
1,2-Dichloropropane	0.36 UJ	0.36 U	0.36 U
2-Butanone (MEK)	0.6 UJ	0.6 U	0.6 U
2-Chloro-1,3-butadiene	0.35 UJ	0.35 U	0.35 U
2-Hexanone	0.68 UJ	1.1 J	0.68 U
3-Chloro-1-propene	0.46 UJ	0.46 U	0.46 U
4-Methyl-2-pentanone (MIBK)	0.6 UJ	0.6 U	0.6 U
Acetone	5 UJ	5 U	15 J
Acetonitrile	15 UJ	15 U	15 U
Acrolein	18 UJ	18 R	18 R
Acrylonitrile	3.8 UJ	3.8 UJ	3.8 UJ
Benzene	0.32 UJ	0.32 U	0.32 U
Bromoform	0.41 UJ	0.41 U	0.41 U
Bromomethane	0.5 UJ	0.5 UJ	0.5 UJ
Carbon disulfide	0.17 UJ	0.17 U	0.17 U
Carbon tetrachloride	0.27 UJ	0.27 U	0.27 U
Chlorobenzene	0.34 UJ	0.34 U	0.34 U
Chlorodibromomethane	0.3 UJ	0.3 U	0.3 U
Chloroethane	1 UJ	1 U	1 U
Chloroform	0.29 UJ	0.29 U	0.29 U
Chloromethane	1.5 J	0.28 U	0.28 U
cis-1,3-Dichloropropene	0.37 UJ	0.37 U	0.37 U
Dibromomethane	0.29 UJ	0.29 U	0.29 U
Dichlorobromomethane	0.34 UJ	0.34 U	0.34 U
Dichlorodifluoromethane	0.33 UJ	0.33 UJ	0.33 UJ
Ethyl methacrylate	1 UJ	1 U	1 U
Ethylbenzene	0.3 UJ	0.3 U	0.3 U
Ethylene Dibromide	0.3 UJ	0.3 U	0.3 U
Iodomethane	1 UJ	1 U	1 U
Isobutyl alcohol	19 UJ	19 U	19 U
Methacrylonitrile	6.6 UJ	6.6 U	6.6 U
Methyl methacrylate	0.38 UJ	0.38 U	0.38 U
Methylene Chloride	1 UJ	1 U	1 U
Pentachloroethane	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 UJ	9.2 U	9.2 U
Styrene	0.36 UJ	0.36 U	0.36 U
Tetrachloroethene	0.28 UJ	0.28 U	0.28 U
Toluene	0.31 UJ	0.31 U	0.31 U

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L)			
trans-1,2-Dichloroethene	0.3 UJ	0.3 U	0.3 U
trans-1,3-Dichloropropene	0.27 UJ	0.27 UJ	0.27 UJ
trans-1,4-Dichloro-2-butene	0.83 UJ	0.83 U	0.83 U
Trichloroethene	0.4 UJ	0.4 U	0.4 U
Trichlorofluoromethane	0.29 UJ	0.29 U	0.29 U
Vinyl acetate	0.62 UJ	0.62 UJ	0.62 UJ
Vinyl chloride	0.2 UJ	0.2 U	0.2 U
Xylenes, Total	0.87 UJ	0.87 U	0.87 U
Semi-Volatile Organic Compounds (ug/L)			
1,1'-Biphenyl	0.17 UJ	0.17 U	0.17 U
1,2,4,5-Tetrachlorobenzene	0.23 UJ	0.23 U	0.23 U
1,2,4-Trichlorobenzene	0.13 UJ	0.13 U	0.13 U
1,2-Dichlorobenzene	0.13 UJ	0.13 U	0.13 U
1,3,5-Trinitrobenzene	0.2 UJ	0.2 U	0.2 U
1,3-Dichlorobenzene	0.12 UJ	0.12 U	0.12 U
1,3-Dinitrobenzene	0.22 UJ	0.22 U	0.22 U
1,4-Dichlorobenzene	0.12 UJ	0.12 U	0.12 U
1,4-Dioxane	0.49 UJ	0.49 U	0.49 U
1,4-Naphthoquinone	0.16 UJ	0.16 U	0.16 U
2,2'-oxybis[1-chloropropane]	0.097 UJ	0.097 U	0.097 U
2,3,4,6-Tetrachlorophenol	0.29 UJ	0.29 U	0.29 U
2,4,5-Trichlorophenol	0.16 UJ	0.16 U	0.16 U
2,4,6-Trichlorophenol	0.16 UJ	0.16 U	0.16 U
2,4-Dichlorophenol	0.15 UJ	0.15 U	0.15 U
2,4-Dimethylphenol	0.4 UJ	0.4 U	0.4 U
2,4-Dinitrophenol	2.4 UJ	2.4 U	2.4 U
2,4-Dinitrotoluene	0.17 UJ	0.17 UJ	0.17 UJ
2,6-Dichlorophenol	0.21 UJ	0.21 U	0.21 U
2,6-Dinitrotoluene	0.15 UJ	0.15 U	0.15 U
2-Acetylaminofluorene	0.19 UJ	0.19 U	0.19 U
2-Chloronaphthalene	0.12 UJ	0.12 U	0.12 U
2-Chlorophenol	0.15 UJ	0.15 U	0.15 U
2-Methylnaphthalene	0.022 UJ	0.022 U	0.022 U
2-Methylphenol	0.15 UJ	0.15 U	0.15 U
2-Naphthylamine	1.1 UJ	1.1 U	1.1 U
2-Nitroaniline	0.14 UJ	0.14 U	0.14 U
2-Nitrophenol	0.17 UJ	0.17 U	0.17 U
2-Picoline	0.57 UJ	0.57 U	0.57 U
2-Toluidine	0.32 UJ	0.32 U	0.32 U
3 & 4 Methylphenol	0.15 UJ	0.15 U	2.1
3,3'-Dichlorobenzidine	3.7 UJ	3.7 U	3.7 U
3,3'-Dimethylbenzidine	3.7 UJ	3.7 U	3.7 U
3-Methylcholanthrene	0.2 UJ	0.2 U	0.2 U
3-Nitroaniline	0.28 UJ	0.28 U	0.28 U
4,6-Dinitro-2-methylphenol	0.49 UJ	0.49 UJ	0.49 UJ
4-Aminobiphenyl	0.68 UJ	0.68 U	0.68 U

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Semi-Volatile Organic Compounds (ug/L)			
4-Bromophenyl phenyl ether	0.16 UJ	0.16 U	0.16 U
4-Chloro-3-methylphenol	0.16 UJ	0.16 U	0.16 U
4-Chloroaniline	0.4 UJ	0.4 U	0.4 U
4-Chlorophenyl phenyl ether	0.15 UJ	0.15 U	0.15 U
4-Nitroaniline	0.26 UJ	0.26 U	0.26 U
4-Nitrophenol	0.18 UJ	0.18 UJ	0.18 UJ
4-Nitroquinoline-1-oxide	0.26 R	0.26 R	0.26 R
7,12-Dimethylbenz(a)anthracene	0.2 UJ	0.2 U	0.2 U
Acenaphthene	0.019 UJ	0.019 U	0.11 J
Acenaphthylene	0.049 UJ	0.049 U	0.049 U
Acetophenone	0.19 UJ	0.19 U	0.19 U
alpha,alpha-Dimethyl phenethylamine	1.3 UJ	1.3 U	1.3 U
Aniline	0.4 UJ	0.4 U	0.4 U
Anthracene	0.021 UJ	0.021 U	0.021 U
Aramite, Total	0.49 UJ	0.49 UJ	0.49 UJ
Benzo[a]anthracene	0.025 UJ	0.025 U	0.025 U
Benzo[a]pyrene	0.024 UJ	0.024 U	0.024 U
Benzo[b]fluoranthene	0.036 UJ	0.036 U	0.036 U
Benzo[g,h,i]perylene	0.023 UJ	0.023 UJ	0.023 UJ
Benzo[k]fluoranthene	0.019 UJ	0.019 U	0.019 U
Benzyl alcohol	0.16 UJ	0.16 U	0.16 U
Bis(2-chloroethoxy)methane	0.15 UJ	0.15 U	0.15 U
Bis(2-chloroethyl)ether	0.14 UJ	0.14 U	0.14 U
Bis(2-ethylhexyl) phthalate	0.6 J	0.61 U	0.78 U
Butyl benzyl phthalate	0.17 UJ	0.17 U	0.17 U
Chrysene	0.027 UJ	0.027 U	0.027 U
Diallate	0.19 UJ	0.19 U	0.19 U
Dibenz(a,h)anthracene	0.023 UJ	0.023 UJ	0.023 UJ
Dibenzofuran	0.097 UJ	0.097 U	0.36 J
Diethyl phthalate	0.18 UJ	0.18 U	0.18 U
Dimethyl phthalate	0.17 UJ	0.17 U	0.17 U
Di-n-butyl phthalate	0.31 UJ	0.11 U	0.72 U
Di-n-octyl phthalate	0.097 UJ	0.097 U	0.097 U
Dinoseb	0.49 UJ	0.49 U	0.49 U
Ethyl methanesulfonate	0.23 UJ	0.23 U	0.23 U
Fluoranthene	0.049 UJ	0.049 U	0.049 U
Fluorene	0.018 UJ	0.083 J	0.018 U
Hexachlorobenzene	0.16 UJ	0.16 U	0.16 U
Hexachlorobutadiene	0.13 UJ	0.13 U	0.13 U
Hexachlorocyclopentadiene	0.49 UJ	0.49 U	0.49 U
Hexachloroethane	0.15 UJ	0.15 U	0.15 U
Hexachlorophene	49 R	49 R	49 R
Hexachloropropene	0.12 UJ	0.12 UJ	0.12 UJ
Indeno[1,2,3-cd]pyrene	0.022 UJ	0.022 U	0.022 U
Isophorone	0.15 UJ	0.15 U	0.15 U
Isosafrole	0.3 UJ	0.3 U	0.3 U

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Semi-Volatile Organic Compounds (ug/L)			
Methapyrilene	0.26 UJ	0.26 UJ	0.26 UJ
Methyl methanesulfonate	0.46 UJ	0.46 U	0.46 U
Naphthalene	0.049 UJ	0.049 U	0.049 U
Nitrobenzene	0.14 UJ	0.14 U	0.14 U
N-Nitro-o-toluidine	0.24 UJ	0.24 U	0.24 U
N-Nitrosodiethylamine	0.32 UJ	0.32 U	0.32 U
N-Nitrosodimethylamine	0.19 UJ	0.19 U	0.19 U
N-Nitrosodi-n-butylamine	0.18 UJ	0.18 UJ	0.18 UJ
N-Nitrosodi-n-propylamine	0.13 UJ	0.13 U	0.13 U
N-Nitrosodiphenylamine	0.17 UJ	0.17 U	0.17 U
N-Nitrosomethylethylamine	0.28 UJ	0.28 U	0.28 U
N-Nitrosomorpholine	0.19 UJ	0.19 UJ	0.19 UJ
N-Nitrosopiperidine	0.22 UJ	0.22 UJ	0.22 UJ
N-Nitrosopyrrolidine	0.25 UJ	0.25 U	0.25 U
p-Dimethylamino azobenzene	0.6 UJ	0.6 U	0.6 U
Pentachlorobenzene	0.27 UJ	0.27 U	0.27 U
Pentachloronitrobenzene	0.3 UJ	0.3 U	0.3 U
Pentachlorophenol	0.18 UJ	0.18 U	0.18 U
Phenacetin	0.2 UJ	0.2 U	0.2 U
Phenanthrene	0.017 UJ	0.28	0.017 U
Phenol	0.14 UJ	0.14 U	0.14 U
p-Phenylene diamine	2.4 UJ	2.4 U	2.4 U
Pronamide	0.25 UJ	0.25 U	0.25 U
Pyrene	0.026 UJ	0.026 U	0.026 U
Pyridine	0.22 UJ	0.22 U	0.22 U
Safrole, Total	0.23 UJ	0.23 U	0.23 U
Total Metals (ug/L)			
Antimony	0.36 UJ	0.36 U	0.36 U
Arsenic	0.34 J	0.46 J	0.56 J
Barium	12 J	28	42
Beryllium	0.065 UJ	0.065 U	0.065 U
Cadmium	0.12 UJ	0.12 UJ	0.12 UJ
Chromium	0.6 UJ	0.6 U	0.6 U
Cobalt	1.7 J	0.81 J	0.27 U
Copper	1.8 UJ	1.2 U	2.5 U
Lead	0.15 UJ	0.15 U	0.15 U
Mercury	0.08 UJ	0.08 U	0.08 U
Nickel	0.9 J	0.74 J	0.57 J
Selenium	0.6 UJ	0.6 U	0.6 U
Silver	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 UJ	0.55 U	0.55 U
Tin	0.9 UJ	0.9 U	0.9 U
Vanadium	5.1 J	2.7 J	3.3 J
Zinc	6.5 UJ	10 J	8.9 J

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
CORRECTIVE MEASURES STUDY
SWMU 69 - AIRCRAFT PARKING AREA
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB25	69SB26	69SB27
Sample ID	69GW25	69GW26	69GW27
Date	5/1/2008	5/3/2008	5/3/2008
Dissolved Metals (ug/L)			
Antimony	0.36 UJ	0.36 U	0.36 U
Arsenic	0.28 UJ	0.37 J	0.38 J
Barium	12 J	27	40
Beryllium	0.065 UJ	0.065 U	0.065 U
Cadmium	0.12 UJ	0.12 U	0.12 U
Chromium	0.6 UJ	0.6 U	0.6 U
Cobalt	2.4 J	1.2 J	0.71 J
Copper	1.7 UJ	1.2 U	1.8 U
Lead	0.15 UJ	0.15 U	0.15 U
Mercury	0.08 UJ	0.08 U	0.08 U
Nickel	0.89 J	0.85 J	0.59 J
Selenium	0.6 UJ	0.6 U	0.6 U
Silver	0.09 UJ	0.09 U	0.09 U
Thallium	0.55 UJ	0.55 U	0.55 U
Tin	0.9 UJ	0.9 U	0.9 U
Vanadium	4.8 J	2.5 J	2.4 J
Zinc	13 J	16 J	7.5 J

2010 DISTURBED SOIL SAMPLING INVESTIGATION DATA USED IN THE ERA

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SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL: 2010 DATA
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB101	69SB102	69SB103	69SB104	69SB105	69SB106	69SB107	69SB108
Sample ID	69SB101-00	69SB102-00	69SB103-00	69SB104-00	69SB105-00	69SB106-00	69SB107-00	69SB108-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.2 U	2.3 U	2 U	2.2 U	2.1 U	2.1 U	2.3 UJ	2.4 UJ
Arsenic	6.2	3.7	2.6	4	2.1	2.9	3.9	4.1
Barium	17 J	9.7 J	16 J	9 J	35 J	14 J	17	21
Beryllium	0.11 U	0.12 U	0.063 J	0.11 U	0.057 J	0.1 U	0.11 U	0.12 U
Cadmium	0.047 J	0.12 U	0.1 U	0.11 U	0.29	0.1 U	0.066 J	1.4
Chromium	18 J	20 J	21 J	5.9 J	14 J	13 J	26	23
Cobalt	5.3	5	4.1	1.3	7.9	4.2	7	6.6
Copper	15	17	44	3	33	14	15	19
Lead	0.59	0.67	2.6	0.25 J	9.7	1.7	2.5	12
Mercury	0.029	0.013 J	0.021	0.021 U	0.0096 J	0.02 U	0.022 U	0.024 U
Nickel	6.4	7.3	5	2	6.2	4.9	8.6	7.6
Selenium	1.1 U	1.2 U	1 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U
Silver	0.22 U	0.23 U	0.2 U	0.22 U	0.21 U	0.21 U	0.23 U	0.24 U
Thallium	0.054 J	0.46 U	0.41 U	0.43 U	0.43 U	0.42 U	0.45 U	0.47 U
Tin	22 U	23 U	20 U	22 U	21 U	21 U	23 U	24 U
Vanadium	70 J	110	75	9	76	44	65 J	62 J
Zinc	7.5	10	8.6	4.3 U	21	7.2	11	16

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CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB109	69SB110	69SB111	69SB112	69SB113	69SB114	69SB115	69SB116
Sample ID	69SB109-00	69SB110-00	69SB111-00	69SB112-00	69SB113-00	69SB114-00	69SB115-00	69SB116-00
Date	8/3/2010	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.2 UJ	2.3 UJ	2.6 UJ	2.2 UJ	2.1 U	2.5 U	2.3 U	2.5 U
Arsenic	2.3	3.4	4.1 J	3.9	3.9	3.7	3.5	4
Barium	34	24	19	11	19	41	130	29
Beryllium	0.11 U	0.06 J	0.13 U	0.11 U	0.058 J	0.24	0.21	0.067 J
Cadmium	0.62	0.082 J	0.45	0.086 J	0.16	0.72	5.3	0.35
Chromium	15	23	18	38	26	20	35	14
Cobalt	4.9	7.6	5.8	9.8	5.9	12	11	5.5
Copper	24	28	16	32	17 J	32 J	57 J	20 J
Lead	6	7	6.4 R	1.1	3.6 J	17 J	53 J	6.8 J
Mercury	0.013 J	0.022 U	0.028 U	0.021 U	0.0086 J	0.036	0.1	0.012 J
Nickel	5.2	7.4	6.3	12	7.9	6.7	13	5.3
Selenium	1.1 U	1.2 U	1.3 U	1.1 U	1.1 U	1.2 U	1.2 U	1.3 U
Silver	0.22 U	0.23 U	0.26 U	0.22 U	0.21 U	0.25 U	0.15 J	0.25 U
Thallium	0.44 U	0.47 U	0.52 U	0.43 U	0.071 J	0.5 U	0.061 J	0.5 U
Tin	22 U	23 U	26 U	22 U	21 U	25 U	23 U	25 U
Vanadium	66 J	76 J	52 J	100 J	71 J	100 J	93 J	52 J
Zinc	19	18	14	10	8.7	88	200	27

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB117	69SB118	69SB119	69SB120	69SB121	69SB122	69SB123	69SB124
Sample ID	69SB117-00	69SB118-00	69SB119-00	69SB120-00	69SB121-00	69SB122-00	69SB123-00	69SB124-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.1 U	2.1 U	2.8 U	2.4 U	2.4 U	2.5 U	2.3 U	3.2 U
Arsenic	4.3	5.8	3	4	4.3	3.6	2.3	2.7
Barium	20	18	13	41	27	32	28	80
Beryllium	0.11 U	0.056 J	0.14 U	0.13	0.072 J	0.09 J	0.067 J	0.25
Cadmium	0.063 J	0.15	0.32	0.55	0.72	4.4	0.79	1.7
Chromium	26	26	36	22	27	33	68	27
Cobalt	6.5	6.1	6.7	12	7.9	8.3	16	13
Copper	16 J	18 J	20	82	24	43	37	87
Lead	2.5 J	9.1 J	5.4 J	11 J	12 J	71 J	7.3 J	16 J
Mercury	0.021 U	0.009 J	0.03 J	0.025 J	0.029 J	0.034 J	0.032 J	0.053 J
Nickel	7.7	7.4	7.8	9.1	8.9	10	19	13
Selenium	1.1 U	1 U	1.4 U	1.2 U	1.2 U	1.3 U	1.1 U	1.6 U
Silver	0.21 U	0.21 U	0.28 U	0.24 U	0.24 U	0.25 U	0.23 U	0.18 J
Thallium	0.43 U	0.42 U	0.57 U	0.077 J	0.12 J	0.51 U	0.46 U	0.14 J
Tin	21 U	21 U	28 U	24 U	24 U	25 U	23 U	32 U
Vanadium	74 J	71 J	77	100	73	100	110	100
Zinc	9.9	9.2	13 J	29 J	25 J	77 J	26 J	110 J

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB125	69SB126	69SB127	69SB128	69SB129	69SB130	69SB131	69SB132
Sample ID	69SB125-00	69SB126-00	69SB127-00	69SB128-00	69SB129-00	69SB130-00	69SB131-00	69SB132-00
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.7 UJ	2.8 UJ	2.8 UJ	2.9 UJ	3 UJ	2.5 UJ	3 UJ	2.6 UJ
Arsenic	2.8	3	2.2	1.4	1.6	1.7	1.8	2
Barium	59 J	470 J	50 J	16 J	26 J	20 J	50 J	10 J
Beryllium	0.23	0.25	0.2	0.15	0.12 J	0.13	0.19	0.11 J
Cadmium	0.28	0.47	1.3	0.059 J	0.26	0.22	1.5 J	0.044 J
Chromium	18 J	27 J	22 J	27 J	19 J	36 J	22 J	17
Cobalt	64	45	10	4.5	3.8	2.3	11	2 J
Copper	67	89	70	120	84	55	68 J	95
Lead	7.1	8.2	19	3.8	3.6	4.6	32 J	2.2
Mercury	0.18	0.17	0.15	0.12	0.093	0.18	0.047	0.11
Nickel	7.3	5.7	7.6	3.3	3.7	3.6	5.6	2.6
Selenium	2	2.1	0.83 J	1 J	0.91 J	0.71 J	1.5 U	0.67 J
Silver	0.27	0.2 J	0.28 U	0.29 U	0.3 U	0.25 U	0.3 U	0.26 U
Thallium	0.26 J	0.32 J	0.57 U	0.58 U	0.6 U	0.49 U	0.11 J	0.51 U
Tin	27 U	28 U	28 U	29 U	30 U	25 U	30 U	26 U
Vanadium	270	310	240	410	330	240	160 J	550
Zinc	60	52	44	12	24	12	51	11

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CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB133	69SB134	69SB135	69SB136	69SB137	69SB138	69SB139	69SB140
Sample ID	69SB133-00	69SB134-00	69SB135-00	69SB136-00	69SB137-00	69SB138-00	69SB139-00	69SB140-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.6 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.4 U	2.6 U	2.7 U
Arsenic	2.6	2.4	2	1	0.93	1.3	5.1	1.2
Barium	29 J	54 J	63 J	68 J	40 J	86	15	29
Beryllium	0.13	0.13	0.16	0.29	0.23	0.25	0.13 U	0.17
Cadmium	0.34	0.75	1.5	0.092 J	0.097 J	0.49	0.095 J	0.36
Chromium	19	18	16	12	12	20 J	7.8 J	17 J
Cobalt	6.4 J	11 J	13 J	17 J	11 J	19	2.1	8
Copper	86	48	64	73	74	88 J	7.4 J	90 J
Lead	8.6	13	35	3.4	4.1	15 J	2.6 J	8.5 J
Mercury	0.066	0.028	0.04	0.073	0.14	0.042 J	0.024 UJ	0.08 J
Nickel	4.5	6.9	7.4	7.3	6.4	6.6	2.5	5.1
Selenium	1 J	1.3 U	1.3 U	1.2 U	1.2 U	1.2 U	1.3 U	1.4 U
Silver	0.26 U	0.25 U	0.25 U	0.25 U	0.25 U	0.24 U	0.26 U	0.27 U
Thallium	0.53 U	0.073 J	0.07 J	0.099 J	0.067 J	0.15 J	0.51 U	0.54 U
Tin	26 U	25 U	25 U	25 U	25 U	24 U	26 U	27 U
Vanadium	370	100	120	160	190	210 J	18 J	210 J
Zinc	21	43	70	71	49	110	13	35

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB141	69SB142	69SB143	69SB144	69SB145	69SB146	69SB147	69SB148
Sample ID	69SB141-00	69SB142-00	69SB143-00	69SB144-00	69SB145-00	69SB146-00	69SB147-00	69SB148-00
Date	8/4/2010	8/4/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (µg/L)								
Antimony	2.6 U	3.2 U	2.3 U	2.2 U	2.3 U	2.3 U	2.5 U	2.4 U
Arsenic	4.7	2.6	1.8	2.1	1.8	0.89	0.96	1.3
Barium	15	22	12	62	12	21	16	22
Beryllium	0.13 U	0.15 J	0.079 J	0.2	0.11 U	0.073 J	0.13 U	0.12
Cadmium	0.43	0.14 J	0.16	0.18	0.14	0.055 J	0.13 U	0.089 J
Chromium	35 J	60 J	19 J	14	68	7.6	9.7	14
Cobalt	13 J	12	4.5	14	14	3.2	0.61	3.7
Copper	44 J	79 J	55 J	57 J	33 J	65 J	37 J	88 J
Lead	5.6 J	4.8 J	2 J	7.4	1.4	2.6	1.8	2.8
Mercury	0.022 J	0.034 UJ	0.08 J	0.099 R	0.025 R	0.023 R	0.025 R	0.079 R
Nickel	14 J	10	4.7	6	19	1.9	1.2 J	4.2
Selenium	1.3 U	1.6 U	1.1 U	0.58 J	1.1 U	0.65 J	0.98 J	0.78 J
Silver	0.26 U	0.32 U	0.23 U	0.22 U	0.23 U	0.23 U	0.25 U	0.24 U
Thallium	0.53 U	0.083 J	0.063 J	0.13 J	0.46 U	0.057 J	0.5 U	0.079 J
Tin	26 U	32 U	23 U	22 U	23 U	23 U	25 U	24 U
Vanadium	94 J	210 J	180 J	150	120	150	310	160
Zinc	21 J	24	12	42	18	10	5.1	13

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB149	69SB150	69SB151	69SB152
Sample ID	69SB149-00	69SB150-00	69SB151-00	69SB152-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1
Inorganics (µg/L)				
Antimony	2.4 U	2.4 UJ	2.4 UJ	2.2 UJ
Arsenic	0.65	0.86	1.5	1.4
Barium	22	47	50	82
Beryllium	0.12 U	0.19	0.19	0.24
Cadmium	0.12 U	0.079 J	0.31	0.19
Chromium	4.2	16	13	13
Cobalt	1	15	13	17
Copper	55 J	96	68	59
Lead	1.3	3.6	7	5.3
Mercury	0.071 R	0.077	0.053	0.024
Nickel	1.3	7.2	11	7.3
Selenium	1.2 U	1.2 U	1.2 U	1.1 U
Silver	0.24 U	0.24 U	0.24 U	0.22 U
Thallium	0.48 U	0.083 J	0.062 J	0.11 J
Tin	24 U	24 U	24 U	22 U
Vanadium	70	160 J	120 J	140 J
Zinc	4.9	49	51	58

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB101	69SB101	69SB102	69SB102	69SB103	69SB103	69SB104	69SB104
Sample ID	69SB101-01	69SB101-02	69SB102-01	69SB102-02	69SB103-01	69SB103-02	69SB104-01	69SB104-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.4 U	2.3 U	2.6 U	2.3 U	2.5 U	2.6 U	2.8 U	2.5 U
Arsenic	1.6	0.73	1.5	0.84	1.2	0.76	0.7	0.27 J
Barium	17 J	15 J	13 J	12 J	27 J	24 J	80 J	76 J
Beryllium	0.12	0.11 U	0.12 J	0.057 J	0.09 J	0.17	0.22	0.074 J
Cadmium	0.12 U	0.11 U	0.13 U	0.11 U	0.12 U	0.13 U	0.14 U	0.12 U
Chromium	17 J	5.3 J	12 J	7.6 J	11 J	5.1 J	8.1 J	4 J
Cobalt	4.1	1.5	3.7	4.2	3.6	3.5	4.5 J	0.6
Copper	130	57	120	54	140	180	200 J	26
Lead	3.6	0.92	2.2	0.99	1.3	1.4	4.2 R	0.48 J
Mercury	0.074	0.099	0.017 J	0.021 J	0.026	0.026 U	0.011 J	0.016 J
Nickel	3.9	1.8	4.4	2.7	2.4	2.1	3.2	2.2
Selenium	1.9	0.73 J	1.8	0.88 J	0.85 J	1.3 U	1.4 U	1.2 U
Silver	0.24 U	0.23 U	0.26 U	0.23 U	0.25 U	0.26 U	0.28 U	0.25 U
Thallium	0.11 J	0.46 U	0.13 J	0.097 J	0.071 J	0.52 U	0.068 J	0.078 J
Tin	24 U	23 U	26 U	23 U	25 U	26 U	28 U	25 U
Vanadium	270	170	220	120	130	330	290	140
Zinc	14	7.2	13	5.4	9.8	11	18 J	4.9 U

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB105	69SB105	69SB106	69SB106	69SB107	69SB107	69SB108	69SB108
Sample ID	69SB105-01	69SB105-02	69SB106-01	69SB106-02	69SB107-01	69SB107-02	69SB108-01	69SB108-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.3 U	2.4 U	2.8 U	2.5 U	2.2 UJ	3.2 UJ	2.5 UJ	2.1 UJ
Arsenic	1	0.72	0.45 J	0.41 J	4.1	4.3 J	4	3.4
Barium	15 J	9.8 J	12 J	11 J	20	22	17	17
Beryllium	0.058 J	0.12 U	0.14 U	0.13 U	0.055 J	0.16 U	0.13 U	0.071 J
Cadmium	0.11 U	0.12 U	0.14 U	0.13 U	0.058 J	0.052 J	0.06 J	0.073 J
Chromium	8.8 J	6.1 J	4.1 J	3 J	27	17	18	28
Cobalt	1.9	0.97	0.39	0.38	7.3	4.1	5.4	5.2
Copper	91	90	43	39	16	48 J	12	23
Lead	1.1	0.83	1	0.87	1.4	0.86	1.5	2.6
Mercury	0.012 J	0.01 J	0.11	0.021 J	0.023 U	0.03 U	0.024 U	0.02 U
Nickel	1.1	1.2	1 J	0.76 J	9.3	6.7	6.5	5.8
Selenium	1.3	0.88 J	1.4 U	1.3 U	1.1 U	1.6 U	1.3 U	1.1 U
Silver	0.23 U	0.24 U	0.28 U	0.25 U	0.22 U	0.32 U	0.25 U	0.21 U
Thallium	0.46 U	0.48 U	0.56 U	0.51 U	0.44 U	0.64 U	0.5 U	0.43 U
Tin	23 U	24 U	28 U	25 U	22 U	32 U	25 U	21 U
Vanadium	300	130	240	48	65 J	150 J	51 J	110 J
Zinc	5.6	6.5	5.6 U	5.1 U	10	7.7	8.1	9.5

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SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB109	69SB109	69SB110	69SB110	69SB111	69SB111	69SB112	69SB112
Sample ID	69SB109-01	69SB109-02	69SB110-01	69SB110-02	69SB111-01	69SB111-02	69SB112-01	69SB112-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.6 UJ	2.6 UJ	2.4 UJ	2.4 UJ	2.9 UJ	2.3 UJ	2.5 UJ	2.6 UJ
Arsenic	0.99	0.95	1.5	0.45 J	0.77	1.1	1.2	1.2
Barium	26	32	9.1	7.1	220	100	90	46
Beryllium	0.16	0.18	0.089 J	0.12 U	0.25	0.22	0.25	0.21
Cadmium	0.13 U	0.13 U	0.12 U	0.12 U	0.18	0.093 J	0.08 J	0.082 J
Chromium	8.6	9.5	9.2	3.2	15	15	15	14
Cobalt	6.6	6.1	3.3	0.76	29	22	18	16
Copper	110	130	97	42	76	94	87	89
Lead	1.4	1.4	1.9	0.5	2.2	2.2	2.3	2.4
Mercury	0.1	0.084	0.18	0.1	0.034	0.067	0.036	0.062
Nickel	3.8	4.5	3	1.2	9.3	6.2	7.6	6
Selenium	1.3 U	1.3 U	1.2 U	1.2 U	1.5 U	1.2 U	1.3 U	1.3 U
Silver	0.26 U	0.26 U	0.24 U	0.24 U	0.29 U	0.23 U	0.25 U	0.26 U
Thallium	0.52 U	0.51 U	0.07 J	0.48 U	0.094 J	0.099 J	0.09 J	0.087 J
Tin	26 U	26 U	24 U	24 U	29 U	23 U	25 U	26 U
Vanadium	200 J	220 J	320 J	110 J	180 J	220 J	210 J	270 J
Zinc	23	26	10	5.4	59	48	60	45

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB113	69SB113	69SB114	69SB114	69SB115	69SB115	69SB116	69SB116
Sample ID	69SB113-01	69SB113-02	69SB114-01	69SB114-02	69SB115-01	69SB115-02	69SB116-01	69SB116-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.2 U	2.4 U	2.6 U	2.5 U	2.1 U	2.5 U	2.5 U	2.4 U
Arsenic	3.9	1.6	5.4	1.1	4.7	1.4	1.2	0.89
Barium	17	190	33 J	150	14	110	66	76
Beryllium	0.11 U	0.31	0.1 J	0.27	0.11 U	0.33	0.35	0.29
Cadmium	0.044 J	0.049 J	0.15	0.12 J	0.044 J	0.084 J	0.076 J	0.069 J
Chromium	28	18	29	18	22	18	19	15
Cobalt	6.5	21	7.2 J	20	3.6	27	16	15
Copper	13 J	77 J	26 J	110 J	8.1 J	120 J	120 J	100 J
Lead	0.75 J	3.3 J	3.6 J	3 J	0.67 J	2.8 J	3 J	2.4 J
Mercury	0.021 U	0.025	0.032	0.072	0.02 U	0.045	0.037	0.035
Nickel	9.1	9.1	8.2 J	9.2	4.9	10	10	9.7
Selenium	1.1 U	1.2 U	1.3 U	1.3 U	1.1 U	1.3 U	1.3 U	1.2 U
Silver	0.22 U	0.24 U	0.26 U	0.25 U	0.21 U	0.25 U	0.25 U	0.24 U
Thallium	0.44 U	0.11 J	0.53 U	0.16 J	0.42 U	0.11 J	0.12 J	0.083 J
Tin	22 U	24 U	26 U	25 U	21 U	25 U	25 U	24 U
Vanadium	83 J	210 J	88 J	210 J	49 J	230 J	220 J	170 J
Zinc	9.4	58	28 J	76	6.4	72	50	72

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB117	69SB117	69SB118	69SB118	69SB119	69SB119	69SB120	69SB120
Sample ID	69SB117-01	69SB117-02	69SB118-01	69SB118-02	69SB119-01	69SB119-02	69SB120-01	69SB120-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.6 U	2.7 U	2.6 U	2.6 U	2.2 U	2.3 U	2.3 U	2.5 U
Arsenic	1.1	0.88	0.88	1.2	4.4	1.2	3.4	0.99
Barium	100	69	110	110	17	97	39	84
Beryllium	0.32	0.31	0.32	0.31	0.066 J	0.27	0.091 J	0.3
Cadmium	0.072 J	0.082 J	0.064 J	0.095 J	0.064 J	0.12	0.084 J	0.069 J
Chromium	17	16	18	14	31	19	24	16
Cobalt	16	14	16	16	7.5	15	9.3	13
Copper	94 J	100 J	96 J	97 J	15	67	28	82
Lead	2.7 J	3 J	2.6 J	2.6 J	2.1 J	5.6 J	3.4 J	2.1 J
Mercury	0.032	0.037	0.034	0.023 J	0.021 UJ	0.035 J	0.022 UJ	0.098 J
Nickel	9.7	9.3	11	9.3	8.5	8.6	7.7	8.5
Selenium	1.3 U	1.3 U	1.3 U	1.3 U	1.1 U	1.2 U	1.2 U	1.2 U
Silver	0.26 U	0.27 U	0.76	0.96	0.22 U	0.21 J	0.23 U	0.25 U
Thallium	0.14 J	0.14 J	0.087 J	0.091 J	0.44 U	0.11 J	0.47 U	0.15 J
Tin	26 U	27 U	26 U	26 U	22 U	23 U	23 U	25 U
Vanadium	180 J	190 J	170 J	180 J	78	170	90	190
Zinc	79	85	86	83	15 J	56 J	20 J	67 J

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SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB121	69SB121	69SB122	69SB122	69SB123	69SB123	69SB124	69SB124
Sample ID	69SB121-01	69SB121-02	69SB122-01	69SB122-02	69SB123-01	69SB123-02	69SB124-01	69SB124-02
Date	8/4/2010	8/4/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.4 U	2.4 U	2.8 U	2.6 U	2.3 U	2.5 U	2.7 U	2.6 U
Arsenic	1.4	1.4	2.6	2.3	2.5	0.87	0.38 J	0.42 J
Barium	59	30	40	53	40	63	250	92
Beryllium	0.42	0.33	0.18	0.16	0.11 J	0.34	0.39	0.3
Cadmium	0.063 J	0.067 J	0.26	0.13 U	0.069 J	0.047 J	0.13	0.043 J
Chromium	21	18	46	36	27	14	19	16
Cobalt	23	10	3	3.2	9.2	15	22	10
Copper	93	80	120	130	40	100	120	120
Lead	2.8 J	2.4 J	9.7 J	5.4 J	0.76 J	2.6 J	3.5 J	3.4 J
Mercury	0.11 J	0.11 J	0.09 J	0.073 J	0.022 UJ	0.03 J	0.064 J	0.12 J
Nickel	10	8.8	4.9	4.5	9.9	9.8	11	8.9
Selenium	1.2 U	1.2 U	1.3 J	1.1 J	1.2 U	1.3 U	1.3 U	1.3 U
Silver	0.24 U	0.24 U	0.28 U	0.26 U	0.23 U	0.24 J	0.27 U	0.26 U
Thallium	0.17 J	0.13 J	0.55 U	0.53 U	0.06 J	0.093 J	0.23 J	0.16 J
Tin	24 U	24 U	28 U	26 U	23 U	25 U	27 U	26 U
Vanadium	230	200	480	430	85	180	120	120
Zinc	80 J	71 J	17 J	15 J	28 J	80 J	100 J	76 J

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB125	69SB125	69SB126	69SB126	69SB127	69SB127	69SB128	69SB128
Sample ID	69SB125-01	69SB125-02	69SB126-01	69SB126-02	69SB127-01	69SB127-02	69SB128-01	69SB128-02
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.3 UJ	2.5 UJ	2.1 UJ	2.4 UJ	2.5 UJ	2.9 UJ	2.8 UJ	2.5 UJ
Arsenic	4	2.4	3.5	1.2	1.7	0.84	1.5	0.33 J
Barium	18 J	54 J	130 J	77 J	25 J	27 J	21 J	28 J
Beryllium	0.11 U	0.21	0.074 J	0.3	0.13	0.11 J	0.14	0.068 J
Cadmium	0.072 J	0.25	0.18	0.11 J	0.065 J	0.031 J	0.057 J	0.034 J
Chromium	29 J	15 J	26 J	17 J	19 J	10 R	18 J	5.7 J
Cobalt	7.7	34	17	24	2.5	1.5 J	4.1	1.5
Copper	19	67	36	92	85	85 J	110	40
Lead	1.3	6	2.7	3	4.4	2.8 J	2.9	0.88
Mercury	0.021	0.15	0.03	0.048	0.026	0.087	0.066	0.081
Nickel	8	8	8.7	9.7	2.7	1.5	2.8	1.4
Selenium	1.1 U	1.7	1 U	1.2 U	1.6	0.91 J	1.1 J	1.2 U
Silver	0.23 U	0.17 J	0.21 U	0.24 U	0.25 U	0.29 U	0.28 U	0.25 U
Thallium	0.46 U	0.11 J	0.08 J	0.13 J	0.5 U	0.58 U	0.55 U	0.49 U
Tin	23 U	25 U	21 U	24 U	25 U	29 U	28 U	25 U
Vanadium	77	240	100	210	580	400 R	390	150
Zinc	10	58	19	74	11	6.7	9.9	5.8

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SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB129	69SB129	69SB130	69SB130	69SB131	69SB131	69SB132	69SB132
Sample ID	69SB129-01	69SB129-02	69SB130-01	69SB130-02	69SB131-01	69SB131-02	69SB132-01	69SB132-02
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.7 UJ	2.4 UJ	2.5 UJ	2.7 UJ	2.2 UJ	2.5 UJ	2.3 UJ	2.7 UJ
Arsenic	0.79	2.4	1.4	2.8	0.68	0.99	1.1	0.77
Barium	18 J	17 J	22 J	19 J	49 J	31 J	12 J	8.2 J
Beryllium	0.075 J	0.12	0.11 J	0.2	0.15	0.17	0.098 J	0.11 J
Cadmium	0.14 U	0.12 U	0.035 J	0.045 J	0.11 U	0.12 U	0.12 U	0.13 U
Chromium	15 J	19 J	29 J	53 J	11	14	11	9.4
Cobalt	1.2	1.4	2	2.7	9.6 J	11 J	1.2 J	1 J
Copper	55	100	75	140	46	66	67	74
Lead	1.7	4.4	1.4	4.5	2	2.1	2.2	1.8
Mercury	0.042	0.083	0.071	0.15	0.046	0.069	0.044	0.034
Nickel	2.8	2.1	2.5	3.5	4.2	4.2	1.5	1.4
Selenium	1.4 U	2.2	0.79 J	1.9	1.1 U	1.2 U	1.2 U	1.3 U
Silver	0.27 U	0.24 U	0.25 U	0.27 U	0.22 U	0.25 U	0.23 U	0.27 U
Thallium	0.54 U	0.47 U	0.08 J	0.54 U	0.085 J	0.11 J	0.47 U	0.54 U
Tin	27 U	24 U	25 U	27 U	22 U	25 U	23 U	27 U
Vanadium	250	560	290	580	130	210	400	350
Zinc	7.3	10	10	14	34	38	6.1	7.7

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB133	69SB133	69SB134	69SB134	69SB135	69SB135	69SB136	69SB136
Sample ID	69SB133-01	69SB133-02	69SB134-01	69SB134-02	69SB135-01	69SB135-02	69SB136-01	69SB136-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.4 UJ	2.6 UJ	2.4 UJ	2.4 UJ	2.6 UJ	2.4 UJ	2.5 UJ	2.4 UJ
Arsenic	1	1.2	1.3	1	1	0.59 J	1.3	1.2
Barium	14 J	14 J	270 J	42 J	78 J	41 J	51 J	30 J
Beryllium	0.095 J	0.098 J	0.37	0.28	0.25	0.19	0.19	0.17
Cadmium	0.045 J	0.13 U	0.27	0.065 J	0.15	0.066 J	0.07 J	0.092 J
Chromium	12	9.1	13	11	12	11	11	11
Cobalt	3.4 J	1.2 J	33 J	14 J	18 J	11 J	19 J	16 J
Copper	85	65	89	73	81	62	73	71
Lead	3.3	2.1	3	2.6	5.3	3	3.5	3.4
Mercury	0.07	0.058	0.069	0.04	0.035	0.047	0.085	0.11
Nickel	3.5	1.7	7.9	7.6	7.6	6.1	5.7	4.6
Selenium	0.92 J	0.79 J	1.2 U	1.2 U	1.3 U	1.2 U	1.2 U	1.2 U
Silver	0.24 U	0.26 U	0.24 U	0.24 U	0.26 U	0.24 U	0.25 U	0.24 U
Thallium	0.49 U	0.51 U	0.18 J	0.1 J	0.083 J	0.072 J	0.12 J	0.13 J
Tin	24 U	26 U	24 U	24 U	26 U	24 U	25 U	24 U
Vanadium	380	220	210	180	200	130	170	160
Zinc	12	7.8	72	65	68	55	57	42

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB137	69SB137	69SB138	69SB138	69SB139	69SB139	69SB140	69SB140
Sample ID	69SB137-01	69SB137-02	69SB138-01	69SB138-02	69SB139-01	69SB139-02	69SB140-01	69SB140-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.5 U	2.7 U	2.6 U	2.4 U	2.3 U	2.4 U	2.6 U	2.5 U
Arsenic	1.4	1.1	1.3	2.5	5.9	1.9	1.8	1.2
Barium	26	30	55	22	48	24	27	16
Beryllium	0.19	0.15	0.24	0.17	0.12	0.13	0.17	0.19
Cadmium	0.05 J	0.045 J	0.089 J	0.049 J	0.031 J	0.12 U	0.066 J	0.061 J
Chromium	15 J	13 J	18 J	28 J	15 J	14 J	52 J	20 J
Cobalt	6.9	6.9	19	9.4	8.3	3.9	6.9	7.8
Copper	80 J	70 J	78 J	130 J	57 J	87 J	67 J	90 J
Lead	2.6 J	2 J	3.3 J	3.7 J	1.7 J	2.1 J	5.9 J	4 J
Mercury	0.13 J	0.085 J	0.051 J	0.028 J	0.036 J	0.15 J	0.068 J	0.071 J
Nickel	5.8	4.5	8	5.6	4	3.4	3.3	4
Selenium	0.74 J	0.68 J	1.3 U	1.1 J	1.1 U	1 J	0.64 J	1.3 U
Silver	0.25 U	0.27 U	0.26 U	0.24 U	0.23 U	0.24 U	0.26 U	0.25 U
Thallium	0.11 J	0.077 J	0.094 J	0.099 J	0.099 J	0.065 J	0.51 U	0.51 U
Tin	25 U	27 U	26 U	24 U	23 U	24 U	26 U	25 U
Vanadium	240 J	230 J	200 J	280 J	140 J	270 J	530 J	370 J
Zinc	33	32	58	28	18	16	20	20

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB141	69SB141	69SB142	69SB142	69SB143	69SB143	69SB144	69SB144
Sample ID	69SB141-01	69SB141-02	69SB142-01	69SB142-02	69SB143-01	69SB143-02	69SB144-01	69SB144-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.3 U	2.6 U	2.4 U	2.4 U	2.4 U	2.8 U	2.6 U	2.7 U
Arsenic	1.1	1	2.2	2.5	1	0.75	0.92	0.51 J
Barium	54	46	26	110	9.1	10	18	25
Beryllium	0.18	0.13	0.18	0.2	0.069 J	0.14 U	0.13	0.075 J
Cadmium	0.064 J	0.052 J	0.044 J	0.053 J	0.12 U	0.14 U	0.13 U	0.14 U
Chromium	28 J	12 J	30 J	22 J	6.2	5	14	9.4
Cobalt	11	15	18	14	1.8	1.8	2	2.7
Copper	91 J	81 J	120 J	130 J	76 J	54 J	100 J	77 J
Lead	3.2 J	2.5 J	3.6 J	2.3 J	1.2	0.82	1.4	0.94
Mercury	0.11 J	0.053 J	0.066 J	0.073 J	0.068 R	0.048 R	0.024 R	0.019 R
Nickel	5.7	4.6	6.9	4.8	1.9	1.8	2	2.1
Selenium	1.1 U	1.3 U	0.96 J	0.88 J	0.73 J	1.4 U	0.9 J	1.4 U
Silver	0.23 U	0.26 U	0.24 U	0.24 U	0.24 U	0.28 U	0.26 U	0.27 U
Thallium	0.099 J	0.088 J	0.17 J	0.15 J	0.078 J	0.07 J	0.11 J	0.14 J
Tin	23 U	26 U	24 U	24 U	24 U	28 U	26 U	27 U
Vanadium	260 J	280 J	270 J	320 J	200	190	380 J	130
Zinc	37	16	33	23	11	6.4	16	12

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SWMU 69 - AIRCRAFT PARKING AREA
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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB145	69SB145	69SB146	69SB146	69SB147	69SB147	69SB148	69SB148
Sample ID	69SB145-01	69SB145-02	69SB146-01	69SB146-02	69SB147-01	69SB147-02	69SB148-01	69SB148-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.8 U	2.4 U	2.5 U	2.8 U	2.6 U	2.5 U	2.6 U	2.5 U
Arsenic	1.3	0.9	0.31 J	0.4 J	0.85	0.73	1.2	1
Barium	26	22	18	8	15	14	18	16
Beryllium	0.071 J	0.12	0.13 U	0.092 J	0.13 U	0.072 J	0.26	0.17
Cadmium	0.14 U	0.12 U	0.13 U	0.14 U	0.13 U	0.12 U	0.13 U	0.12 U
Chromium	13	13	4.4	3.1	10	8.5 J	17	13
Cobalt	1.8	2.3	0.53	1	0.88	2 R	2.9	2.7
Copper	77 J	170 J	34 J	67 J	63 J	74 J	170 J	160 J
Lead	2	1.5	1.5	1.5	1.8	1.4 J	1.3	0.98
Mercury	0.064 R	0.077 R	0.027 R	0.028 R	0.026 R	0.13 R	0.025 R	0.025 R
Nickel	2	1.5	1.3 U	1.4 U	1.3	1.5	2.9	3.9
Selenium	0.95 J	0.63 J	1.3 U	1.4 U	0.75 J	1.2 U	1.1 J	0.94 J
Silver	0.28 U	0.24 U	0.25 U	0.28 U	0.26 U	0.25 U	0.26 U	0.25 U
Thallium	0.55 U	0.49 U	0.5 U	0.56 U	0.51 U	0.084 J	0.52 U	0.49 U
Tin	28 U	24 U	25 U	28 U	26 U	25 U	26 U	25 U
Vanadium	240	280	87	120	250	260 R	270	180
Zinc	5.6	12	5 U	5.6 U	5.9	7.4	11	7.5

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS, SUBSURFACE SOIL: 2010 DATA
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB149	69SB149	69SB150	69SB150	69SB151	69SB151	69SB152	69SB152
Sample ID	69SB149-01	69SB149-02	69SB150-01	69SB150-02	69SB151-01	69SB151-02	69SB152-01	69SB152-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0	1.0-2.0	2.0-3.0
Inorganics (µg/L)								
Antimony	2.3 UJ	2.4 UJ	2.4 UJ	2.5 UJ	2.4 UJ	2.4 UJ	2.3 UJ	2.4 UJ
Arsenic	1.2	1	0.61	0.6 J	0.89	1.1	0.79	0.97
Barium	20	31	60	44	15	7.2	13	27
Beryllium	0.15	0.11 J	0.21	0.45	0.19	0.15	0.14	0.3
Cadmium	0.12 U	0.12 U	0.12 U	0.12 U	0.054 J	0.12 U	0.12 U	0.034 J
Chromium	15	6	6.9	5.7	14	15	11	13
Cobalt	22	2.3	7.4	12	8	5.5	5.5	6.2
Copper	110	110	150	280	120	150	120	200
Lead	2.9	4.4	1.2	0.44 J	4.6	2.1	1.2	3.2
Mercury	0.022 J	0.052	0.017 J	0.013 J	0.066	0.14	0.068	0.065
Nickel	1.6	0.99 J	3.4	3.9	5.6	3.4	4.5	6.4
Selenium	0.72 J	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Silver	0.23 U	0.24 U	0.24 U	0.25 U	0.24 U	0.24 U	0.23 U	0.24 U
Thallium	0.068 J	0.073 J	0.091 J	0.13 J	0.15 J	0.1 J	0.47 U	0.48 U
Tin	23 U	24 U	24 U	25 U	24 U	24 U	23 U	24 U
Vanadium	170 J	130 J	210 J	260 J	170 J	220 J	200 J	310 J
Zinc	7.7	4.9 U	17	21	20	15	8.9	12

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS, SEDIMENT: 2010 DATA
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SD01	69SD02	69SD03	69SD04	69SD05	69SD06	69SD07	69SD08
Sample ID	69SD01	69SD02	69SD03	69SD04	69SD05	69SD06	69SD07	69SD08
Sample Date	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)								
Antimony	4 UJ	4.6 UJ	4.3 UJ	3.3 U	3.3 U	4.1 UJ	5.3 UJ	4.6 UJ
Arsenic	1.6 J	1.8 J	2.8 J	1.9	3.4	3.8 J	4.6 J	3 J
Barium	38 J	38 J	48 J	24 J	26 J	110 J	130 J	140 J
Beryllium	0.13 J	0.15 J	0.14 J	0.16 J	0.2	0.29 J	0.33 J	0.2 J
Cadmium	1.1 J	0.77 J	4.6 J	0.38	0.44	16 J	24 J	12 J
Chromium	26 J	21 J	25 J	20	30	99 J	72 J	40 J
Cobalt	6.4 J	7.2 J	8.5 J	5.8 J	5.6 J	18 J	18 J	14 J
Copper	83 J	96 J	85 J	96 J	130 J	140 J	160 J	110 J
Lead	51 J	8.3 J	48 J	6.4	8.6	440 J	680 J	250 J
Mercury	0.08 J	0.077 J	0.073 J	0.067	0.062	0.085 J	0.076 J	0.067 J
Nickel	6.9 J	6.8 J	10 J	5.3	5.3	34 J	27 J	15 J
Selenium	1.1 J	1.2 J	2.1 UJ	0.85 J	1.3 J	2.1 UJ	2.7 UJ	2.3 UJ
Silver	0.4 UJ	0.46 UJ	0.43 UJ	0.33 U	0.33 U	0.7 J	0.47 J	0.25 J
Thallium	0.4 UJ	0.11 J	0.43 UJ	0.33 U	0.33 U	0.41 UJ	0.53 UJ	0.46 UJ
Tin	40 UJ	46 UJ	43 UJ	33 U	33 U	41 UJ	53 UJ	46 UJ
Vanadium	180 J	220 J	170 J	190 J	350 J	110 J	140 J	150 J
Zinc	49 J	44 J	100 J	40	55	450 J	490 J	220 J

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS, SEDIMENT: 2010 DATA
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SD09	69SD10	69SD11	69SD12	69SD13	69SD14
Sample ID	69SD09	69SD10	69SD11	69SD12	69SD13	69SD14
Sample Date	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)						
Antimony	4.1 UJ	6.2 UJ	3.6 U	3.7 U	3.9 U	3.2 U
Arsenic	4.8 J	2.4 J	2.1	1	2.1	4
Barium	77 J	100 J	52 J	33 J	65 J	99 J
Beryllium	0.25 J	0.22 J	0.18	0.098 J	0.21	0.28
Cadmium	2.9 J	4.1 J	1.5	1.4	1	0.92
Chromium	32 J	23 J	20	10	23	61
Cobalt	20 J	16 J	12 J	7.7 J	15 J	16 J
Copper	130 J	110 J	70 J	38 J	72 J	98 J
Lead	30 J	26 J	24	15	21	15
Mercury	0.07 J	0.14 J	0.063	0.048	0.045	0.05
Nickel	11 J	10 J	8.3	5.2	7.5	8.1
Selenium	1.3 J	3.1 UJ	1.8 U	1.8 U	1.9 U	1 J
Silver	0.41 UJ	0.62 UJ	0.36 U	0.37 U	0.39 U	0.32 U
Thallium	0.41 UJ	0.62 UJ	0.36 U	0.37 U	0.39 U	0.32 U
Tin	41 UJ	62 UJ	36 U	37 U	39 U	32 U
Vanadium	370 J	230 J	150 J	67 J	170 J	350 J
Zinc	89 J	110 J	71	44	63	70

APPENDIX E
BIOACCUMULATIVE CHEMICALS

APPENDIX E

IDENTIFICATION OF BIOACCUMULATIVE CHEMICALS

Only those organic chemicals with a log octanol-water partition coefficient (K_{ow}) value greater than or equal to 3.0 will be considered a bioaccumulative chemical. Justification for defining bioaccumulative organic chemicals as those with log K_{ow} values greater than or equal to 3.0 is provided below.

- The potential for organic chemicals to accumulate in organisms has been shown to correlate well with the K_{ow}. USEPA (1985), as sited in USEPA/ACOE (1998), recommends that only chemicals for which the log K_{ow} is greater than 3.5 be considered for evaluation of bioaccumulation potential since chemicals with log K_{ow} values less than 3.5 are not likely to bioaccumulate to a significant degree.

- Although organic chemicals with log K_{ow} values in the 2 to 7 range have at least some potential to bioconcentrate (Connell, 1990), significant bioconcentration does not generally occur for chemicals with log K_{ow} values less than 3.0 (Maki and Duthie, 1978) to 5.0 (Gobas and Mackay, 1990). Most work with bioconcentration (uptake from the surrounding medium, such as water) and bioaccumulation (uptake from all exposure routes, including via food) of organic chemicals has concerned chemicals with log K_{ow} values of 3.0 or more (USEPA, 1995a), since organic chemicals with lower log K_{ow} values generally have little potential for significant bioaccumulation.

- The USEPA has developed a number of scoring algorithms to evaluate the relative hazard of chemicals to human or ecological receptors. All of these algorithms have a component that addresses bioaccumulation potential. The evaluation of bioaccumulation potential is generally based on measured or estimated (using log K_{ow} values) BCFs or BAFs, or less commonly using log K_{ow} itself. For example, USEPA (1980) developed a bioaccumulation potential scoring system that considered organics with BCF values of less than 100 (equivalent to a log K_{ow} of approximately 3.0) to have negligible potential to bioaccumulate in aquatic food webs, while organic chemicals with BCFs in the 100 to 1,000 range (equivalent to log K_{ow} values of about 3.0 to 4.3) are considered to have low bioaccumulation potential. The more recent Scoring and Ranking Assessment Model (SCRAM), developed by EPA Region 5 for the Great Lakes, has similar bioaccumulation scoring cut-offs (USEPA, 2000).

- The proposed categorization of persistent, bioaccumulative, and toxic (PBT) chemicals under the Toxic Substances Control Act (TSCA) defines chemicals with a tendency to accumulate in organisms as those with a BCF or BAF of greater than 1,000 (Federal Register 63(192):53417; 10/5/98). Using the equation listed below (USEPA, 1995b), a BCF/BAF of 1,000 equates to a log K_{ow} value of approximately 4.3.

$$Log\ BCF = [(0.79)(\log K_{ow}) - 0.40] \qquad \text{(Equation E-1)}$$

- The Beta Test Version 1.0 of the EPA Waste Minimization Prioritization Tool (WMPT), used to develop a list of PBTs for the Resource Conservation and Recovery Act (RCRA) program, defined organic chemicals with a low potential to bioaccumulate as those with log K_{ow} values of less than 3.5 and those with a high potential to bioaccumulate as those with log K_{ow} values greater than 5.0 (USEPA, 1998). The 1998 version of the EPA WMPT defines bioaccumulation potential based on BCF or BAF values (rather than on log K_{ow} values directly), with a scoring "fenceline" for organic chemicals with a low

bioaccumulation potential defined as a BCF or BAF of less than 250. Although the tool no longer uses log K_{ow} directly, log K_{ow} values can be used to estimate a BCF or BAF value. Using Equation E-1, a BCF/BAF of 250 equates to a log K_{ow} value of approximately 3.5.

- Garten and Trabalka (1983) have reviewed terrestrial food web data and concluded that only organic chemicals with log K_{ow} values greater than 3.5 have the potential to significantly bioaccumulate from food to birds to mammals.

The information listed above indicates that a log K_{ow} of 3.0 to 3.5 is a reasonable, non-arbitrary parameter value to use in defining an organic chemical with the potential to bioaccumulate. For conservatism, the low end (3.0) of this log K_{ow} range will be used to define a bioaccumulative organic chemical. Table 7-3 lists log K_{ow} values (range and recommended value) for volatile and semi-volatile organic chemicals that were analyzed for in media collected from SWMU 69. Log K_{ow} values were primarily obtained from the USEPA (1995c and 1996). The recommended value from these sources generally represents a "high-end" or best estimate from empirical data. The organic chemicals that will be evaluated in the dietary intake models are those with a log K_{ow} value of greater than or equal to 3.0. For conservatism, the maximum value in the log K_{ow} range is used for this determination not the recommended value.

Inorganic chemicals were not quantitatively screened for bioaccumulation potential since log K_{ow} values are not available for these chemicals. Although all Appendix IX metals are retained for evaluation in the upper trophic level food chain models, only mercury and selenium are known to biomagnify in food chains (in organic forms; Suter, 1993) and only cadmium, copper, and zinc generally have the potential to bioaccumulate significantly. The other metals are retained by default.

Appendix E References

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APPENDIX F
ProUCL COPC CALCULATIONS

2008 CORRECTIVE MEASURES STUDY INVESTIGATION
ProUCL COPC CALCULATIONS

Acetone - SWMU 69 Surface Soil

General Statistics

Number of Valid Data	23	Number of Detected Data	16
Number of Distinct Detected Data	15	Number of Non-Detect Data	7
Number of Missing Values	2	Percent Non-Detects	30.43%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	9.1	Minimum Detected	2.208
Maximum Detected	260	Maximum Detected	5.561
Mean of Detected	98.13	Mean of Detected	4.196
SD of Detected	79.32	SD of Detected	0.999
Minimum Non-Detect	5.8	Minimum Non-Detect	1.758
Maximum Non-Detect	33	Maximum Non-Detect	3.497

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	10
Number treated as Detected	13
Single DL Non-Detect Percentage	43.48%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.938
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	70.82	Mean	3.504
SD	77.98	SD	1.399
95% DL/2 (t) UCL	98.74	95% H-Stat (DL/2) UCL	191.7
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	45.26	Mean in Log Scale	3.543
SD	106.7	SD in Log Scale	1.316
95% MLE (t) UCL	83.45	Mean in Original Scale	70.76
95% MLE (Tiku) UCL	89.45	SD in Original Scale	77.99
		95% Percentile Bootstrap UCL	97.93
		95% BCA Bootstrap UCL	100.5

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.2	Data appear Normal at 5% Significance Level
Theta Star	81.79	
nu star	38.4	
A-D Test Statistic	0.392	
5% A-D Critical Value	0.756	
K-S Test Statistic	0.756	
5% K-S Critical Value	0.219	
Data appear Gamma Distributed at 5% Significance Level		

Assuming Gamma Distribution		Nonparametric Statistics	
Gamma ROS Statistics using Extrapolated Data		Kaplan-Meier (KM) Method	
Minimum	9.1	Mean	71.33
Maximum	260	SD	75.82
Mean	77.47	SE of Mean	16.34
Median	41.48	95% KM (t) UCL	99.38
SD	73.93	95% KM (z) UCL	98.2
k star	1.093	95% KM (jackknife) UCL	98.43
Theta star	70.85	95% KM (bootstrap t) UCL	106.1
Nu star	50.3	95% KM (BCA) UCL	103.2
AppChi2	35.01	95% KM (Percentile Bootstrap) UCL	99.26
95% Gamma Approximate UCL	111.3	95% KM (Chebyshev) UCL	142.5
95% Adjusted Gamma UCL	114.3	97.5% KM (Chebyshev) UCL	173.3
		99% KM (Chebyshev) UCL	233.9
		Potential UCLs to Use	
		95% KM (t) UCL	99.38
		95% KM (Percentile Bootstrap) UCL	99.26

Note: DL/2 is not a recommended method.

Barium - SWMU 69 Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	19

Raw Statistics

Minimum	14
Maximum	800
Mean	77.84
Median	26
SD	169.6
Coefficient of Variation	2.178
Skewness	3.808

Log-transformed Statistics

Minimum of Log Data	2.639
Maximum of Log Data	6.685
Mean of log Data	3.547
SD of log Data	1

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.4
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.773
Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	135.9

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	161.2
95% Modified-t UCL	140.2

Assuming Lognormal Distribution

95% H-UCL	95.12
95% Chebyshev (MVUE) UCL	110.6
97.5% Chebyshev (MVUE) UCL	134.4
99% Chebyshev (MVUE) UCL	181.2

Gamma Distribution Test

k star (bias corrected)	0.68
Theta Star	114.5
nu star	33.98
Approximate Chi Square Value (.05)	21.65
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	20.98
Anderson-Darling Test Statistic	3.682
Anderson-Darling 5% Critical Value	0.784
Kolmogorov-Smirnov Test Statistic	0.291
Kolmogorov-Smirnov 5% Critical Value	0.181

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	122.2
95% Adjusted Gamma UCL	126.1

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	133.6
95% Jackknife UCL	135.9
95% Standard Bootstrap UCL	133.1
95% Bootstrap-t UCL	493.8
95% Hall's Bootstrap UCL	384
95% Percentile Bootstrap UCL	137.4
95% BCA Bootstrap UCL	165.9
95% Chebyshev(Mean, Sd) UCL	225.7
97.5% Chebyshev(Mean, Sd) UCL	289.6
99% Chebyshev(Mean, Sd) UCL	415.3

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL	225.7

Cadmium - SWMU 69 Surface Soil

General Statistics

Number of Valid Data	25	Number of Detected Data	24
Number of Distinct Detected Data	22	Number of Non-Detect Data	1
		Percent Non-Detects	4.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.051	Minimum Detected	-2.976
Maximum Detected	36	Maximum Detected	3.584
Mean of Detected	3.372	Mean of Detected	-0.0432
SD of Detected	7.839	SD of Detected	1.522
Minimum Non-Detect	0.039	Minimum Non-Detect	-3.244
Maximum Non-Detect	0.039	Maximum Non-Detect	-3.244

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.435	Shapiro Wilk Test Statistic	0.967
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.238	Mean	-0.199
SD	7.703	SD	1.681
95% DL/2 (t) UCL	5.874	95% H-Stat (DL/2) UCL	9.658
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	3.03	Mean in Log Scale	-0.193
SD	7.748	SD in Log Scale	1.669
95% MLE (t) UCL	5.681	Mean in Original Scale	3.238
95% MLE (Tiku) UCL	5.416	SD in Original Scale	7.703
		95% Percentile Bootstrap UCL	6.127
		95% BCA Bootstrap UCL	8.168

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.469	Data appear Lognormal at 5% Significance Level	
Theta Star	7.194		
nu star	22.5		
A-D Test Statistic	1.694	Nonparametric Statistics	
5% A-D Critical Value	0.806	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.806	Mean	3.239
5% K-S Critical Value	0.188	SD	7.547
Data not Gamma Distributed at 5% Significance Level		SE of Mean	1.542
		95% KM (t) UCL	5.877
Assuming Gamma Distribution		95% KM (z) UCL	5.775
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	5.874
Minimum	1E-09	95% KM (bootstrap t) UCL	18.2
Maximum	36	95% KM (BCA) UCL	6.265
Mean	3.237	95% KM (Percentile Bootstrap) UCL	5.934
Median	0.8	95% KM (Chebyshev) UCL	9.96
SD	7.703	97.5% KM (Chebyshev) UCL	12.87
k star	0.319	99% KM (Chebyshev) UCL	18.58
Theta star	10.16		
Nu star	15.93	Potential UCLs to Use	
AppChi2	7.911	99% KM (Chebyshev) UCL	18.58
95% Gamma Approximate UCL	6.518		
95% Adjusted Gamma UCL	6.85		

Note: DL/2 is not a recommended method.

Chromium - SWMU 69 Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	20

Raw Statistics

Minimum	15
Maximum	89
Mean	35.64
Median	31
SD	19.13
Coefficient of Variation	0.537
Skewness	1.71

Log-transformed Statistics

Minimum of Log Data	2.708
Maximum of Log Data	4.489
Mean of log Data	3.464
SD of log Data	0.457

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.805
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.947
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	42.19

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	43.33
95% Modified-t UCL	42.41

Assuming Lognormal Distribution

95% H-UCL	42.42
95% Chebyshev (MVUE) UCL	49.84
97.5% Chebyshev (MVUE) UCL	56.13
99% Chebyshev (MVUE) UCL	68.49

Gamma Distribution Test

k star (bias corrected)	4.184
Theta Star	8.517
nu star	209.2
Approximate Chi Square Value (.05)	176.7
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	174.7
Anderson-Darling Test Statistic	0.798
Anderson-Darling 5% Critical Value	0.747
Kolmogorov-Smirnov Test Statistic	0.169
Kolmogorov-Smirnov 5% Critical Value	0.175

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	42.19
95% Adjusted Gamma UCL	42.68

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	41.93
95% Jackknife UCL	42.19
95% Standard Bootstrap UCL	41.73
95% Bootstrap-t UCL	44.81
95% Hall's Bootstrap UCL	46.28
95% Percentile Bootstrap UCL	42.08
95% BCA Bootstrap UCL	43.56
95% Chebyshev(Mean, Sd) UCL	52.32
97.5% Chebyshev(Mean, Sd) UCL	59.54
99% Chebyshev(Mean, Sd) UCL	73.71

Potential UCL to Use

Use 95% Approximate Gamma UCL 42.19

Cobalt - SWMU Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	19

Raw Statistics

Minimum	5.7
Maximum	18
Mean	10.34
Median	9.6
SD	3.711
Coefficient of Variation	0.359
Skewness	0.603

Log-transformed Statistics

Minimum of Log Data	1.74
Maximum of Log Data	2.89
Mean of log Data	2.275
SD of log Data	0.356

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.92
Shapiro Wilk Critical Value	0.918

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	11.61

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	11.65
95% Modified-t UCL	11.62

Assuming Lognormal Distribution

95% H-UCL	11.85
95% Chebyshev (MVUE) UCL	13.61
97.5% Chebyshev (MVUE) UCL	15.02
99% Chebyshev (MVUE) UCL	17.81

Gamma Distribution Test

k star (bias corrected)	7.402
Theta Star	1.396
nu star	370.1
Approximate Chi Square Value (.05)	326.5
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	323.7
Anderson-Darling Test Statistic	0.455
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.116
Kolmogorov-Smirnov 5% Critical Value	0.175

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	11.72
95% Adjusted Gamma UCL	11.82

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	11.56
95% Jackknife UCL	11.61
95% Standard Bootstrap UCL	11.54
95% Bootstrap-t UCL	11.75
95% Hall's Bootstrap UCL	11.61
95% Percentile Bootstrap UCL	11.6
95% BCA Bootstrap UCL	11.64
95% Chebyshev(Mean, Sd) UCL	13.57
97.5% Chebyshev(Mean, Sd) UCL	14.97
99% Chebyshev(Mean, Sd) UCL	17.72

Potential UCL to Use

Use 95% Student's-t UCL	11.61

Copper - SWMU 69 Surace Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	18

Raw Statistics

Minimum	16	Minimum of Log Data	2.773
Maximum	130	Maximum of Log Data	4.868
Mean	47.16	Mean of log Data	3.679
Median	36	SD of log Data	0.584
SD	31.47		
Coefficient of Variation	0.667		
Skewness	1.607		

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.805
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.954
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	57.93
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL	59.67
95% Modified-t UCL	58.27

Assuming Lognormal Distribution

95% H-UCL	59.83
95% Chebyshev (MVUE) UCL	71.61
97.5% Chebyshev (MVUE) UCL	82.43
99% Chebyshev (MVUE) UCL	103.7

Gamma Distribution Test

k star (bias corrected)	2.682
Theta Star	17.58
nu star	134.1
Approximate Chi Square Value (.05)	108.3
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	106.8
Anderson-Darling Test Statistic	0.67
Anderson-Darling 5% Critical Value	0.751
Kolmogorov-Smirnov Test Statistic	0.146
Kolmogorov-Smirnov 5% Critical Value	0.176

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	57.51
95% Jackknife UCL	57.93
95% Standard Bootstrap UCL	57.48
95% Bootstrap-t UCL	61.31
95% Hall's Bootstrap UCL	62.63
95% Percentile Bootstrap UCL	58.2
95% BCA Bootstrap UCL	58.76
95% Chebyshev(Mean, Sd) UCL	74.6
97.5% Chebyshev(Mean, Sd) UCL	86.47
99% Chebyshev(Mean, Sd) UCL	109.8

Assuming Gamma Distribution

95% Approximate Gamma UCL	58.37
95% Adjusted Gamma UCL	59.23

Potential UCL to Use

Use 95% Approximate Gamma UCL 58.37

Lead - SWMU 69 Surface Soil

General Statistics

Number of Valid Data	25	Number of Detected Data	25
Number of Distinct Detected Data	25	Number of Non-Detect Data	0
Number of Missing Values	1	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.71	Minimum Detected	-0.342
Maximum Detected	520	Maximum Detected	6.254
Mean of Detected	57.5	Mean of Detected	2.788
SD of Detected	114.9	SD of Detected	1.643
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.522	Shapiro Wilk Test Statistic	0.982
5% Shapiro Wilk Critical Value	0.918	5% Shapiro Wilk Critical Value	0.918
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	57.5	Mean	2.788
SD	114.9	SD	1.643
95% DL/2 (t) UCL	96.81	95% H-Stat (DL/2) UCL	196.8
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.469	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	122.7		
nu star	23.43		
A-D Test Statistic	1.095	Nonparametric Statistics	
5% A-D Critical Value	0.807	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.807	Mean	57.5
5% K-S Critical Value	0.184	SD	112.6
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	22.97
		95% KM (t) UCL	96.81
Assuming Gamma Distribution		95% KM (z) UCL	95.29
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	96.81
Minimum	0.71	95% KM (bootstrap t) UCL	140.2
Maximum	520	95% KM (BCA) UCL	100.6
Mean	57.5	95% KM (Percentile Bootstrap) UCL	99.67
Median	15	95% KM (Chebyshev) UCL	157.6
SD	114.9	97.5% KM (Chebyshev) UCL	201
k star	0.469	99% KM (Chebyshev) UCL	286.1
Theta star	122.7		
Nu star	23.43	Potential UCLs to Use	
AppChi2	13.42	95% KM (Chebyshev) UCL	157.6
95% Gamma Approximate UCL	100.4		
95% Adjusted Gamma UCL	104.4		

Note: DL/2 is not a recommended method.

Mercury - SWMU 69 Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	22

Raw Statistics

Minimum	0.0066
Maximum	0.16
Mean	0.0394
Median	0.023
SD	0.0411
Coefficient of Variation	1.041
Skewness	1.852

Log-transformed Statistics

Minimum of Log Data	-5.021
Maximum of Log Data	-1.833
Mean of log Data	-3.65
SD of log Data	0.906

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.742
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.948
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.0535

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.0562
95% Modified-t UCL	0.054

Assuming Lognormal Distribution

95% H-UCL	0.0608
95% Chebyshev (MVUE) UCL	0.0721
97.5% Chebyshev (MVUE) UCL	0.0868
99% Chebyshev (MVUE) UCL	0.115

Gamma Distribution Test

k star (bias corrected)	1.206
Theta Star	0.0327
nu star	60.31
Approximate Chi Square Value (.05)	43.45
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	42.47
Anderson-Darling Test Statistic	0.832
Anderson-Darling 5% Critical Value	0.765
Kolmogorov-Smirnov Test Statistic	0.16
Kolmogorov-Smirnov 5% Critical Value	0.178

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.0529
95% Jackknife UCL	0.0535
95% Standard Bootstrap UCL	0.0527
95% Bootstrap-t UCL	0.06
95% Hall's Bootstrap UCL	0.0568
95% Percentile Bootstrap UCL	0.0533
95% BCA Bootstrap UCL	0.0559
95% Chebyshev(Mean, Sd) UCL	0.0752
97.5% Chebyshev(Mean, Sd) UCL	0.0907
99% Chebyshev(Mean, Sd) UCL	0.121

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.0547
95% Adjusted Gamma UCL	0.056

Potential UCL to Use

Use 95% Approximate Gamma UCL 0.0547

Selenium - SWMU 69 Surface Soil

General Statistics

Number of Valid Data	25	Number of Detected Data	21
Number of Distinct Detected Data	18	Number of Non-Detect Data	4
		Percent Non-Detects	16.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.13	Minimum Detected	-2.04
Maximum Detected	1.8	Maximum Detected	0.588
Mean of Detected	0.44	Mean of Detected	-1.08
SD of Detected	0.382	SD of Detected	0.705
Minimum Non-Detect	0.13	Minimum Non-Detect	-2.04
Maximum Non-Detect	0.18	Maximum Non-Detect	-1.715

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	8
Number treated as Detected	17
Single DL Non-Detect Percentage	32.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.731	Shapiro Wilk Test Statistic	0.95
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.382	Mean	-1.323
SD	0.375	SD	0.861
95% DL/2 (t) UCL	0.51	95% H-Stat (DL/2) UCL	0.48
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.298	Mean in Log Scale	-1.311
SD	0.465	SD in Log Scale	0.848
95% MLE (t) UCL	0.458	Mean in Original Scale	0.383
95% MLE (Tiku) UCL	0.467	SD in Original Scale	0.374
		95% Percentile Bootstrap UCL	0.506
		95% BCA Bootstrap UCL	0.543

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.814	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.243	
nu star	76.19	
A-D Test Statistic	0.603	Nonparametric Statistics
5% A-D Critical Value	0.753	Kaplan-Meier (KM) Method
K-S Test Statistic	0.753	Mean
5% K-S Critical Value	0.192	SD
Data appear Gamma Distributed at 5% Significance Level		SE of Mean
		95% KM (t) UCL
Assuming Gamma Distribution		95% KM (z) UCL
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL
Minimum	1E-09	95% KM (bootstrap t) UCL
Maximum	1.8	95% KM (BCA) UCL
Mean	0.379	95% KM (Percentile Bootstrap) UCL
Median	0.25	95% KM (Chebyshev) UCL
SD	0.378	97.5% KM (Chebyshev) UCL
k star	0.358	99% KM (Chebyshev) UCL
Theta star	1.06	
Nu star	17.9	Potential UCLs to Use
AppChi2	9.317	95% KM (BCA) UCL
95% Gamma Approximate UCL	0.729	
95% Adjusted Gamma UCL	0.763	

0.391	
0.36	
0.0738	
0.517	
0.512	
0.516	
0.598	
0.526	
0.52	
0.713	
0.852	
1.125	
0.526	

Note: DL/2 is not a recommended method.

Vanadium - Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	20

Raw Statistics

Minimum	46	Minimum of Log Data	3.829
Maximum	280	Maximum of Log Data	5.635
Mean	116.4	Mean of log Data	4.657
Median	100	SD of log Data	0.449
SD	56.71		
Coefficient of Variation	0.487		
Skewness	1.398		

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.878
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	135.8
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL	138.4
95% Modified-t UCL	136.3

Assuming Lognormal Distribution

95% H-UCL	138.9
95% Chebyshev (MVUE) UCL	162.9
97.5% Chebyshev (MVUE) UCL	183.2
99% Chebyshev (MVUE) UCL	223.1

Gamma Distribution Test

k star (bias corrected)	4.567
Theta Star	25.48
nu star	228.3
Approximate Chi Square Value (.05)	194.4
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	192.2
Anderson-Darling Test Statistic	0.361
Anderson-Darling 5% Critical Value	0.747
Kolmogorov-Smirnov Test Statistic	0.131
Kolmogorov-Smirnov 5% Critical Value	0.175

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	136.7
95% Adjusted Gamma UCL	138.2

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	135
95% Jackknife UCL	135.8
95% Standard Bootstrap UCL	134.5
95% Bootstrap-t UCL	140
95% Hall's Bootstrap UCL	142.1
95% Percentile Bootstrap UCL	135.4
95% BCA Bootstrap UCL	137.3
95% Chebyshev(Mean, Sd) UCL	165.8
97.5% Chebyshev(Mean, Sd) UCL	187.2
99% Chebyshev(Mean, Sd) UCL	229.2

Potential UCL to Use

Use 95% Approximate Gamma UCL 136.7

Zinc - Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	23

Raw Statistics

Minimum	9
Maximum	650
Mean	77.44
Median	34
SD	131.9
Coefficient of Variation	1.703
Skewness	3.805

Log-transformed Statistics

Minimum of Log Data	2.197
Maximum of Log Data	6.477
Mean of log Data	3.727
SD of log Data	0.998

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.495
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	122.6
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL	142.3
95% Modified-t UCL	125.9

Assuming Lognormal Distribution

95% H-UCL	113.7
95% Chebyshev (MVUE) UCL	132.2
97.5% Chebyshev (MVUE) UCL	160.7
99% Chebyshev (MVUE) UCL	216.6

Gamma Distribution Test

k star (bias corrected)	0.849
Theta Star	91.18
nu star	42.47
Approximate Chi Square Value (.05)	28.53
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	27.75
Anderson-Darling Test Statistic	1.549
Anderson-Darling 5% Critical Value	0.776
Kolmogorov-Smirnov Test Statistic	0.204
Kolmogorov-Smirnov 5% Critical Value	0.18

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	115.3
95% Adjusted Gamma UCL	118.5

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	120.8
95% Jackknife UCL	122.6
95% Standard Bootstrap UCL	120.6
95% Bootstrap-t UCL	219.4
95% Hall's Bootstrap UCL	288.5
95% Percentile Bootstrap UCL	124.8
95% BCA Bootstrap UCL	155
95% Chebyshev(Mean, Sd) UCL	192.4
97.5% Chebyshev(Mean, Sd) UCL	242.2
99% Chebyshev(Mean, Sd) UCL	339.9

Potential UCL to Use	Use 95% H-UCL	113.7

Nickel - SWMU 69 Surface Soil

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	20

Raw Statistics

Minimum	4	Minimum of Log Data	1.386
Maximum	34	Maximum of Log Data	3.526
Mean	11.21	Mean of log Data	2.295
Median	9	SD of log Data	0.48
SD	6.562		
Coefficient of Variation	0.585		
Skewness	2.19		

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.779
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	13.46

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	13.99
95% Modified-t UCL	13.55

Assuming Lognormal Distribution

95% H-UCL	13.47
95% Chebyshev (MVUE) UCL	15.89
97.5% Chebyshev (MVUE) UCL	17.97
99% Chebyshev (MVUE) UCL	22.06

Gamma Distribution Test

k star (bias corrected)	3.774
Theta Star	2.971
nu star	188.7
Approximate Chi Square Value (.05)	157.9
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	156
Anderson-Darling Test Statistic	0.706
Anderson-Darling 5% Critical Value	0.748
Kolmogorov-Smirnov Test Statistic	0.167
Kolmogorov-Smirnov 5% Critical Value	0.175

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	13.37
95% Jackknife UCL	13.46
95% Standard Bootstrap UCL	13.35
95% Bootstrap-t UCL	14.62
95% Hall's Bootstrap UCL	18.59
95% Percentile Bootstrap UCL	13.6
95% BCA Bootstrap UCL	14.01
95% Chebyshev(Mean, Sd) UCL	16.93
97.5% Chebyshev(Mean, Sd) UCL	19.41
99% Chebyshev(Mean, Sd) UCL	24.27

Assuming Gamma Distribution

95% Approximate Gamma UCL	13.4
95% Adjusted Gamma UCL	13.56

Potential UCL to Use

Use 95% Approximate Gamma UCL 13.4

2010 DISTURBED SOIL SAMPLING INVESTIGATION
ProUCL COPC CALCULATIONS

ProUCL Version 4.00.05
Antimony - Surface Soil

General Statistics

Number of Valid Data	52	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	52
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Antimony was not processed!

Arsenic - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	35
Raw Statistics		Log-transformed Statistics	
Minimum	0.65	Minimum of Log Data	-0.431
Maximum	6.2	Maximum of Log Data	1.825
Mean	2.729	Mean of log Data	0.869
Median	2.6	SD of log Data	0.549
SD	1.344		
Coefficient of Variation	0.493		
Skewness	0.49		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0867	Lilliefors Test Statistic	0.106
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3.041	95% H-UCL	3.212
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.736
95% Adjusted-CLT UCL (Chen-1995)	3.049	97.5% Chebyshev (MVUE) UCL	4.157
95% Modified-t UCL (Johnson-1978)	3.043	99% Chebyshev (MVUE) UCL	4.984
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.665	Data appear Normal at 5% Significance Level	
Theta Star	0.744		
MLE of Mean	2.729		
MLE of Standard Deviation	1.425		
nu star	381.2		
Approximate Chi Square Value (.05)	336.9	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	3.035
Adjusted Chi Square Value	335.8	95% Jackknife UCL	3.041
		95% Standard Bootstrap UCL	3.032
Anderson-Darling Test Statistic	0.457	95% Bootstrap-t UCL	3.054
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL	3.044
Kolmogorov-Smirnov Test Statistic	0.0973	95% Percentile Bootstrap UCL	3.027
Kolmogorov-Smirnov 5% Critical Value	0.124	95% BCA Bootstrap UCL	3.063
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3.541
		97.5% Chebyshev(Mean, Sd) UCL	3.893
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4.583
95% Approximate Gamma UCL	3.087		
95% Adjusted Gamma UCL	3.098		
Potential UCL to Use		Use 95% Student's-t UCL	3.041

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Barium - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	37
Raw Statistics		Log-transformed Statistics	
Minimum	9	Minimum of Log Data	2.197
Maximum	470	Maximum of Log Data	6.153
Mean	41.78	Mean of log Data	3.348
Median	25	SD of log Data	0.752
SD	65.19		
Coefficient of Variation	1.56		
Skewness	5.813		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.308	Lilliefors Test Statistic	0.115
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	56.93	95% H-UCL	46.96
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	56.39
95% Adjusted-CLT UCL (Chen-1995)	64.44	97.5% Chebyshev (MVUE) UCL	64.56
95% Modified-t UCL (Johnson-1978)	58.14	99% Chebyshev (MVUE) UCL	80.61
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.375	Data appear Lognormal at 5% Significance Level	
Theta Star	30.39		
MLE of Mean	41.78		
MLE of Standard Deviation	35.63		
nu star	143		
Approximate Chi Square Value (.05)	116.4	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	56.65
Adjusted Chi Square Value	115.7	95% Jackknife UCL	56.93
		95% Standard Bootstrap UCL	56.65
Anderson-Darling Test Statistic	2.355	95% Bootstrap-t UCL	79.29
Anderson-Darling 5% Critical Value	0.769	95% Hall's Bootstrap UCL	115.5
Kolmogorov-Smirnov Test Statistic	0.166	95% Percentile Bootstrap UCL	58.19
Kolmogorov-Smirnov 5% Critical Value	0.126	95% BCA Bootstrap UCL	67.33
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	81.19
		97.5% Chebyshev(Mean, Sd) UCL	98.24
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	131.7
95% Approximate Gamma UCL	51.35		
95% Adjusted Gamma UCL	51.65		
Potential UCL to Use		Use 95% H-UCL	46.96

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Beryllium - Surface Soil

General Statistics			
Number of Valid Data	52	Number of Detected Data	36
Number of Distinct Detected Data	23	Number of Non-Detect Data	16
		Percent Non-Detects	30.77%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.056	Minimum Detected	-2.882
Maximum Detected	0.29	Maximum Detected	-1.238
Mean of Detected	0.15	Mean of Detected	-2.02
SD of Detected	0.0704	SD of Detected	0.525
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.14	Maximum Non-Detect	-1.966
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	34
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	18
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	65.38%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.921	Shapiro Wilk Test Statistic	0.904
5% Shapiro Wilk Critical Value	0.935	5% Shapiro Wilk Critical Value	0.935
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.122	Mean	-2.27
SD	0.0722	SD	0.579
95% DL/2 (t) UCL	0.139	95% H-Stat (DL/2) UCL	0.143
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.107	Mean in Log Scale	-2.194
SD	0.0938	SD in Log Scale	0.524
95% MLE (t) UCL	0.128	Mean in Original Scale	0.128
95% MLE (Tiku) UCL	0.14	SD in Original Scale	0.0681
		95% t UCL	0.143
		95% Percentile Bootstrap UCL	0.143
		95% BCA Bootstrap UCL	0.144
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.873	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.0387		
nu star	278.8		

A-D Test Statistic	0.888	Nonparametric Statistics	
5% A-D Critical Value	0.752	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.752	Mean	0.125
5% K-S Critical Value	0.147	SD	0.069
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.00982
		95% KM (t) UCL	0.142
Assuming Gamma Distribution		95% KM (z) UCL	0.142
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.142
Minimum	0.056	95% KM (bootstrap t) UCL	0.144
Maximum	0.29	95% KM (BCA) UCL	0.141
Mean	0.146	95% KM (Percentile Bootstrap) UCL	0.142
Median	0.138	95% KM (Chebyshev) UCL	0.168
SD	0.0613	97.5% KM (Chebyshev) UCL	0.187
k star	5.044	99% KM (Chebyshev) UCL	0.223
Theta star	0.0289		
Nu star	524.5	Potential UCLs to Use	
AppChi2	472.4	95% KM (Percentile Bootstrap) UCL	0.142
95% Gamma Approximate UCL	0.162		
95% Adjusted Gamma UCL	0.162		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Cadmium - Surface Soil

General Statistics

Number of Valid Data	52	Number of Detected Data	46
Number of Distinct Detected Data	42	Number of Non-Detect Data	6
		Percent Non-Detects	11.54%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.044	Minimum Detected	-3.124
Maximum Detected	5.3	Maximum Detected	1.668
Mean of Detected	0.606	Mean of Detected	-1.269
SD of Detected	1.016	SD of Detected	1.192
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.13	Maximum Non-Detect	-2.04

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	33
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	36.54%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.547	Shapiro Wilk Test Statistic	0.956
5% Shapiro Wilk Critical Value	0.945	5% Shapiro Wilk Critical Value	0.945
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.543	Mean	-1.454
SD	0.971	SD	1.234
95% DL/2 (t) UCL	0.768	95% H-Stat (DL/2) UCL	0.782

Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.197	Mean in Log Scale	-1.423
SD	1.295	SD in Log Scale	1.203
95% MLE (t) UCL	0.498	Mean in Original Scale	0.545
95% MLE (Tiku) UCL	0.525	SD in Original Scale	0.969
		95% t UCL	0.77
		95% Percentile Bootstrap UCL	0.785
		95% BCA Bootstrap UCL	0.857

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.739	Data appear Lognormal at 5% Significance Level
Theta Star	0.82	
nu star	68.03	

A-D Test Statistic	1.655	Nonparametric Statistics	
5% A-D Critical Value	0.789	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.789	Mean	0.545
5% K-S Critical Value	0.136	SD	0.96
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.135
		95% KM (t) UCL	0.77
Assuming Gamma Distribution		95% KM (z) UCL	0.766
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.77
Minimum	1.00E-12	95% KM (bootstrap t) UCL	1
Maximum	5.3	95% KM (BCA) UCL	0.784
Mean	0.537	95% KM (Percentile Bootstrap) UCL	0.776
Median	0.205	95% KM (Chebyshev) UCL	1.132
SD	0.974	97.5% KM (Chebyshev) UCL	1.386
k star	0.253	99% KM (Chebyshev) UCL	1.884
Theta star	2.125		
Nu star	26.28	Potential UCLs to Use	
AppChi2	15.6	95% KM (Chebyshev) UCL	1.132
95% Gamma Approximate UCL	0.905		
95% Adjusted Gamma UCL	0.919		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Chromium - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	25
Raw Statistics		Log-transformed Statistics	
Minimum	4.2	Minimum of Log Data	1.435
Maximum	68	Maximum of Log Data	4.22
Mean	22.66	Mean of log Data	2.978
Median	19.5	SD of log Data	0.543
SD	13.31		
Coefficient of Variation	0.587		
Skewness	1.925		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.199	Lilliefors Test Statistic	0.106
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	25.75	95% H-UCL	26.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	30.56
95% Adjusted-CLT UCL (Chen-1995)	26.22	97.5% Chebyshev (MVUE) UCL	33.97
95% Modified-t UCL (Johnson-1978)	25.83	99% Chebyshev (MVUE) UCL	40.67
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.46	Data appear Lognormal at 5% Significance Level	
Theta Star	6.549		
MLE of Mean	22.66		
MLE of Standard Deviation	12.18		
nu star	359.8		
Approximate Chi Square Value (.05)	316.8	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	25.69
Adjusted Chi Square Value	315.7	95% Jackknife UCL	25.75
		95% Standard Bootstrap UCL	25.6
Anderson-Darling Test Statistic	0.768	95% Bootstrap-t UCL	26.72
Anderson-Darling 5% Critical Value	0.755	95% Hall's Bootstrap UCL	26.96
Kolmogorov-Smirnov Test Statistic	0.129	95% Percentile Bootstrap UCL	25.82
Kolmogorov-Smirnov 5% Critical Value	0.124	95% BCA Bootstrap UCL	26.03
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30.7
		97.5% Chebyshev(Mean, Sd) UCL	34.19
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	41.02
95% Approximate Gamma UCL	25.73		
95% Adjusted Gamma UCL	25.82		
Potential UCL to Use		Use 95% H-UCL	26.3

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	40
Raw Statistics		Log-transformed Statistics	
Minimum	0.61	Minimum of Log Data	-0.494
Maximum	64	Maximum of Log Data	4.159
Mean	10.03	Mean of log Data	1.974
Median	7.75	SD of log Data	0.844
SD	10.26		
Coefficient of Variation	1.023		
Skewness	3.695		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.215	Lilliefors Test Statistic	0.0966
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	12.41	95% H-UCL	13.26
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	16.07
95% Adjusted-CLT UCL (Chen-1995)	13.15	97.5% Chebyshev (MVUE) UCL	18.62
95% Modified-t UCL (Johnson-1978)	12.53	99% Chebyshev (MVUE) UCL	23.62
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.573	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	6.374		
MLE of Mean	10.03		
MLE of Standard Deviation	7.995		
nu star	163.6		
Approximate Chi Square Value (.05)	135.1	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	12.37
Adjusted Chi Square Value	134.3	95% Jackknife UCL	12.41
		95% Standard Bootstrap UCL	12.33
Anderson-Darling Test Statistic	0.817	95% Bootstrap-t UCL	14.41
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL	25.14
Kolmogorov-Smirnov Test Statistic	0.105	95% Percentile Bootstrap UCL	12.54
Kolmogorov-Smirnov 5% Critical Value	0.125	95% BCA Bootstrap UCL	13.37
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	16.23
		97.5% Chebyshev(Mean, Sd) UCL	18.92
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	24.19
95% Approximate Gamma UCL	12.15		
95% Adjusted Gamma UCL	12.22		
Potential UCL to Use		Use 95% Approximate Gamma UCL	12.15

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Copper - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	38
Raw Statistics		Log-transformed Statistics	
Minimum	3	Minimum of Log Data	1.099
Maximum	120	Maximum of Log Data	4.787
Mean	50.53	Mean of log Data	3.696
Median	51.5	SD of log Data	0.764
SD	29.17		
Coefficient of Variation	0.577		
Skewness	0.242		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.111	Lilliefors Test Statistic	0.158
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	57.3	95% H-UCL	67.45
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	81.11
95% Adjusted-CLT UCL (Chen-1995)	57.33	97.5% Chebyshev (MVUE) UCL	93.01
95% Modified-t UCL (Johnson-1978)	57.33	99% Chebyshev (MVUE) UCL	116.4
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.241	Data appear Normal at 5% Significance Level	
Theta Star	22.55		
MLE of Mean	50.53		
MLE of Standard Deviation	33.76		
nu star	233		
Approximate Chi Square Value (.05)	198.7	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	57.18
Adjusted Chi Square Value	197.8	95% Jackknife UCL	57.3
		95% Standard Bootstrap UCL	57.19
Anderson-Darling Test Statistic	0.955	95% Bootstrap-t UCL	57.66
Anderson-Darling 5% Critical Value	0.761	95% Hall's Bootstrap UCL	57.34
Kolmogorov-Smirnov Test Statistic	0.137	95% Percentile Bootstrap UCL	56.58
Kolmogorov-Smirnov 5% Critical Value	0.124	95% BCA Bootstrap UCL	57.08
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	68.16
		97.5% Chebyshev(Mean, Sd) UCL	75.79
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	90.78
95% Approximate Gamma UCL	59.26		
95% Adjusted Gamma UCL	59.53		
Potential UCL to Use		Use 95% Student's-t UCL	57.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Lead - Surface Soil

General Statistics

Number of Valid Data	51	Number of Detected Data	51
Number of Distinct Detected Data	44	Number of Non-Detect Data	0
Number of Missing Values	1	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.25	Minimum Detected	-1.386
Maximum Detected	71	Maximum Detected	4.263
Mean of Detected	9.316	Mean of Detected	1.639
SD of Detected	12.95	SD of Detected	1.108
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.253	Lilliefors Test Statistic	0.0611
5% Lilliefors Critical Value	0.124	5% Lilliefors Critical Value	0.124
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	9.316	Mean	1.639
SD	12.95	SD	1.108
95% DL/2 (t) UCL	12.36	95% H-Stat (DL/2) UCL	13.88

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.932	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	10	
nu star	95.01	

A-D Test Statistic	1.072	Nonparametric Statistics	
5% A-D Critical Value	0.781	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.781	Mean	9.316
5% K-S Critical Value	0.128	SD	12.82
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	1.814
		95% KM (t) UCL	12.36
Assuming Gamma Distribution		95% KM (z) UCL	12.3
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	12.36
Minimum	0.25	95% KM (bootstrap t) UCL	14.54
Maximum	71	95% KM (BCA) UCL	12.25
Mean	9.316	95% KM (Percentile Bootstrap) UCL	12.32
Median	5.4	95% KM (Chebyshev) UCL	17.22
SD	12.95	97.5% KM (Chebyshev) UCL	20.64
k star	0.932	99% KM (Chebyshev) UCL	27.36
Theta star	10		
Nu star	95.01	Potential UCLs to Use	
AppChi2	73.53	95% KM (Chebyshev) UCL	17.22
95% Gamma Approximate UCL	12.04		
95% Adjusted Gamma UCL	12.13		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Mercury - Surface Soil

General Statistics			
Number of Valid Data	46	Number of Detected Data	36
Number of Distinct Detected Data	31	Number of Non-Detect Data	10
Number of Missing Values	6	Percent Non-Detects	21.74%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0086	Minimum Detected	-4.756
Maximum Detected	0.18	Maximum Detected	-1.715
Mean of Detected	0.0619	Mean of Detected	-3.138
SD of Detected	0.0513	SD of Detected	0.895
Minimum Non-Detect	0.02	Minimum Non-Detect	-3.912
Maximum Non-Detect	0.034	Maximum Non-Detect	-3.381
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	25
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	21
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	54.35%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.85	Shapiro Wilk Test Statistic	0.953
5% Shapiro Wilk Critical Value	0.935	5% Shapiro Wilk Critical Value	0.935
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.051	Mean	-3.423
SD	0.0499	SD	0.963
95% DL/2 (t) UCL	0.0634	95% H-Stat (DL/2) UCL	0.072
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0245	Mean in Log Scale	-3.407
SD	0.078	SD in Log Scale	0.95
95% MLE (t) UCL	0.0438	Mean in Original Scale	0.0513
95% MLE (Tiku) UCL	0.0496	SD in Original Scale	0.0497
		95% t UCL	0.0636
		95% Percentile Bootstrap UCL	0.0634
		95% BCA Bootstrap UCL	0.0662
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.439	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.043		
nu star	103.6		

A-D Test Statistic	0.465	Nonparametric Statistics	
5% A-D Critical Value	0.766	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.766	Mean	0.0511
5% K-S Critical Value	0.15	SD	0.0493
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.00738
		95% KM (t) UCL	0.0635
Assuming Gamma Distribution		95% KM (z) UCL	0.0633
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0635
Minimum	1.00E-12	95% KM (bootstrap t) UCL	0.0665
Maximum	0.18	95% KM (BCA) UCL	0.0639
Mean	0.0532	95% KM (Percentile Bootstrap) UCL	0.0635
Median	0.0343	95% KM (Chebyshev) UCL	0.0833
SD	0.0487	97.5% KM (Chebyshev) UCL	0.0972
k star	0.648	99% KM (Chebyshev) UCL	0.125
Theta star	0.0821		
Nu star	59.58	Potential UCLs to Use	
AppChi2	42.84	95% KM (BCA) UCL	0.0639
95% Gamma Approximate UCL	0.074		
95% Adjusted Gamma UCL	0.0748		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Nickel - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	42
Raw Statistics		Log-transformed Statistics	
Minimum	1.2	Minimum of Log Data	0.182
Maximum	19	Maximum of Log Data	2.944
Mean	7.088	Mean of log Data	1.813
Median	6.8	SD of log Data	0.582
SD	3.754		
Coefficient of Variation	0.53		
Skewness	1.261		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.184	Lilliefors Test Statistic	0.124
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	7.961	95% H-UCL	8.495
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.942
95% Adjusted-CLT UCL (Chen-1995)	8.042	97.5% Chebyshev (MVUE) UCL	11.12
95% Modified-t UCL (Johnson-1978)	7.976	99% Chebyshev (MVUE) UCL	13.42
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.394	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	2.089		
MLE of Mean	7.088		
MLE of Standard Deviation	3.848		
nu star	352.9		
Approximate Chi Square Value (.05)	310.4	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	7.945
Adjusted Chi Square Value	309.3	95% Jackknife UCL	7.961
		95% Standard Bootstrap UCL	7.955
Anderson-Darling Test Statistic	0.764	95% Bootstrap-t UCL	8.063
Anderson-Darling 5% Critical Value	0.755	95% Hall's Bootstrap UCL	8.144
Kolmogorov-Smirnov Test Statistic	0.12	95% Percentile Bootstrap UCL	7.952
Kolmogorov-Smirnov 5% Critical Value	0.124	95% BCA Bootstrap UCL	7.988
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9.358
		97.5% Chebyshev(Mean, Sd) UCL	10.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	12.27
95% Approximate Gamma UCL	8.06		
95% Adjusted Gamma UCL	8.089		
Potential UCL to Use		Use 95% Approximate Gamma UCL	8.06

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Selenium - Surface Soil

General Statistics			
Number of Valid Data	52	Number of Detected Data	12
Number of Distinct Detected Data	11	Number of Non-Detect Data	40
		Percent Non-Detects	76.92%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.58	Minimum Detected	-0.545
Maximum Detected	2.1	Maximum Detected	0.742
Mean of Detected	1.018	Mean of Detected	-0.0694
SD of Detected	0.503	SD of Detected	0.409
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1.6	Maximum Non-Detect	0.47
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	50
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	96.15%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.73	Shapiro Wilk Test Statistic	0.85
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.7	Mean	-0.407
SD	0.299	SD	0.284
95% DL/2 (t) UCL	0.77	95% H-Stat (DL/2) UCL	0.742
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.186
		SD in Log Scale	0.293
		Mean in Original Scale	0.87
		SD in Original Scale	0.303
		95% t UCL	0.94
		95% Percentile Bootstrap UCL	0.942
		95% BCA Bootstrap UCL	0.952
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	4.5	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.226		
nu star	108		

A-D Test Statistic	0.988	Nonparametric Statistics	
5% A-D Critical Value	0.732	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.732	Mean	0.848
5% K-S Critical Value	0.246	SD	0.28
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0571
		95% KM (t) UCL	0.944
Assuming Gamma Distribution		95% KM (z) UCL	0.942
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.946
Minimum	0.313	95% KM (bootstrap t) UCL	0.956
Maximum	2.1	95% KM (BCA) UCL	0.937
Mean	1.044	95% KM (Percentile Bootstrap) UCL	0.945
Median	1.014	95% KM (Chebyshev) UCL	1.097
SD	0.365	97.5% KM (Chebyshev) UCL	1.205
k star	7.225	99% KM (Chebyshev) UCL	1.416
Theta star	0.144		
Nu star	751.4	Potential UCLs to Use	
AppChi2	688.8	95% KM (t) UCL	0.944
95% Gamma Approximate UCL	1.139	95% KM (% Bootstrap) UCL	0.945
95% Adjusted Gamma UCL	1.141		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Silver - Surface Soil

General Statistics

Number of Valid Data	52	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	48
		Percent Non-Detects	92.31%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.15	Minimum Detected	-1.897
Maximum Detected	0.27	Maximum Detected	-1.309
Mean of Detected	0.2	Mean of Detected	-1.633
SD of Detected	0.051	SD of Detected	0.246
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.32	Maximum Non-Detect	-1.139

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	52
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.944	Shapiro Wilk Test Statistic	0.978
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.128	Mean	-2.074
SD	0.0274	SD	0.173
95% DL/2 (t) UCL	0.134	95% H-Stat (DL/2) UCL	0.133

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.752
		SD in Log Scale	0.137
		Mean in Original Scale	0.175
		SD in Original Scale	0.025
		95% t UCL	0.181
		95% Percentile Bootstrap UCL	0.181
		95% BCA Bootstrap UCL	0.181

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	5.588	Data appear Normal at 5% Significance Level
Theta Star	0.0358	
nu star	44.7	

A-D Test Statistic	0.252	Nonparametric Statistics	
5% A-D Critical Value	0.657	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.657	Mean	0.176
5% K-S Critical Value	0.394	SD	0.0242
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0126
		95% KM (t) UCL	0.197
Assuming Gamma Distribution		95% KM (z) UCL	0.197
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.204
Minimum	0.0897	95% KM (bootstrap t) UCL	0.202
Maximum	0.27	95% KM (BCA) UCL	0.27
Mean	0.198	95% KM (Percentile Bootstrap) UCL	0.203
Median	0.207	95% KM (Chebyshev) UCL	0.231
SD	0.0482	97.5% KM (Chebyshev) UCL	0.255
k star	13.86	99% KM (Chebyshev) UCL	0.302
Theta star	0.0143		
Nu star	1442	Potential UCLs to Use	
AppChi2	1355	95% KM (t) UCL	0.197
95% Gamma Approximate UCL	0.211	95% KM (Percentile Bootstrap) UCL	0.203
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Thallium - Surface Soil

General Statistics			
Number of Valid Data	52	Number of Detected Data	22
Number of Distinct Detected Data	20	Number of Non-Detect Data	30
		Percent Non-Detects	57.69%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.054	Minimum Detected	-2.919
Maximum Detected	0.32	Maximum Detected	-1.139
Mean of Detected	0.106	Mean of Detected	-2.367
SD of Detected	0.0662	SD of Detected	0.471
Minimum Non-Detect	0.41	Minimum Non-Detect	-0.892
Maximum Non-Detect	0.6	Maximum Non-Detect	-0.511
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	52
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.706	Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.186	Mean	-1.819
SD	0.083	SD	0.567
95% DL/2 (t) UCL	0.205	95% H-Stat (DL/2) UCL	0.222
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.367
		SD in Log Scale	0.344
		Mean in Original Scale	0.1
		SD in Original Scale	0.0457
		95% t UCL	0.111
		95% Percentile Bootstrap UCL	0.111
		95% BCA Bootstrap UCL	0.115
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.611	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.0294		
nu star	158.9		

A-D Test Statistic	1.249	Nonparametric Statistics	
5% A-D Critical Value	0.747	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.747	Mean	0.106
5% K-S Critical Value	0.186	SD	0.0647
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0141
		95% KM (t) UCL	0.13
Assuming Gamma Distribution		95% KM (z) UCL	0.13
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.13
Minimum	0.054	95% KM (bootstrap t) UCL	0.149
Maximum	0.32	95% KM (BCA) UCL	0.131
Mean	0.11	95% KM (Percentile Bootstrap) UCL	0.131
Median	0.115	95% KM (Chebyshev) UCL	0.168
SD	0.0463	97.5% KM (Chebyshev) UCL	0.195
k star	7.132	99% KM (Chebyshev) UCL	0.247
Theta star	0.0154		
Nu star	741.8	Potential UCLs to Use	
AppChi2	679.6	95% KM (t) UCL	0.13
95% Gamma Approximate UCL	0.12	95% KM (% Bootstrap) UCL	0.131
95% Adjusted Gamma UCL	0.12		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Tin - Surface Soil

General Statistics

Number of Valid Data	52	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	52
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Tin was not processed!

Vanadium - Surface Soil

General Statistics			
Number of Valid Observations	52	Number of Distinct Observations	32
Raw Statistics		Log-transformed Statistics	
Minimum	9	Minimum of Log Data	2.197
Maximum	550	Maximum of Log Data	6.31
Mean	145.7	Mean of log Data	4.74
Median	105	SD of log Data	0.739
SD	106.6		
Coefficient of Variation	0.731		
Skewness	1.714		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.192	Lilliefors Test Statistic	0.107
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	170.5	95% H-UCL	186.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	223.2
95% Adjusted-CLT UCL (Chen-1995)	173.8	97.5% Chebyshev (MVUE) UCL	255.1
95% Modified-t UCL (Johnson-1978)	171.1	99% Chebyshev (MVUE) UCL	317.8
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.107	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	69.16		
MLE of Mean	145.7		
MLE of Standard Deviation	100.4		
nu star	219.1		
Approximate Chi Square Value (.05)	185.9	Nonparametric Statistics	
Adjusted Level of Significance	0.0454	95% CLT UCL	170
Adjusted Chi Square Value	185	95% Jackknife UCL	170.5
		95% Standard Bootstrap UCL	169.5
Anderson-Darling Test Statistic	0.788	95% Bootstrap-t UCL	177
Anderson-Darling 5% Critical Value	0.762	95% Hall's Bootstrap UCL	177.2
Kolmogorov-Smirnov Test Statistic	0.117	95% Percentile Bootstrap UCL	172.8
Kolmogorov-Smirnov 5% Critical Value	0.125	95% BCA Bootstrap UCL	175.1
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	210.1
		97.5% Chebyshev(Mean, Sd) UCL	238
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	292.7
95% Approximate Gamma UCL	171.8		
95% Adjusted Gamma UCL	172.6		
Potential UCL to Use		Use 95% Approximate Gamma UCL	171.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Zinc - Surface Soil

General Statistics

Number of Valid Data	52	Number of Detected Data	51
Number of Distinct Detected Data	37	Number of Non-Detect Data	1
		Percent Non-Detects	1.92%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.9	Minimum Detected	1.589
Maximum Detected	200	Maximum Detected	5.298
Mean of Detected	34.34	Mean of Detected	3.143
SD of Detected	35.47	SD of Detected	0.876
Minimum Non-Detect	4.3	Minimum Non-Detect	1.459
Maximum Non-Detect	4.3	Maximum Non-Detect	1.459

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.209	Lilliefors Test Statistic	0.118
5% Lilliefors Critical Value	0.124	5% Lilliefors Critical Value	0.124
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	33.72	Mean	3.097
SD	35.41	SD	0.928
95% DL/2 (t) UCL	41.94	95% H-Stat (DL/2) UCL	45.51

Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	33.37	Mean in Log Scale	3.099
SD	35.53	SD in Log Scale	0.923
95% MLE (t) UCL	41.63	Mean in Original Scale	33.72
95% MLE (Tiku) UCL	41.04	SD in Original Scale	35.4
		95% t UCL	41.94
		95% Percentile Bootstrap UCL	42.09
		95% BCA Bootstrap UCL	43.01

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.344	Data appear Lognormal at 5% Significance Level
Theta Star	25.55	
nu star	137.1	

A-D Test Statistic	1.227	Nonparametric Statistics	
5% A-D Critical Value	0.77	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.77	Mean	33.77
5% K-S Critical Value	0.127	SD	35.02
Data not Gamma Distributed at 5% Significance Level		SE of Mean	4.904
		95% KM (t) UCL	41.99
Assuming Gamma Distribution		95% KM (z) UCL	41.84
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	41.98
Minimum	1.00E-12	95% KM (bootstrap t) UCL	45.52
Maximum	200	95% KM (BCA) UCL	42.71
Mean	33.68	95% KM (Percentile Bootstrap) UCL	42.13
Median	21	95% KM (Chebyshev) UCL	55.15
SD	35.44	97.5% KM (Chebyshev) UCL	64.4
k star	0.611	99% KM (Chebyshev) UCL	82.57
Theta star	55.14		
Nu star	63.51	Potential UCLs to Use	
AppChi2	46.18	95% KM (Chebyshev) UCL	55.15
95% Gamma Approximate UCL	46.32		
95% Adjusted Gamma UCL	46.74		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

ProUCL Version 4.00.05
Antimony - Subsurface Soil

General Statistics

Number of Valid Data	104	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	104
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Antimony was not processed!

Arsenic - Subsurface Soil

General Statistics			
Number of Valid Observations	104	Number of Distinct Observations	56
Raw Statistics		Log-transformed Statistics	
Minimum	0.27	Minimum of Log Data	-1.309
Maximum	5.9	Maximum of Log Data	1.775
Mean	1.502	Mean of log Data	0.183
Median	1.1	SD of log Data	0.649
SD	1.153		
Coefficient of Variation	0.768		
Skewness	1.876		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.256	Lilliefors Test Statistic	0.135
Lilliefors Critical Value	0.0869	Lilliefors Critical Value	0.0869
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.689	95% H-UCL	1.677
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.927
95% Adjusted-CLT UCL (Chen-1995)	1.71	97.5% Chebyshev (MVUE) UCL	2.121
95% Modified-t UCL (Johnson-1978)	1.693	99% Chebyshev (MVUE) UCL	2.502
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.331	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.644		
MLE of Mean	1.502		
MLE of Standard Deviation	0.983		
nu star	484.9		
Approximate Chi Square Value (.05)	434.8	Nonparametric Statistics	
Adjusted Level of Significance	0.0477	95% CLT UCL	1.688
Adjusted Chi Square Value	434.2	95% Jackknife UCL	1.689
		95% Standard Bootstrap UCL	1.685
Anderson-Darling Test Statistic	3.497	95% Bootstrap-t UCL	1.73
Anderson-Darling 5% Critical Value	0.763	95% Hall's Bootstrap UCL	1.715
Kolmogorov-Smirnov Test Statistic	0.18	95% Percentile Bootstrap UCL	1.68
Kolmogorov-Smirnov 5% Critical Value	0.0894	95% BCA Bootstrap UCL	1.707
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.995
		97.5% Chebyshev(Mean, Sd) UCL	2.208
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.627
95% Approximate Gamma UCL	1.675		
95% Adjusted Gamma UCL	1.677		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	1.995

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Barium - Subsurface Soil

General Statistics			
Number of Valid Observations	104	Number of Distinct Observations	61
Raw Statistics		Log-transformed Statistics	
Minimum	7.1	Minimum of Log Data	1.96
Maximum	270	Maximum of Log Data	5.598
Mean	46.38	Mean of log Data	3.451
Median	27	SD of log Data	0.845
SD	48.93		
Coefficient of Variation	1.055		
Skewness	2.525		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.214	Lilliefors Test Statistic	0.102
Lilliefors Critical Value	0.0869	Lilliefors Critical Value	0.0869
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	54.34	95% H-UCL	53.57
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	63.47
95% Adjusted-CLT UCL (Chen-1995)	55.54	97.5% Chebyshev (MVUE) UCL	71.53
95% Modified-t UCL (Johnson-1978)	54.54	99% Chebyshev (MVUE) UCL	87.34
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.406	Data do not follow a Discernable Distribution (0.05)	
Theta Star	32.98		
MLE of Mean	46.38		
MLE of Standard Deviation	39.11		
nu star	292.5		
Approximate Chi Square Value (.05)	253.9	Nonparametric Statistics	
Adjusted Level of Significance	0.0477	95% CLT UCL	54.27
Adjusted Chi Square Value	253.4	95% Jackknife UCL	54.34
		95% Standard Bootstrap UCL	54.07
Anderson-Darling Test Statistic	2.812	95% Bootstrap-t UCL	56.39
Anderson-Darling 5% Critical Value	0.771	95% Hall's Bootstrap UCL	56.52
Kolmogorov-Smirnov Test Statistic	0.152	95% Percentile Bootstrap UCL	54.75
Kolmogorov-Smirnov 5% Critical Value	0.0902	95% BCA Bootstrap UCL	55.14
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	67.29
		97.5% Chebyshev(Mean, Sd) UCL	76.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	94.12
95% Approximate Gamma UCL	53.43		
95% Adjusted Gamma UCL	53.54		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	67.29

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Beryllium - Subsurface Soil

General Statistics			
Number of Valid Data	104	Number of Detected Data	91
Number of Distinct Detected Data	45	Number of Non-Detect Data	13
		Percent Non-Detects	12.50%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.055	Minimum Detected	-2.9
Maximum Detected	0.45	Maximum Detected	-0.799
Mean of Detected	0.184	Mean of Detected	-1.827
SD of Detected	0.0948	SD of Detected	0.537
Minimum Non-Detect	0.11	Minimum Non-Detect	-2.207
Maximum Non-Detect	0.16	Maximum Non-Detect	-1.833
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	54
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	50
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	51.92%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.114	Lilliefors Test Statistic	0.0689
5% Lilliefors Critical Value	0.0929	5% Lilliefors Critical Value	0.0929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.169	Mean	-1.945
SD	0.0974	SD	0.593
95% DL/2 (t) UCL	0.185	95% H-Stat (DL/2) UCL	0.19
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.153	Mean in Log Scale	-1.901
SD	0.12	SD in Log Scale	0.543
95% MLE (t) UCL	0.172	Mean in Original Scale	0.173
95% MLE (Tiku) UCL	0.178	SD in Original Scale	0.0942
		95% t UCL	0.188
		95% Percentile Bootstrap UCL	0.188
		95% BCA Bootstrap UCL	0.189
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.715	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.0496		
nu star	676.2		

A-D Test Statistic	0.656	Nonparametric Statistics	
5% A-D Critical Value	0.756	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.756	Mean	0.172
5% K-S Critical Value	0.0941	SD	0.0943
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.00933
		95% KM (t) UCL	0.188
Assuming Gamma Distribution		95% KM (z) UCL	0.187
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.188
Minimum	0.0304	95% KM (bootstrap t) UCL	0.188
Maximum	0.45	95% KM (BCA) UCL	0.188
Mean	0.175	95% KM (Percentile Bootstrap) UCL	0.188
Median	0.155	95% KM (Chebyshev) UCL	0.213
SD	0.093	97.5% KM (Chebyshev) UCL	0.23
k star	3.558	99% KM (Chebyshev) UCL	0.265
Theta star	0.0493		
Nu star	740	Potential UCLs to Use	
AppChi2	677.9	95% KM (BCA) UCL	0.188
95% Gamma Approximate UCL	0.191		
95% Adjusted Gamma UCL	0.192		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Cadmium - Subsurface Soil

General Statistics			
Number of Valid Data	104	Number of Detected Data	61
Number of Distinct Detected Data	41	Number of Non-Detect Data	43
		Percent Non-Detects	41.35%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.031	Minimum Detected	-3.474
Maximum Detected	0.27	Maximum Detected	-1.309
Mean of Detected	0.0815	Mean of Detected	-2.649
SD of Detected	0.0526	SD of Detected	0.501
Minimum Non-Detect	0.11	Minimum Non-Detect	-2.207
Maximum Non-Detect	0.14	Maximum Non-Detect	-1.966
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	97
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	93.27%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.235	Lilliefors Test Statistic	0.131
5% Lilliefors Critical Value	0.113	5% Lilliefors Critical Value	0.113
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0737	Mean	-2.701
SD	0.0413	SD	0.39
95% DL/2 (t) UCL	0.0804	95% H-Stat (DL/2) UCL	0.0776
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.222	Mean in Log Scale	-2.704
SD	0.0487	SD in Log Scale	0.445
95% MLE (t) UCL	0.23	Mean in Original Scale	0.0748
95% MLE (Tiku) UCL	0.252	SD in Original Scale	0.0431
		95% t UCL	0.0819
		95% Percentile Bootstrap UCL	0.0822
		95% BCA Bootstrap UCL	0.0834
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.512	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.0232		
nu star	428.5		

A-D Test Statistic	2.333	Nonparametric Statistics	
5% A-D Critical Value	0.755	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.755	Mean	0.0737
5% K-S Critical Value	0.114	SD	0.0427
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00451
		95% KM (t) UCL	0.0812
Assuming Gamma Distribution		95% KM (z) UCL	0.0811
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0812
Minimum	0.031	95% KM (bootstrap t) UCL	0.0823
Maximum	0.27	95% KM (BCA) UCL	0.0812
Mean	0.0817	95% KM (Percentile Bootstrap) UCL	0.081
Median	0.0803	95% KM (Chebyshev) UCL	0.0934
SD	0.0401	97.5% KM (Chebyshev) UCL	0.102
k star	5.991	99% KM (Chebyshev) UCL	0.119
Theta star	0.0136		
Nu star	1246	Potential UCLs to Use	
AppChi2	1165	95% KM (t) UCL	0.0812
95% Gamma Approximate UCL	0.0873	95% KM (% Bootstrap) UCL	0.081
95% Adjusted Gamma UCL	0.0874		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Chromium - Subsurface Soil

General Statistics

Number of Valid Data	103	Number of Detected Data	103
Number of Distinct Detected Data	47	Number of Non-Detect Data	0
Number of Missing Values	1	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3	Minimum Detected	1.099
Maximum Detected	53	Maximum Detected	3.97
Mean of Detected	15.94	Mean of Detected	2.609
SD of Detected	9.311	SD of Detected	0.588
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.167	Lilliefors Test Statistic	0.108
5% Lilliefors Critical Value	0.0873	5% Lilliefors Critical Value	0.0873
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	15.94	Mean	2.609
SD	9.311	SD	0.588
95% DL/2 (t) UCL	17.46	95% H-Stat (DL/2) UCL	18.02

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	3.191	Data do not follow a Discernable Distribution (0.05)
Theta Star	4.996	
nu star	657.4	

A-D Test Statistic	0.761	Nonparametric Statistics	
5% A-D Critical Value	0.758	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.758	Mean	15.94
5% K-S Critical Value	0.0892	SD	9.266
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.917
		95% KM (t) UCL	17.46
Assuming Gamma Distribution		95% KM (z) UCL	17.45
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	17.46
Minimum	3	95% KM (bootstrap t) UCL	17.69
Maximum	53	95% KM (BCA) UCL	17.47
Mean	15.94	95% KM (Percentile Bootstrap) UCL	17.51
Median	15	95% KM (Chebyshev) UCL	19.94
SD	9.311	97.5% KM (Chebyshev) UCL	21.67
k star	3.191	99% KM (Chebyshev) UCL	25.07
Theta star	4.996		
Nu star	657.4	Potential UCLs to Use	
AppChi2	598.9	95% KM (BCA) UCL	17.47
95% Gamma Approximate UCL	17.5		
95% Adjusted Gamma UCL	17.52		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Cobalt - Subsurface Soil

General Statistics

Number of Valid Data	103	Number of Detected Data	103
Number of Distinct Detected Data	68	Number of Non-Detect Data	0
Number of Missing Values	1	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.38	Minimum Detected	-0.968
Maximum Detected	34	Maximum Detected	3.526
Mean of Detected	8.99	Mean of Detected	1.723
SD of Detected	7.857	SD of Detected	1.089
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.143	Lilliefors Test Statistic	0.0912
5% Lilliefors Critical Value	0.0873	5% Lilliefors Critical Value	0.0873
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	8.99	Mean	1.723
SD	7.857	SD	1.089
95% DL/2 (t) UCL	10.28	95% H-Stat (DL/2) UCL	12.97

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.167	Data appear Gamma Distributed at 5% Significance Level
Theta Star	7.702	
nu star	240.5	

A-D Test Statistic	0.661	Nonparametric Statistics	
5% A-D Critical Value	0.778	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.778	Mean	8.99
5% K-S Critical Value	0.0909	SD	7.819
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.774
		95% KM (t) UCL	10.28
Assuming Gamma Distribution		95% KM (z) UCL	10.26
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	10.28
Minimum	0.38	95% KM (bootstrap t) UCL	10.46
Maximum	34	95% KM (BCA) UCL	10.28
Mean	8.99	95% KM (Percentile Bootstrap) UCL	10.27
Median	6.9	95% KM (Chebyshev) UCL	12.36
SD	7.857	97.5% KM (Chebyshev) UCL	13.82
k star	1.167	99% KM (Chebyshev) UCL	16.69
Theta star	7.702		
Nu star	240.5	Potential UCLs to Use	
AppChi2	205.6	95% KM (Chebyshev) UCL	12.36
95% Gamma Approximate UCL	10.52		
95% Adjusted Gamma UCL	10.54		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Copper - Subsurface Soil

General Statistics			
Number of Valid Observations	104	Number of Distinct Observations	57
Raw Statistics		Log-transformed Statistics	
Minimum	8.1	Minimum of Log Data	2.092
Maximum	280	Maximum of Log Data	5.635
Mean	87.97	Mean of log Data	4.321
Median	85	SD of log Data	0.626
SD	44.6		
Coefficient of Variation	0.507		
Skewness	0.998		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.105	Lilliefors Test Statistic	0.157
Lilliefors Critical Value	0.0869	Lilliefors Critical Value	0.0869
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	95.23	95% H-UCL	103
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	117.9
95% Adjusted-CLT UCL (Chen-1995)	95.62	97.5% Chebyshev (MVUE) UCL	129.4
95% Modified-t UCL (Johnson-1978)	95.3	99% Chebyshev (MVUE) UCL	152
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.275	Data do not follow a Discernable Distribution (0.05)	
Theta Star	26.87		
MLE of Mean	87.97		
MLE of Standard Deviation	48.62		
nu star	681.1		
Approximate Chi Square Value (.05)	621.6	Nonparametric Statistics	
Adjusted Level of Significance	0.0477	95% CLT UCL	95.17
Adjusted Chi Square Value	620.8	95% Jackknife UCL	95.23
		95% Standard Bootstrap UCL	95.24
Anderson-Darling Test Statistic	1.442	95% Bootstrap-t UCL	96.05
Anderson-Darling 5% Critical Value	0.758	95% Hall's Bootstrap UCL	95.87
Kolmogorov-Smirnov Test Statistic	0.116	95% Percentile Bootstrap UCL	95.04
Kolmogorov-Smirnov 5% Critical Value	0.0889	95% BCA Bootstrap UCL	95.59
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	107
		97.5% Chebyshev(Mean, Sd) UCL	115.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	131.5
95% Approximate Gamma UCL	96.4		
95% Adjusted Gamma UCL	96.52		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	107

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Lead - Subsurface Soil

General Statistics

Number of Valid Data	103	Number of Detected Data	103
Number of Distinct Detected Data	51	Number of Non-Detect Data	0
Number of Missing Values	1	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.44	Minimum Detected	-0.821
Maximum Detected	9.7	Maximum Detected	2.272
Mean of Detected	2.457	Mean of Detected	0.733
SD of Detected	1.446	SD of Detected	0.599
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.101	Lilliefors Test Statistic	0.098
5% Lilliefors Critical Value	0.0873	5% Lilliefors Critical Value	0.0873
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.457	Mean	0.733
SD	1.446	SD	0.599
95% DL/2 (t) UCL	2.694	95% H-Stat (DL/2) UCL	2.786

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	3.089	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.796	
nu star	636.2	

A-D Test Statistic	0.359	Nonparametric Statistics	
5% A-D Critical Value	0.758	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.758	Mean	2.457
5% K-S Critical Value	0.0892	SD	1.439
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.142
		95% KM (t) UCL	2.694
Assuming Gamma Distribution		95% KM (z) UCL	2.691
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.694
Minimum	0.44	95% KM (bootstrap t) UCL	2.73
Maximum	9.7	95% KM (BCA) UCL	2.699
Mean	2.457	95% KM (Percentile Bootstrap) UCL	2.693
Median	2.2	95% KM (Chebyshev) UCL	3.078
SD	1.446	97.5% KM (Chebyshev) UCL	3.347
k star	3.089	99% KM (Chebyshev) UCL	3.875
Theta star	0.796		
Nu star	636.2	Potential UCLs to Use	
AppChi2	578.7	95% KM (BCA) UCL	2.699
95% Gamma Approximate UCL	2.701		
95% Adjusted Gamma UCL	2.705		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Mercury - Subsurface Soil

General Statistics			
Number of Valid Data	92	Number of Detected Data	82
Number of Distinct Detected Data	56	Number of Non-Detect Data	10
Number of Missing Values	12	Percent Non-Detects	10.87%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.01	Minimum Detected	-4.605
Maximum Detected	0.18	Maximum Detected	-1.715
Mean of Detected	0.0623	Mean of Detected	-2.977
SD of Detected	0.0379	SD of Detected	0.672
Minimum Non-Detect	0.02	Minimum Non-Detect	-3.912
Maximum Non-Detect	0.03	Maximum Non-Detect	-3.507

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	26
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	66
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	28.26%

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.114	Lilliefors Test Statistic	0.12
5% Lilliefors Critical Value	0.0978	5% Lilliefors Critical Value	0.0978
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0568	Mean	-3.14
SD	0.0391	SD	0.79
95% DL/2 (t) UCL	0.0635	95% H-Stat (DL/2) UCL	0.0702
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0524	Mean in Log Scale	-3.095
SD	0.0454	SD in Log Scale	0.722
95% MLE (t) UCL	0.0603	Mean in Original Scale	0.0574
95% MLE (Tiku) UCL	0.0607	SD in Original Scale	0.0384
		95% t UCL	0.0641
		95% Percentile Bootstrap UCL	0.0643
		95% BCA Bootstrap UCL	0.0641
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.557	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.0244		
nu star	419.4		

A-D Test Statistic	0.397	Nonparametric Statistics	
5% A-D Critical Value	0.761	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.761	Mean	0.0572
5% K-S Critical Value	0.0996	SD	0.0385
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.00404
		95% KM (t) UCL	0.0639
Assuming Gamma Distribution		95% KM (z) UCL	0.0638
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0639
Minimum	1.00E-12	95% KM (bootstrap t) UCL	0.0645
Maximum	0.18	95% KM (BCA) UCL	0.064
Mean	0.0569	95% KM (Percentile Bootstrap) UCL	0.0638
Median	0.0475	95% KM (Chebyshev) UCL	0.0748
SD	0.039	97.5% KM (Chebyshev) UCL	0.0824
k star	0.769	99% KM (Chebyshev) UCL	0.0974
Theta star	0.074		
Nu star	141.6	Potential UCLs to Use	
AppChi2	115.1	95% KM (BCA) UCL	0.064
95% Gamma Approximate UCL	0.0701		
95% Adjusted Gamma UCL	0.0703		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Nickel - Subsurface Soil

General Statistics			
Number of Valid Data	104	Number of Detected Data	102
Number of Distinct Detected Data	62	Number of Non-Detect Data	2
		Percent Non-Detects	1.92%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.76	Minimum Detected	-0.274
Maximum Detected	11	Maximum Detected	2.398
Mean of Detected	5.179	Mean of Detected	1.435
SD of Detected	3.002	SD of Detected	0.699
Minimum Non-Detect	1.3	Minimum Non-Detect	0.262
Maximum Non-Detect	1.4	Maximum Non-Detect	0.336
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	95
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	8.65%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.106	Lilliefors Test Statistic	0.116
5% Lilliefors Critical Value	0.0877	5% Lilliefors Critical Value	0.0877
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.092	Mean	1.4
SD	3.037	SD	0.737
95% DL/2 (t) UCL	5.587	95% H-Stat (DL/2) UCL	6.146
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	4.989	Mean in Log Scale	1.411
SD	3.203	SD in Log Scale	0.714
95% MLE (t) UCL	5.51	Mean in Original Scale	5.102
95% MLE (Tiku) UCL	5.505	SD in Original Scale	3.023
		95% t UCL	5.594
		95% Percentile Bootstrap UCL	5.594
		95% BCA Bootstrap UCL	5.583
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.476	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.091		
nu star	505.2		

A-D Test Statistic	1.527	Nonparametric Statistics	
5% A-D Critical Value	0.762	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.762	Mean	5.1
5% K-S Critical Value	0.0898	SD	3.012
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.297
		95% KM (t) UCL	5.592
Assuming Gamma Distribution		95% KM (z) UCL	5.588
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	5.592
Minimum	1.00E-12	95% KM (bootstrap t) UCL	5.621
Maximum	11	95% KM (BCA) UCL	5.669
Mean	5.079	95% KM (Percentile Bootstrap) UCL	5.605
Median	4.5	95% KM (Chebyshev) UCL	6.393
SD	3.057	97.5% KM (Chebyshev) UCL	6.953
k star	0.777	99% KM (Chebyshev) UCL	8.053
Theta star	6.537		
Nu star	161.6	Potential UCLs to Use	
AppChi2	133.2	95% KM (BCA) UCL	5.669
95% Gamma Approximate UCL	6.162		
95% Adjusted Gamma UCL	6.178		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Selenium - Subsurface Soil

General Statistics			
Number of Valid Data	104	Number of Detected Data	33
Number of Distinct Detected Data	24	Number of Non-Detect Data	71
		Percent Non-Detects	68.27%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.63	Minimum Detected	-0.462
Maximum Detected	2.2	Maximum Detected	0.788
Mean of Detected	1.072	Mean of Detected	0.00822
SD of Detected	0.415	SD of Detected	0.341
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1.6	Maximum Non-Detect	0.47
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	98
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	6
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	94.23%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.827	Shapiro Wilk Test Statistic	0.907
5% Shapiro Wilk Critical Value	0.931	5% Shapiro Wilk Critical Value	0.931
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.765	Mean	-0.323
SD	0.315	SD	0.303
95% DL/2 (t) UCL	0.816	95% H-Stat (DL/2) UCL	0.798
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.71	Mean in Log Scale	-0.101
SD	0.566	SD in Log Scale	0.273
95% MLE (t) UCL	0.802	Mean in Original Scale	0.94
95% MLE (Tiku) UCL	1.304	SD in Original Scale	0.293
		95% t UCL	0.988
		95% Percentile Bootstrap UCL	0.989
		95% BCA Bootstrap UCL	0.99
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	7.604	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.141		
nu star	501.9		

A-D Test Statistic	1.432	Nonparametric Statistics	
5% A-D Critical Value	0.748	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.748	Mean	0.921
5% K-S Critical Value	0.153	SD	0.275
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0341
		95% KM (t) UCL	0.977
Assuming Gamma Distribution		95% KM (z) UCL	0.977
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.977
Minimum	0.446	95% KM (bootstrap t) UCL	0.982
Maximum	2.2	95% KM (BCA) UCL	0.978
Mean	1.082	95% KM (Percentile Bootstrap) UCL	0.975
Median	1.1	95% KM (Chebyshev) UCL	1.069
SD	0.3	97.5% KM (Chebyshev) UCL	1.134
k star	12.83	99% KM (Chebyshev) UCL	1.26
Theta star	0.0843		
Nu star	2668	Potential UCLs to Use	
AppChi2	2549	95% KM (t) UCL	0.977
95% Gamma Approximate UCL	1.132	95% KM (% Bootstrap) UCL	0.975
95% Adjusted Gamma UCL	1.133		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Silver - Subsurface Soil

General Statistics

Number of Valid Data	104	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	99
		Percent Non-Detects	95.19%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.17	Minimum Detected	-1.772
Maximum Detected	0.96	Maximum Detected	-0.0408
Mean of Detected	0.468	Mean of Detected	-1.015
SD of Detected	0.366	SD of Detected	0.797
Minimum Non-Detect	0.21	Minimum Non-Detect	-1.561
Maximum Non-Detect	0.32	Maximum Non-Detect	-1.139

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	102
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	2
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	98.08%

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.809	Shapiro Wilk Test Statistic	0.841
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.141	Mean	-2.034
SD	0.104	SD	0.288
95% DL/2 (t) UCL	0.158	95% H-Stat (DL/2) UCL	0.143

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.866
		SD in Log Scale	0.508
		Mean in Original Scale	0.178
		SD in Original Scale	0.121
		95% t UCL	0.198
		95% Percentile Bootstrap UCL	0.199
		95% BCA Bootstrap UCL	0.205

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.976	Data appear Normal at 5% Significance Level	
Theta Star	0.479		
nu star	9.761		
A-D Test Statistic	0.569	Nonparametric Statistics	
5% A-D Critical Value	0.684	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.684	Mean	0.192
5% K-S Critical Value	0.36	SD	0.0962
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.013
		95% KM (t) UCL	0.214
Assuming Gamma Distribution		95% KM (z) UCL	0.214
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.219
Minimum	1.00E-12	95% KM (bootstrap t) UCL	0.216
Maximum	1.073	95% KM (BCA) UCL	0.76
Mean	0.477	95% KM (Percentile Bootstrap) UCL	0.76
Median	0.479	95% KM (Chebyshev) UCL	0.249
SD	0.331	97.5% KM (Chebyshev) UCL	0.273
k star	0.257	99% KM (Chebyshev) UCL	0.321
Theta star	1.856		
Nu star	53.45	Potential UCLs to Use	
AppChi2	37.65	95% KM (t) UCL	0.214
95% Gamma Approximate UCL	0.677	95% KM (Percentile Bootstrap) UCL	0.76
95% Adjusted Gamma UCL	0.68		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Thallium - Subsurface Soil

General Statistics			
Number of Valid Data	104	Number of Detected Data	61
Number of Distinct Detected Data	31	Number of Non-Detect Data	43
		Percent Non-Detects	41.35%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.06	Minimum Detected	-2.813
Maximum Detected	0.23	Maximum Detected	-1.47
Mean of Detected	0.108	Mean of Detected	-2.273
SD of Detected	0.0338	SD of Detected	0.293
Minimum Non-Detect	0.42	Minimum Non-Detect	-0.868
Maximum Non-Detect	0.64	Maximum Non-Detect	-0.446
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	104
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.16	Lilliefors Test Statistic	0.0995
5% Lilliefors Critical Value	0.113	5% Lilliefors Critical Value	0.113
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.167	Mean	-1.906
SD	0.077	SD	0.496
95% DL/2 (t) UCL	0.18	95% H-Stat (DL/2) UCL	0.184
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.273
		SD in Log Scale	0.249
		Mean in Original Scale	0.106
		SD in Original Scale	0.0282
		95% t UCL	0.111
		95% Percentile Bootstrap UCL	0.111
		95% BCA Bootstrap UCL	0.111

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	11.03	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.00975		
nu star	1346		
A-D Test Statistic	0.705	Nonparametric Statistics	
5% A-D Critical Value	0.751	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.751	Mean	0.108
5% K-S Critical Value	0.114	SD	0.0335
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.00432
		95% KM (t) UCL	0.115
Assuming Gamma Distribution		95% KM (z) UCL	0.115
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.115
Minimum	0.06	95% KM (bootstrap t) UCL	0.116
Maximum	0.23	95% KM (BCA) UCL	0.115
Mean	0.109	95% KM (Percentile Bootstrap) UCL	0.115
Median	0.11	95% KM (Chebyshev) UCL	0.126
SD	0.0279	97.5% KM (Chebyshev) UCL	0.135
k star	16.14	99% KM (Chebyshev) UCL	0.151
Theta star	0.00678		
Nu star	3357	Potential UCLs to Use	
AppChi2	3223	95% KM (t) UCL	0.115
95% Gamma Approximate UCL	0.114		
95% Adjusted Gamma UCL	0.114		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Tin - Subsurface Soil

General Statistics

Number of Valid Data	104	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	104
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Tin was not processed!

Vanadium - Subsurface Soil

General Statistics

Number of Valid Data	102	Number of Detected Data	102
Number of Distinct Detected Data	45	Number of Non-Detect Data	0
Number of Missing Values	2	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	48	Minimum Detected	3.871
Maximum Detected	580	Maximum Detected	6.363
Mean of Detected	219.6	Mean of Detected	5.267
SD of Detected	111.2	SD of Detected	0.518
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.126	Lilliefors Test Statistic	0.116
5% Lilliefors Critical Value	0.0877	5% Lilliefors Critical Value	0.0877
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	219.6	Mean	5.267
SD	111.2	SD	0.518
95% DL/2 (t) UCL	237.9	95% H-Stat (DL/2) UCL	243.8

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	4.047	Data appear Gamma Distributed at 5% Significance Level
Theta Star	54.27	
nu star	825.6	

A-D Test Statistic	0.558	Nonparametric Statistics	
5% A-D Critical Value	0.756	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.756	Mean	219.6
5% K-S Critical Value	0.0892	SD	110.6
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	11.01
		95% KM (t) UCL	237.9
Assuming Gamma Distribution		95% KM (z) UCL	237.7
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	237.9
Minimum	48	95% KM (bootstrap t) UCL	239.6
Maximum	580	95% KM (BCA) UCL	237
Mean	219.6	95% KM (Percentile Bootstrap) UCL	238
Median	205	95% KM (Chebyshev) UCL	267.6
SD	111.2	97.5% KM (Chebyshev) UCL	288.4
k star	4.047	99% KM (Chebyshev) UCL	329.1
Theta star	54.27		
Nu star	825.6	Potential UCLs to Use	
AppChi2	759.9	95% KM (BCA) UCL	237
95% Gamma Approximate UCL	238.6		
95% Adjusted Gamma UCL	238.9		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Zinc - Subsurface Soil

General Statistics			
Number of Valid Data	104	Number of Detected Data	98
Number of Distinct Detected Data	63	Number of Non-Detect Data	6
		Percent Non-Detects	5.77%
Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.4	Minimum Detected	1.686
Maximum Detected	100	Maximum Detected	4.605
Mean of Detected	30.23	Mean of Detected	3.022
SD of Detected	26.27	SD of Detected	0.896
Minimum Non-Detect	4.9	Minimum Non-Detect	1.589
Maximum Non-Detect	5.6	Maximum Non-Detect	1.723
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	96
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	7.69%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.223	Lilliefors Test Statistic	0.119
5% Lilliefors Critical Value	0.0895	5% Lilliefors Critical Value	0.0895
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	28.64	Mean	2.902
SD	26.3	SD	0.996
95% DL/2 (t) UCL	32.92	95% H-Stat (DL/2) UCL	37.12
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	27.61	Mean in Log Scale	2.904
SD	27.63	SD in Log Scale	0.992
95% MLE (t) UCL	32.1	Mean in Original Scale	28.64
95% MLE (Tiku) UCL	31.9	SD in Original Scale	26.29
		95% t UCL	32.92
		95% Percentile Bootstrap UCL	32.82
		95% BCA Bootstrap UCL	33.62
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.398	Data do not follow a Discernable Distribution (0.05)	
Theta Star	21.63		
nu star	274		

A-D Test Statistic	3.438	Nonparametric Statistics	
5% A-D Critical Value	0.772	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.772	Mean	28.8
5% K-S Critical Value	0.0922	SD	26.02
Data not Gamma Distributed at 5% Significance Level		SE of Mean	2.565
		95% KM (t) UCL	33.06
Assuming Gamma Distribution		95% KM (z) UCL	33.02
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	33.05
Minimum	1.00E-12	95% KM (bootstrap t) UCL	33.42
Maximum	100	95% KM (BCA) UCL	32.76
Mean	28.49	95% KM (Percentile Bootstrap) UCL	33.12
Median	16	95% KM (Chebyshev) UCL	39.98
SD	26.46	97.5% KM (Chebyshev) UCL	44.82
k star	0.322	99% KM (Chebyshev) UCL	54.32
Theta star	88.53		
Nu star	66.93	Potential UCLs to Use	
AppChi2	49.1	95% KM (BCA) UCL	32.76
95% Gamma Approximate UCL	38.83		
95% Adjusted Gamma UCL	39		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

ProUCL Version 4.00.05
Antimony - Sediment

General Statistics

Number of Valid Data	14	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	14
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Antimony was not processed!

Arsenic - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	13
Raw Statistics		Log-transformed Statistics	
Minimum	1	Minimum of Log Data	0
Maximum	4.8	Maximum of Log Data	1.569
Mean	2.807	Mean of log Data	0.945
Median	2.6	SD of log Data	0.448
SD	1.167		
Coefficient of Variation	0.416		
Skewness	0.359		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.954	Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3.36	95% H-UCL	3.647
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.328
95% Adjusted-CLT UCL (Chen-1995)	3.352	97.5% Chebyshev (MVUE) UCL	4.979
95% Modified-t UCL (Johnson-1978)	3.365	99% Chebyshev (MVUE) UCL	6.259
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.67	Data appear Normal at 5% Significance Level	
Theta Star	0.601		
MLE of Mean	2.807		
MLE of Standard Deviation	1.299		
nu star	130.8		
Approximate Chi Square Value (.05)	105.4	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	3.32
Adjusted Chi Square Value	102.3	95% Jackknife UCL	3.36
		95% Standard Bootstrap UCL	3.303
Anderson-Darling Test Statistic	0.208	95% Bootstrap-t UCL	3.463
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	3.329
Kolmogorov-Smirnov Test Statistic	0.131	95% Percentile Bootstrap UCL	3.321
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	3.307
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.167
		97.5% Chebyshev(Mean, Sd) UCL	4.755
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	5.911
95% Approximate Gamma UCL	3.484		
95% Adjusted Gamma UCL	3.587		
Potential UCL to Use		Use 95% Student's-t UCL	3.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Barium - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	13
Raw Statistics		Log-transformed Statistics	
Minimum	24	Minimum of Log Data	3.178
Maximum	140	Maximum of Log Data	4.942
Mean	70	Mean of log Data	4.09
Median	58.5	SD of log Data	0.598
SD	39.41		
Coefficient of Variation	0.563		
Skewness	0.527		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.91	Shapiro Wilk Test Statistic	0.939
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	88.65	95% H-UCL	102.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	121.3
95% Adjusted-CLT UCL (Chen-1995)	88.91	97.5% Chebyshev (MVUE) UCL	143.3
95% Modified-t UCL (Johnson-1978)	88.9	99% Chebyshev (MVUE) UCL	186.6
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.648	Data appear Normal at 5% Significance Level	
Theta Star	26.43		
MLE of Mean	70		
MLE of Standard Deviation	43.02		
nu star	74.15		
Approximate Chi Square Value (.05)	55.32	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	87.33
Adjusted Chi Square Value	53.16	95% Jackknife UCL	88.65
		95% Standard Bootstrap UCL	86.7
Anderson-Darling Test Statistic	0.37	95% Bootstrap-t UCL	91.13
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	87.73
Kolmogorov-Smirnov Test Statistic	0.159	95% Percentile Bootstrap UCL	87.07
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	87.79
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	115.9
		97.5% Chebyshev(Mean, Sd) UCL	135.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	174.8
95% Approximate Gamma UCL	93.83		
95% Adjusted Gamma UCL	97.63		
Potential UCL to Use		Use 95% Student's-t UCL	88.65

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Beryllium - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	13
Raw Statistics		Log-transformed Statistics	
Minimum	0.098	Minimum of Log Data	-2.323
Maximum	0.33	Maximum of Log Data	-1.109
Mean	0.203	Mean of log Data	-1.648
Median	0.2	SD of log Data	0.341
SD	0.0666		
Coefficient of Variation	0.329		
Skewness	0.39		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.973	Shapiro Wilk Test Statistic	0.982
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.234	95% H-UCL	0.245
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.285
95% Adjusted-CLT UCL (Chen-1995)	0.234	97.5% Chebyshev (MVUE) UCL	0.32
95% Modified-t UCL (Johnson-1978)	0.235	99% Chebyshev (MVUE) UCL	0.389
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	7.714	Data appear Normal at 5% Significance Level	
Theta Star	0.0263		
MLE of Mean	0.203		
MLE of Standard Deviation	0.073		
nu star	216		
Approximate Chi Square Value (.05)	183	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	0.232
Adjusted Chi Square Value	178.9	95% Jackknife UCL	0.234
		95% Standard Bootstrap UCL	0.231
Anderson-Darling Test Statistic	0.14	95% Bootstrap-t UCL	0.236
Anderson-Darling 5% Critical Value	0.735	95% Hall's Bootstrap UCL	0.234
Kolmogorov-Smirnov Test Statistic	0.0974	95% Percentile Bootstrap UCL	0.231
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	0.233
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.28
		97.5% Chebyshev(Mean, Sd) UCL	0.314
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.38
95% Approximate Gamma UCL	0.239		
95% Adjusted Gamma UCL	0.245		
Potential UCL to Use		Use 95% Student's-t UCL	0.234

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cadmium - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	14
Raw Statistics		Log-transformed Statistics	
Minimum	0.38	Minimum of Log Data	-0.968
Maximum	24	Maximum of Log Data	3.178
Mean	5.079	Mean of log Data	0.796
Median	1.45	SD of log Data	1.316
SD	7.176		
Coefficient of Variation	1.413		
Skewness	1.898		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.691	Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	8.476	95% H-UCL	17.88
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	12.92
95% Adjusted-CLT UCL (Chen-1995)	9.273	97.5% Chebyshev (MVUE) UCL	16.45
95% Modified-t UCL (Johnson-1978)	8.638	99% Chebyshev (MVUE) UCL	23.39
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.617	Data appear Lognormal at 5% Significance Level	
Theta Star	8.227		
MLE of Mean	5.079		
MLE of Standard Deviation	6.464		
nu star	17.29		
Approximate Chi Square Value (.05)	8.877	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	8.234
Adjusted Chi Square Value	8.088	95% Jackknife UCL	8.476
		95% Standard Bootstrap UCL	8.176
Anderson-Darling Test Statistic	0.814	95% Bootstrap-t UCL	11.74
Anderson-Darling 5% Critical Value	0.773	95% Hall's Bootstrap UCL	8.97
Kolmogorov-Smirnov Test Statistic	0.244	95% Percentile Bootstrap UCL	8.333
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL	9.094
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	13.44
		97.5% Chebyshev(Mean, Sd) UCL	17.06
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	24.16
95% Approximate Gamma UCL	9.891		
95% Adjusted Gamma UCL	10.86		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	13.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Chromium - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	12
Raw Statistics		Log-transformed Statistics	
Minimum	10	Minimum of Log Data	2.303
Maximum	99	Maximum of Log Data	4.595
Mean	35.86	Mean of log Data	3.402
Median	25.5	SD of log Data	0.597
SD	24.7		
Coefficient of Variation	0.689		
Skewness	1.666		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.79	Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	47.55	95% H-UCL	51.66
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	60.93
95% Adjusted-CLT UCL (Chen-1995)	49.85	97.5% Chebyshev (MVUE) UCL	71.99
95% Modified-t UCL (Johnson-1978)	48.04	99% Chebyshev (MVUE) UCL	93.72
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.38	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	15.06		
MLE of Mean	35.86		
MLE of Standard Deviation	23.24		
nu star	66.65		
Approximate Chi Square Value (.05)	48.86	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	46.71
Adjusted Chi Square Value	46.85	95% Jackknife UCL	47.55
		95% Standard Bootstrap UCL	46.35
Anderson-Darling Test Statistic	0.758	95% Bootstrap-t UCL	53.77
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	52.59
Kolmogorov-Smirnov Test Statistic	0.213	95% Percentile Bootstrap UCL	47.43
Kolmogorov-Smirnov 5% Critical Value	0.231	95% BCA Bootstrap UCL	50.07
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	64.63
		97.5% Chebyshev(Mean, Sd) UCL	77.08
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	101.5
95% Approximate Gamma UCL	48.91		
95% Adjusted Gamma UCL	51.02		
Potential UCL to Use		Use 95% Approximate Gamma UCL	48.91

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	12
Raw Statistics		Log-transformed Statistics	
Minimum	5.6	Minimum of Log Data	1.723
Maximum	20	Maximum of Log Data	2.996
Mean	12.16	Mean of log Data	2.403
Median	13	SD of log Data	0.465
SD	5.153		
Coefficient of Variation	0.424		
Skewness	0.0231		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.897	Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	14.6	95% H-UCL	15.97
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	19.01
95% Adjusted-CLT UCL (Chen-1995)	14.43	97.5% Chebyshev (MVUE) UCL	21.95
95% Modified-t UCL (Johnson-1978)	14.6	99% Chebyshev (MVUE) UCL	27.72
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.326	Data appear Normal at 5% Significance Level	
Theta Star	2.811		
MLE of Mean	12.16		
MLE of Standard Deviation	5.845		
nu star	121.1		
Approximate Chi Square Value (.05)	96.7	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	14.42
Adjusted Chi Square Value	93.81	95% Jackknife UCL	14.6
		95% Standard Bootstrap UCL	14.23
Anderson-Darling Test Statistic	0.682	95% Bootstrap-t UCL	14.69
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL	14.27
Kolmogorov-Smirnov Test Statistic	0.184	95% Percentile Bootstrap UCL	14.39
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	14.29
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	18.16
		97.5% Chebyshev(Mean, Sd) UCL	20.76
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	25.86
95% Approximate Gamma UCL	15.23		
95% Adjusted Gamma UCL	15.7		
Potential UCL to Use		Use 95% Student's-t UCL	14.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Copper - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	11
Raw Statistics		Log-transformed Statistics	
Minimum	38	Minimum of Log Data	3.638
Maximum	160	Maximum of Log Data	5.075
Mean	101.3	Mean of log Data	4.564
Median	97	SD of log Data	0.362
SD	31.93		
Coefficient of Variation	0.315		
Skewness	-0.0299		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.984	Shapiro Wilk Test Statistic	0.923
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	116.4	95% H-UCL	124.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	145.5
95% Adjusted-CLT UCL (Chen-1995)	115.2	97.5% Chebyshev (MVUE) UCL	164.4
95% Modified-t UCL (Johnson-1978)	116.4	99% Chebyshev (MVUE) UCL	201.5
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	7.408	Data appear Normal at 5% Significance Level	
Theta Star	13.67		
MLE of Mean	101.3		
MLE of Standard Deviation	37.21		
nu star	207.4		
Approximate Chi Square Value (.05)	175.1	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	115.3
Adjusted Chi Square Value	171.2	95% Jackknife UCL	116.4
		95% Standard Bootstrap UCL	115
Anderson-Darling Test Statistic	0.258	95% Bootstrap-t UCL	116.8
Anderson-Darling 5% Critical Value	0.735	95% Hall's Bootstrap UCL	117.4
Kolmogorov-Smirnov Test Statistic	0.122	95% Percentile Bootstrap UCL	114.6
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	114.8
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	138.5
		97.5% Chebyshev(Mean, Sd) UCL	154.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	186.2
95% Approximate Gamma UCL	120		
95% Adjusted Gamma UCL	122.7		
Potential UCL to Use		Use 95% Student's-t UCL	116.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Lead - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	13
Raw Statistics		Log-transformed Statistics	
Minimum	6.4	Minimum of Log Data	1.856
Maximum	680	Maximum of Log Data	6.522
Mean	116	Mean of log Data	3.597
Median	25	SD of log Data	1.472
SD	203.5		
Coefficient of Variation	1.755		
Skewness	2.198		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.598	Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	212.3	95% H-UCL	476
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	275.8
95% Adjusted-CLT UCL (Chen-1995)	239.6	97.5% Chebyshev (MVUE) UCL	354.4
95% Modified-t UCL (Johnson-1978)	217.6	99% Chebyshev (MVUE) UCL	508.8
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.474	Data appear Lognormal at 5% Significance Level	
Theta Star	244.7		
MLE of Mean	116		
MLE of Standard Deviation	168.4		
nu star	13.27		
Approximate Chi Square Value (.05)	6.073	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	205.4
Adjusted Chi Square Value	5.44	95% Jackknife UCL	212.3
		95% Standard Bootstrap UCL	201.3
Anderson-Darling Test Statistic	1.387	95% Bootstrap-t UCL	372.5
Anderson-Darling 5% Critical Value	0.789	95% Hall's Bootstrap UCL	264.4
Kolmogorov-Smirnov Test Statistic	0.309	95% Percentile Bootstrap UCL	209.7
Kolmogorov-Smirnov 5% Critical Value	0.241	95% BCA Bootstrap UCL	241.3
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	353
		97.5% Chebyshev(Mean, Sd) UCL	455.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	657.1
95% Approximate Gamma UCL	253.3		
95% Adjusted Gamma UCL	282.8		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	353

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Mercury - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	13
Raw Statistics		Log-transformed Statistics	
Minimum	0.045	Minimum of Log Data	-3.101
Maximum	0.14	Maximum of Log Data	-1.966
Mean	0.0716	Mean of log Data	-2.676
Median	0.0685	SD of log Data	0.282
SD	0.0231		
Coefficient of Variation	0.322		
Skewness	2.035		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.799	Shapiro Wilk Test Statistic	0.915
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.0826	95% H-UCL	0.083
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0951
95% Adjusted-CLT UCL (Chen-1995)	0.0854	97.5% Chebyshev (MVUE) UCL	0.105
95% Modified-t UCL (Johnson-1978)	0.0831	99% Chebyshev (MVUE) UCL	0.125
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	10.1	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.00709		
MLE of Mean	0.0716		
MLE of Standard Deviation	0.0225		
nu star	282.8		
Approximate Chi Square Value (.05)	244.8	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	0.0818
Adjusted Chi Square Value	240.1	95% Jackknife UCL	0.0826
		95% Standard Bootstrap UCL	0.0812
Anderson-Darling Test Statistic	0.562	95% Bootstrap-t UCL	0.0884
Anderson-Darling 5% Critical Value	0.734	95% Hall's Bootstrap UCL	0.133
Kolmogorov-Smirnov Test Statistic	0.168	95% Percentile Bootstrap UCL	0.0821
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	0.0861
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.0985
		97.5% Chebyshev(Mean, Sd) UCL	0.11
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.133
95% Approximate Gamma UCL	0.0827		
95% Adjusted Gamma UCL	0.0844		
Potential UCL to Use		Use 95% Approximate Gamma UCL	0.0827

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Nickel - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	12
Raw Statistics		Log-transformed Statistics	
Minimum	5.2	Minimum of Log Data	1.649
Maximum	34	Maximum of Log Data	3.526
Mean	11.46	Mean of log Data	2.256
Median	8.2	SD of log Data	0.576
SD	8.598		
Coefficient of Variation	0.75		
Skewness	2.006		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.705	Shapiro Wilk Test Statistic	0.87
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	15.53	95% H-UCL	15.87
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18.85
95% Adjusted-CLT UCL (Chen-1995)	16.55	97.5% Chebyshev (MVUE) UCL	22.19
95% Modified-t UCL (Johnson-1978)	15.73	99% Chebyshev (MVUE) UCL	28.76
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.326	Data do not follow a Discernable Distribution (0.05)	
Theta Star	4.927		
MLE of Mean	11.46		
MLE of Standard Deviation	7.513		
nu star	65.11		
Approximate Chi Square Value (.05)	47.55	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	15.24
Adjusted Chi Square Value	45.56	95% Jackknife UCL	15.53
		95% Standard Bootstrap UCL	15.07
Anderson-Darling Test Statistic	1.026	95% Bootstrap-t UCL	22.28
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	34.65
Kolmogorov-Smirnov Test Statistic	0.234	95% Percentile Bootstrap UCL	15.42
Kolmogorov-Smirnov 5% Critical Value	0.231	95% BCA Bootstrap UCL	16.86
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	21.47
		97.5% Chebyshev(Mean, Sd) UCL	25.81
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34.32
95% Approximate Gamma UCL	15.69		
95% Adjusted Gamma UCL	16.37		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	21.47

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Selenium - Sediment

General Statistics

Number of Valid Data	14	Number of Detected Data	6
Number of Distinct Detected Data	5	Number of Non-Detect Data	8
		Percent Non-Detects	57.14%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.85	Minimum Detected	-0.163
Maximum Detected	1.3	Maximum Detected	0.262
Mean of Detected	1.125	Mean of Detected	0.107
SD of Detected	0.178	SD of Detected	0.166
Minimum Non-Detect	1.8	Minimum Non-Detect	0.588
Maximum Non-Detect	3.1	Maximum Non-Detect	1.131

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	14
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.921	Shapiro Wilk Test Statistic	0.909
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.118	Mean	0.0967
SD	0.202	SD	0.177
95% DL/2 (t) UCL	1.214	95% H-Stat (DL/2) UCL	1.222

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.107
		SD in Log Scale	0.114
		Mean in Original Scale	1.119
		SD in Original Scale	0.124
		95% t UCL	1.178
		95% Percentile Bootstrap UCL	1.17
		95% BCA Bootstrap UCL	1.169

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	22.63	Data appear Normal at 5% Significance Level
Theta Star	0.0497	
nu star	271.6	

A-D Test Statistic	0.316	Nonparametric Statistics	
5% A-D Critical Value	0.697	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.697	Mean	1.125
5% K-S Critical Value	0.332	SD	0.163
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0727
		95% KM (t) UCL	1.254
Assuming Gamma Distribution		95% KM (z) UCL	1.245
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.261
Minimum	0.85	95% KM (bootstrap t) UCL	1.259
Maximum	1.3	95% KM (BCA) UCL	1.225
Mean	1.14	95% KM (Percentile Bootstrap) UCL	1.24
Median	1.157	95% KM (Chebyshev) UCL	1.442
SD	0.124	97.5% KM (Chebyshev) UCL	1.579
k star	66.7	99% KM (Chebyshev) UCL	1.849
Theta star	0.0171		
Nu star	1868	Potential UCLs to Use	
AppChi2	1768	95% KM (t) UCL	1.254
95% Gamma Approximate UCL	1.204	95% KM (Percentile Bootstrap) UCL	1.24
95% Adjusted Gamma UCL	1.213		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Silver - Sediment

General Statistics

Number of Valid Data	14	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	11
		Percent Non-Detects	78.57%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.25	Minimum Detected	-1.386
Maximum Detected	0.7	Maximum Detected	-0.357
Mean of Detected	0.473	Mean of Detected	-0.833
SD of Detected	0.225	SD of Detected	0.519
Minimum Non-Detect	0.32	Minimum Non-Detect	-1.139
Maximum Non-Detect	0.62	Maximum Non-Detect	-0.478

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	1
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	92.86%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	0.983
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.259	Mean	-1.453
SD	0.15	SD	0.427
95% DL/2 (t) UCL	0.33	95% H-Stat (DL/2) UCL	0.324

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.279
		SD in Log Scale	0.325
		Mean in Original Scale	0.296
		SD in Original Scale	0.132
		95% t UCL	0.358
		95% Percentile Bootstrap UCL	0.357
		95% BCA Bootstrap UCL	0.391

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	Nonparametric Statistics	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.299
5% K-S Critical Value	N/A	SD	0.126
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0415
		95% KM (t) UCL	0.373
Assuming Gamma Distribution		95% KM (z) UCL	0.367
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.444
Minimum	N/A	95% KM (bootstrap t) UCL	0.33
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	0.7
Median	N/A	95% KM (Chebyshev) UCL	0.48
SD	N/A	97.5% KM (Chebyshev) UCL	0.558
k star	N/A	99% KM (Chebyshev) UCL	0.712
Theta star	N/A		
Nu star	N/A	Potential UCLs to Use	
AppChi2	N/A	95% KM (t) UCL	0.373
95% Gamma Approximate UCL	N/A	95% KM (Percentile Bootstrap) UCL	0.7
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Thallium - Sediment

General Statistics

Number of Valid Data	14	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	13
		Percent Non-Detects	92.86%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT

The data set for variable Thallium was not processed!

Tin - Sediment

General Statistics

Number of Valid Data	14	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	14
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Tin was not processed!

Vanadium - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	11
Raw Statistics		Log-transformed Statistics	
Minimum	67	Minimum of Log Data	4.205
Maximum	370	Maximum of Log Data	5.914
Mean	203.4	Mean of log Data	5.217
Median	175	SD of log Data	0.469
SD	92.71		
Coefficient of Variation	0.456		
Skewness	0.784		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.889	Shapiro Wilk Test Statistic	0.943
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	247.2	95% H-UCL	267.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	318.2
95% Adjusted-CLT UCL (Chen-1995)	249.7	97.5% Chebyshev (MVUE) UCL	367.6
95% Modified-t UCL (Johnson-1978)	248.1	99% Chebyshev (MVUE) UCL	464.7
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.192	Data appear Normal at 5% Significance Level	
Theta Star	48.51		
MLE of Mean	203.4		
MLE of Standard Deviation	99.32		
nu star	117.4		
Approximate Chi Square Value (.05)	93.37	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	244.1
Adjusted Chi Square Value	90.53	95% Jackknife UCL	247.2
		95% Standard Bootstrap UCL	242.2
Anderson-Darling Test Statistic	0.431	95% Bootstrap-t UCL	252.9
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL	246.9
Kolmogorov-Smirnov Test Statistic	0.149	95% Percentile Bootstrap UCL	241.4
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	246.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	311.4
		97.5% Chebyshev(Mean, Sd) UCL	358.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	449.9
95% Approximate Gamma UCL	255.7		
95% Adjusted Gamma UCL	263.7		
Potential UCL to Use		Use 95% Student's-t UCL	247.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Zinc - Sediment

General Statistics			
Number of Valid Observations	14	Number of Distinct Observations	13
Raw Statistics		Log-transformed Statistics	
Minimum	40	Minimum of Log Data	3.689
Maximum	490	Maximum of Log Data	6.194
Mean	135.4	Mean of log Data	4.522
Median	70.5	SD of log Data	0.825
SD	149.2		
Coefficient of Variation	1.102		
Skewness	1.939		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.647	Shapiro Wilk Test Statistic	0.841
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	206	95% H-UCL	229.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	253.7
95% Adjusted-CLT UCL (Chen-1995)	223	97.5% Chebyshev (MVUE) UCL	309.2
95% Modified-t UCL (Johnson-1978)	209.4	99% Chebyshev (MVUE) UCL	418.3
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.178	Data do not follow a Discernable Distribution (0.05)	
Theta Star	114.9		
MLE of Mean	135.4		
MLE of Standard Deviation	124.7		
nu star	32.97		
Approximate Chi Square Value (.05)	20.85	Nonparametric Statistics	
Adjusted Level of Significance	0.0312	95% CLT UCL	200.9
Adjusted Chi Square Value	19.57	95% Jackknife UCL	206
		95% Standard Bootstrap UCL	197.2
Anderson-Darling Test Statistic	1.344	95% Bootstrap-t UCL	320.2
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL	261.3
Kolmogorov-Smirnov Test Statistic	0.268	95% Percentile Bootstrap UCL	200.1
Kolmogorov-Smirnov 5% Critical Value	0.233	95% BCA Bootstrap UCL	223.1
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	309.2
		97.5% Chebyshev(Mean, Sd) UCL	384.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	532.1
95% Approximate Gamma UCL	214.1		
95% Adjusted Gamma UCL	228		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	309.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX G
HHRA – DATA SETS

2008 CORRECTIVE MEASURES STUDY INVESTIGATION HHRA

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)									
1,1,1,2-Tetrachloroethane	0.57 U	2.7 UJ	1.6 U	0.88 U	0.51 U	1.9 U	0.42 U	0.5 U	4.8 UJ
1,1,1-Trichloroethane	0.52 U	2.4 UJ	1.4 U	0.8 U	0.46 U	1.7 U	0.38 U	0.46 U	4.3 UJ
1,1,2,2-Tetrachloroethane	1.2 U	5.8 UJ	3.4 U	1.9 U	1.1 U	4.1 U	0.93 U	1.1 U	10 UJ
1,1,2-Trichloroethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U	0.79 U	0.95 U	8.9 UJ
1,1-Dichloroethane	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U	0.33 U	0.39 U	3.7 UJ
1,1-Dichloroethene	0.48 U	2.2 UJ	1.3 U	0.74 U	0.43 U	1.6 U	0.36 U	0.43 U	4 UJ
1,2,3-Trichloropropane	1.2 U	5.8 UJ	3.4 U	1.9 U	1.1 U	4.1 U	0.93 U	1.1 U	10 UJ
1,2-Dibromo-3-Chloropropane	2.5 U	12 UJ	6.9 U	3.9 U	2.2 U	8.2 U	1.9 U	2.2 U	21 UJ
1,2-Dichloroethane	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
1,2-Dichloropropane	0.98 U	4.6 UJ	2.7 U	1.5 U	0.88 U	3.2 U	0.73 U	0.87 U	8.2 UJ
2-Butanone (MEK)	20 U	11 UJ	6.6 U	3.7 U	28 U	7.9 U	1.8 U	2.1 U	20 UJ
2-Chloro-1,3-butadiene	0.51 U	2.4 UJ	1.4 U	0.78 U	0.46 U	1.7 U	0.38 UJ	0.45 UJ	4.2 UJ
2-Hexanone	1.9 UJ	8.7 UJ	5.2 U	2.9 U	1.7 U	6.1 U	1.4 U	1.7 U	16 UJ
3-Chloro-1-propene	1.3 U	6.2 UJ	3.7 UJ	2.1 UJ	1.2 UJ	4.4 UJ	0.99 R	1.2 R	11 UJ
4-Methyl-2-pentanone (MIBK)	2.6 U	12 UJ	7.1 U	4 U	2.3 U	8.5 U	1.9 U	2.3 U	22 UJ
Acetone	190	18 UJ	11 U	6.1 R	260	33 U	9.1 J	29 J	33 UJ
Acetonitrile	26 U	190 UJ	110 U	62 UJ	36 U	130 U	30 UJ	36 UJ	330 UJ
Acrolein	17 R	79 R	47 R	26 R	15 R	56 R	13 R	15 R	140 R
Acrylonitrile	20 U	95 UJ	57 UJ	32 UJ	18 U	67 UJ	15 UJ	18 UJ	170 UJ
Benzene	0.7 U	3.3 UJ	1.9 U	1.1 U	0.63 U	2.3 U	0.52 U	0.62 U	5.9 UJ
Bromoform	0.98 U	4.6 UJ	2.7 U	1.5 U	0.88 U	3.2 U	0.73 U	0.87 U	8.2 UJ
Bromomethane	1.4 UJ	6.6 UJ	3.9 U	2.2 UJ	1.3 U	4.7 U	1.1 UJ	1.3 UJ	12 UJ
Carbon disulfide	0.45 U	2.1 UJ	1.3 U	0.7 U	0.41 U	1.5 U	0.34 U	0.4 U	3.8 UJ
Carbon tetrachloride	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
Chlorobenzene	0.65 U	3 UJ	1.8 U	1 U	0.58 U	2.1 U	0.48 U	0.58 U	5.4 UJ
Chlorodibromomethane	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U	0.33 U	0.39 U	3.7 UJ
Chloroethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U	0.79 U	0.95 U	8.9 UJ
Chloroform	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U	0.33 U	0.39 U	3.7 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg) (Cont)									
Chloromethane	0.63 U	2.9 UJ	1.7 U	0.98 UJ	0.57 U	2.1 U	0.47 U	0.56 U	5.3 UJ
cis-1,3-Dichloropropene	0.77 U	3.6 UJ	2.1 U	1.2 U	0.69 U	2.5 U	0.57 U	0.69 U	6.5 UJ
Dibromomethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U	0.79 U	0.95 U	8.9 UJ
Dichlorobromomethane	0.74 U	3.4 UJ	2 U	1.1 U	0.66 U	2.4 U	0.55 U	0.65 U	6.2 UJ
Dichlorodifluoromethane	0.79 U	3.7 UJ	2.2 U	1.2 U	0.71 U	2.6 U	0.59 U	0.7 U	6.6 UJ
Ethyl methacrylate	2 UJ	9.1 UJ	5.4 U	3 U	1.8 U	6.4 U	1.5 U	1.7 U	16 UJ
Ethylbenzene	0.67 U	3.1 UJ	1.8 U	1 U	0.6 U	2.2 J	0.5 U	0.59 U	6.2 J
Ethylene Dibromide	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U	0.99 U	1.2 U	11 UJ
Iodomethane	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 UJ	2.9 U	0.66 U	0.79 U	7.4 UJ
Isobutyl alcohol	61 R	290 R	170 R	95 R	55 R	200 R	46 R	54 R	510 R
Methacrylonitrile	21 UJ	99 UJ	59 U	33 U	19 UJ	70 U	16 U	19 U	180 UJ
Methyl methacrylate	3.3 UJ	15 UJ	9.1 U	5.1 U	3 UJ	11 U	2.4 U	2.9 U	27 UJ
Methylene Chloride	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
Pentachloroethane	2 U	9.1 UJ	5.4 UJ	3 UJ	1.8 UJ	6.4 UJ	1.5 U	1.7 U	16 UJ
Propionitrile	12 U	87 UJ	52 U	29 U	17 U	61 U	14 UJ	17 UJ	160 UJ
Styrene	0.59 U	2.7 UJ	1.6 U	0.91 U	0.53 U	1.9 U	0.44 U	0.52 U	4.9 UJ
Tetrachloroethene	0.65 U	3 UJ	1.8 U	1 U	0.58 U	2.1 U	0.48 U	0.58 U	5.4 UJ
Toluene	0.7 U	3.3 J	1.9 U	1.1 U	0.63 U	2.5 J	0.52 U	0.62 U	5.9 UJ
trans-1,2-Dichloroethene	0.86 U	4 UJ	2.4 U	1.3 U	0.77 U	2.8 U	0.64 U	0.77 U	7.2 UJ
trans-1,3-Dichloropropene	0.77 U	3.6 UJ	2.1 U	1.2 U	0.69 U	2.5 U	0.57 U	0.69 U	6.5 UJ
trans-1,4-Dichloro-2-butene	2.8 UJ	13 UJ	7.6 U	4.3 U	2.5 UJ	9.1 U	2 U	2.4 U	23 UJ
Trichloroethene	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
Trichlorofluoromethane	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U	0.99 U	1.2 U	11 UJ
Vinyl acetate	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U	0.99 UJ	1.2 UJ	11 UJ
Vinyl chloride	0.52 U	2.4 UJ	1.4 U	0.8 U	0.46 U	1.7 U	0.38 U	0.46 U	4.3 UJ
Xylenes, Total	2 U	9.5 UJ	6.1 J	3.2 U	1.8 U	14 J	1.5 U	1.8 U	28 J

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SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg)									
1,1'-Biphenyl	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.2 U	9.5 U	27 UJ
1,2,4,5-Tetrachlorobenzene	9.5 U	13 UJ	9.9 UJ	8.6 UJ	26 J	9.2 UJ	7 U	8.1 U	23 UJ
1,2,4-Trichlorobenzene	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.2 U	9.5 U	27 UJ
1,2-Dichlorobenzene	11 U	14 UJ	11 UJ	9.6 UJ	14 UJ	10 UJ	7.8 U	9 U	26 UJ
1,3,5-Trinitrobenzene	26 U	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ	19 U	22 U	62 UJ
1,3-Dichlorobenzene	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ	6.6 U	7.7 U	22 UJ
1,3-Dinitrobenzene	5.9 U	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ	5.7 UJ	4.3 U	5 U	14 UJ
1,4-Dichlorobenzene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
1,4-Dioxane	12 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	8.9 U	10 U	29 UJ
1,4-Naphthoquinone	5.9 UJ	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ	5.7 UJ	4.3 U	5 U	14 UJ
2,2'-oxybis[1-chloropropane]	9.5 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ	9.2 UJ	7 U	8.1 U	23 UJ
2,3,4,6-Tetrachlorophenol	6.4 UJ	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ	6.1 UJ	4.7 U	5.4 U	15 UJ
2,4,5-Trichlorophenol	10 UJ	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ	7.5 U	8.7 U	25 UJ
2,4,6-Trichlorophenol	12 UJ	16 UJ	12 UJ	11 UJ	16 UJ	12 UJ	8.8 U	10 U	29 UJ
2,4-Dichlorophenol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9 U	10 U	30 UJ
2,4-Dimethylphenol	26 UJ	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ	19 U	22 U	62 UJ
2,4-Dinitrophenol	130 UJ	170 UJ	130 UJ	110 UJ	160 UJ	120 UJ	92 UJ	110 UJ	300 UJ
2,4-Dinitrotoluene	8.9 U	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ	6.5 UJ	7.6 U	22 UJ
2,6-Dichlorophenol	9.7 UJ	13 UJ	10 UJ	8.8 UJ	13 UJ	9.3 UJ	7.1 U	8.2 U	23 UJ
2,6-Dinitrotoluene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
2-Acetylaminofluorene	7.7 U	11 UJ	8 UJ	7 UJ	10 UJ	7.4 UJ	5.7 U	6.5 U	19 UJ
2-Chloronaphthalene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
2-Chlorophenol	10 UJ	14 UJ	10 UJ	9 UJ	13 UJ	9.6 UJ	7.3 U	8.5 U	24 UJ
2-Methylnaphthalene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	9.2 J	2.5 UJ	1.9 U	2.2 U	6.2 UJ
2-Methylphenol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9 U	10 U	30 UJ
2-Naphthylamine	30 U	41 UJ	31 UJ	27 UJ	39 UJ	29 UJ	22 U	26 UJ	73 UJ
2-Nitroaniline	9.8 U	13 UJ	10 UJ	8.9 UJ	13 UJ	9.5 UJ	7.2 U	8.3 U	24 UJ
2-Nitrophenol	11 UJ	15 UJ	11 UJ	10 UJ	14 UJ	11 UJ	8.1 U	9.4 U	27 UJ

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
2-Picoline	18 U	25 UJ	19 UJ	16 UJ	24 UJ	18 UJ	13 U	15 U	44 UJ
2-Toluidine	14 U	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 U	12 U	34 UJ
3 & 4 Methylphenol	11 UJ	15 UJ	11 UJ	10 UJ	14 UJ	11 UJ	8.1 U	9.4 U	27 UJ
3,3'-Dichlorobenzidine	14 UJ	19 UJ	14 UJ	13 UJ	18 UJ	13 UJ	10 U	12 U	34 UJ
3,3'-Dimethylbenzidine	270 U	370 UJ	280 UJ	250 UJ	350 UJ	260 UJ	200 U	230 UJ	660 UJ
3-Methylcholanthrene	9.2 U	13 UJ	9.6 UJ	8.4 UJ	12 UJ	8.9 UJ	6.8 U	7.8 U	22 UJ
3-Nitroaniline	6.8 U	9.3 UJ	7.1 UJ	6.2 UJ	8.9 UJ	6.6 UJ	5 U	5.8 U	16 UJ
4,6-Dinitro-2-methylphenol	8.8 UJ	12 UJ	9.1 UJ	8 UJ	11 UJ	8.5 UJ	6.4 UJ	7.4 UJ	21 UJ
4-Aminobiphenyl	20 U	27 UJ	20 UJ	18 UJ	26 UJ	19 UJ	14 U	17 U	48 UJ
4-Bromophenyl phenyl ether	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
4-Chloro-3-methylphenol	11 UJ	16 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.3 U	9.6 U	27 UJ
4-Chloroaniline	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ	6.6 U	7.7 U	22 UJ
4-Chlorophenyl phenyl ether	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
4-Nitroaniline	12 U	16 UJ	12 UJ	11 UJ	15 UJ	11 UJ	8.5 UJ	9.9 U	28 UJ
4-Nitrophenol	50 UJ	68 UJ	52 UJ	45 UJ	65 UJ	48 UJ	37 UJ	42 U	120 UJ
4-Nitroquinoline-1-oxide	17 R	23 R	17 R	15 R	22 R	16 R	12 R	14 R	40 R
7,12-Dimethylbenz(a)anthracene	14 UJ	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 U	12 U	34 UJ
Acenaphthene	0.86 U	1.2 UJ	0.9 UJ	0.78 UJ	10 J	0.83 UJ	0.63 U	0.73 U	5.4 J
Acenaphthylene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	11 J	2.5 UJ	1.9 U	2.2 U	9.8 J
Acetophenone	13 U	18 UJ	14 UJ	12 UJ	17 UJ	13 UJ	9.5 U	11 U	31 UJ
alpha,alpha-Dimethyl phenethylamine	89 U	120 UJ	93 UJ	81 UJ	120 UJ	86 UJ	65 U	76 U	220 UJ
Aniline	9.5 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ	9.2 UJ	7 U	8.1 U	23 UJ
Anthracene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	34 J	2.5 UJ	1.9 U	2.2 U	22 J
Aramite, Total	17 UJ	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 UJ	40 UJ
Benzo[a]anthracene	73 J	10 J	2.7 UJ	8.3 J	460 J	5.5 J	1.9 U	2.2 U	200 J
Benzo[a]pyrene	69 J	22 J	1 UJ	13 J	530 J	0.96 UJ	0.73 U	0.85 U	330 J
Benzo[b]fluoranthene	160 J	50 J	1.2 UJ	20 J	1300 J	28 J	0.84 U	0.98 U	900 J
Benzo[g,h,i]perylene	57 J	38 J	2.7 UJ	30 J	1400 J	23 J	1.9 U	2.2 U	340 J

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SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Benzo[k]fluoranthene	1.5 U	2.1 UJ	1.6 UJ	14 J	2 UJ	1.5 UJ	1.1 U	1.3 U	3.7 UJ
Benzyl alcohol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	8.9 U	10 U	29 UJ
Bis(2-chloroethoxy)methane	10 U	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ	7.5 U	8.7 U	25 UJ
Bis(2-chloroethyl)ether	7.8 U	12 UJ	9 UJ	7.8 UJ	11 UJ	8.3 UJ	6.3 U	7.3 U	21 UJ
Bis(2-ethylhexyl) phthalate	110	230 J	64 UJ	170 J	1000 J	47 UJ	14 J	9.4 J	260 J
Butyl benzyl phthalate	11 U	15 UJ	11 UJ	86 J	300 J	11 UJ	8 U	9.2 U	98 J
Chrysene	170 J	30 J	9 J	30 J	1000 J	16 J	0.68 U	0.78 U	520 J
Diallate	15 U	20 UJ	15 UJ	13 UJ	19 UJ	14 UJ	11 U	12 U	35 UJ
Dibenz(a,h)anthracene	19	6.3 J	0.93 UJ	8.1 J	220 J	5 UJ	0.65 U	0.76 U	65 J
Dibenzofuran	6.4 U	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ	6.1 UJ	4.7 U	5.4 U	15 UJ
Diethyl phthalate	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 U	40 UJ
Dimethoate	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ	3.7 U	4.2 U	12 UJ
Dimethyl phthalate	9.7 U	13 UJ	10 UJ	8.8 UJ	13 UJ	9.3 UJ	7.1 U	8.2 U	23 UJ
Di-n-butyl phthalate	38 U	52 UJ	39 UJ	34 UJ	49 UJ	36 UJ	28 U	32 U	92 UJ
Di-n-octyl phthalate	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ	3.7 U	4.2 U	12 UJ
Dinoseb	26 U	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ	19 U	22 U	62 UJ
Disulfoton	8.9 U	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ	6.5 UJ	7.6 UJ	22 UJ
Ethyl methanesulfonate	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 U	40 UJ
Ethyl Parathion	12 U	16 UJ	12 UJ	11 UJ	15 UJ	11 UJ	8.5 U	9.9 U	28 UJ
Famphur	5.4 U	7.4 UJ	5.7 UJ	4.9 UJ	7.1 UJ	5.3 UJ	4 UJ	4.6 U	13 UJ
Fluoranthene	300 J	27 J	3.1 J	21 J	1100 J	14 J	1.9 U	2.2 U	700 J
Fluorene	6.4 J	1.6 UJ	1.2 UJ	1.1 UJ	14 J	1.1 UJ	0.85 U	0.99 U	6.7 UJ
Hexachlorobenzene	10 U	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ	7.5 U	8.7 U	25 UJ
Hexachlorobutadiene	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 U	12 U	33 UJ
Hexachlorocyclopentadiene	21 U	29 UJ	22 UJ	19 UJ	28 UJ	20 UJ	16 U	18 U	51 UJ
Hexachloroethane	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.2 U	9.5 U	27 UJ
Hexachlorophene	1300 R	1700 R	1300 R	1100 R	1600 R	1200 R	920 R	1100 R	3000 R
Hexachloropropene	11 UJ	15 UJ	11 UJ	9.9 UJ	14 UJ	11 UJ	8 UJ	9.2 UJ	26 UJ

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Indeno[1,2,3-cd]pyrene	37	21 J	1.9 UJ	22 J	1400 J	11 J	1.3 UJ	1.5 UJ	170 J
Isophorone	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
Isosafrole	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
Methapyrilene	14 UJ	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 UJ	12 UJ	34 UJ
Methyl methanesulfonate	14 U	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 U	12 U	34 UJ
Methyl parathion	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ	3.7 U	4.2 U	12 UJ
Naphthalene	0.91 U	1.2 UJ	0.94 UJ	0.82 UJ	3.4 J	0.88 UJ	0.66 U	0.77 U	2.2 UJ
Nitrobenzene	10 U	14 UJ	11 UJ	9.5 UJ	14 UJ	10 UJ	7.6 U	8.9 U	25 UJ
N-Nitro-o-toluidine	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ	6.6 U	7.7 U	22 UJ
N-Nitrosodiethylamine	18 U	25 UJ	19 UJ	16 UJ	24 UJ	18 UJ	13 U	15 U	44 UJ
N-Nitrosodimethylamine	15 U	20 UJ	15 UJ	13 UJ	19 UJ	14 UJ	11 U	13 U	36 UJ
N-Nitrosodi-n-butylamine	14 UJ	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 UJ	12 UJ	33 UJ
N-Nitrosodi-n-propylamine	9.8 U	13 UJ	10 UJ	8.9 UJ	13 UJ	9.5 UJ	7.2 U	8.3 U	24 UJ
N-Nitrosodiphenylamine	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
N-Nitrosomethylethylamine	8.6 U	12 UJ	9 UJ	7.8 UJ	11 UJ	8.3 UJ	6.3 U	7.3 U	21 UJ
N-Nitrosomorpholine	10 UJ	14 UJ	10 UJ	9 UJ	13 UJ	9.6 UJ	7.3 UJ	8.5 UJ	24 UJ
N-Nitrosopiperidine	13 UJ	18 UJ	13 UJ	12 UJ	17 UJ	12 UJ	9.4 U	11 UJ	31 UJ
N-Nitrosopyrrolidine	13 U	18 UJ	14 UJ	12 UJ	18 UJ	13 UJ	9.9 U	11 UJ	33 UJ
o,o',o''-Triethylphosphorothioate	24 U	33 UJ	25 UJ	22 UJ	32 UJ	23 UJ	18 U	21 U	59 UJ
p-Dimethylamino azobenzene	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
Pentachlorobenzene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	13 J	9 UJ	6.9 U	8 U	23 UJ
Pentachloronitrobenzene	8.9 UJ	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ	6.5 U	7.6 U	22 UJ
Pentachlorophenol	13 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9.2 U	11 U	30 UJ
Phenacetin	7.1 U	9.7 UJ	7.4 UJ	6.4 UJ	9.3 UJ	6.9 UJ	5.2 U	6 U	17 UJ
Phenanthrene	170 J	4.9 J	2.7 UJ	8.6 J	270 J	5.4 J	1.9 UJ	2.2 U	160 J
Phenol	7.3 U	9.9 UJ	7.5 UJ	6.6 UJ	9.5 UJ	7 UJ	5.3 U	6.2 U	18 UJ
Phorate	12 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9.1 U	11 U	30 UJ
p-Phenylene diamine	240 U	330 UJ	250 UJ	220 UJ	320 UJ	230 UJ	180 U	210 U	590 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Pronamide	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 U	12 U	33 UJ
Pyrene	290 J	30 J	4 J	22 J	1200 J	17 J	1.9 U	2.2 U	690 J
Pyridine	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 U	40 UJ
Safrole, Total	13 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9.2 U	11 U	30 UJ
Sulfotepp	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 U	12 U	33 UJ
Thionazin	14 U	19 UJ	14 UJ	13 UJ	18 UJ	13 UJ	10 U	12 U	34 UJ
Metals (mg/kg)									
Antimony	0.24 UJ	0.3 UJ	0.18 UJ	0.15 UJ	2 J	0.23 UJ	0.21 U	0.094 U	0.83 UJ
Arsenic	2.1	3 J	4.6	1.6	5.4	2.1	4.6	1.6	3.9 J
Barium	29	38 J	21	18	800	42	18	17	61 J
Beryllium	0.098 J	0.12 J	0.066 J	0.099 J	0.35	0.16	0.07 J	0.19	0.17 J
Cadmium	1.3 J	3.5 J	0.68 J	0.61 J	36 J	0.87 J	0.65 J	0.039 UJ	18 J
Chromium	58 J	42 J	33 J	15 J	89 J	24 J	21	24	38 J
Cobalt	14	13 J	9.5	12	17	9.6	6	5.7	12 J
Copper	50	47 J	28	36	130	73	16	82	130 J
Lead	59 J	41 J	20	7.7	520	15	8.9	2.8 J	250 J
Mercury	0.026 J	0.022 J	0.011 J	0.16	0.12	0.13	0.0099 J	0.057	0.077 J
Nickel	17	13 J	8.7	4	34	6.1	7.1	5.9	14 J
Selenium	0.34 J	0.36 J	0.18 U	1.8	0.72 J	0.81	0.14 J	0.79	0.67 J
Silver	0.056 J	0.08 J	0.024 U	0.19 J	0.54	0.065 J	0.022 J	0.037 J	0.25 J
Thallium	0.17 U	0.23 UJ	0.18 U	0.15 U	0.22 U	0.16 U	0.12 U	0.15 U	0.42 UJ
Tin	5.5 U	7.6 UJ	6.1 U	5.1 U	9 J	5.2 U	4 U	5 U	14 UJ
Vanadium	140 J	140 J	110 J	170 J	100 J	230 J	58	280	92 J
Zinc	51	83 J	23	34	650	41	16	34	270 J

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SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)									
1,1,1,2-Tetrachloroethane	0.85 U	0.78 U	0.53 U	1.2 U	1.1 U	1.3 U	0.65 U	0.41 U	0.74 U
1,1,1-Trichloroethane	0.77 U	0.71 U	0.48 U	1.1 U	0.96 U	1.1 U	0.59 U	0.37 U	0.67 U
1,1,2,2-Tetrachloroethane	1.9 U	1.7 U	1.2 U	2.6 U	2.3 U	2.7 U	1.4 U	0.9 U	1.6 U
1,1,2-Trichloroethane	1.6 U	1.5 U	1 U	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
1,1-Dichloroethane	0.66 U	0.61 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
1,1-Dichloroethene	0.72 U	0.66 U	0.45 U	1 U	0.89 U	1.1 U	0.55 U	0.35 U	0.62 U
1,2,3-Trichloropropane	1.9 U	1.7 U	1.2 U	2.6 U	2.3 U	2.7 U	1.4 U	0.9 U	1.6 U
1,2-Dibromo-3-Chloropropane	3.7 U	3.4 UJ	2.3 UJ	5.3 U	4.6 U	5.5 U	2.9 U	1.8 U	3.2 U
1,2-Dichloroethane	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
1,2-Dichloropropane	1.5 U	1.3 U	0.91 U	2.1 U	1.8 U	2.2 U	1.1 U	0.71 U	1.3 U
2-Butanone (MEK)	3.6 U	3.3 U	3.7 U	5.1 U	4.5 U	5.3 U	2.8 U	22 U	3.1 U
2-Chloro-1,3-butadiene	0.76 U	0.69 U	0.47 U	1.1 U	0.94 U	1.1 U	0.58 U	0.37 U	0.66 U
2-Hexanone	2.8 U	2 J	1.7 U	4 U	3.5 U	4.1 U	2.1 U	1.4 U	2.4 U
3-Chloro-1-propene	2 U	1.8 UJ	1.2 UJ	2.8 UJ	2.5 U	2.9 UJ	1.5 U	0.97 U	1.7 U
4-Methyl-2-pentanone (MIBK)	3.8 U	3.5 U	2.4 U	5.5 U	4.8 U	5.7 U	3 U	1.9 U	3.3 U
Acetone	5.8 U	13 J	24 R	8.3 U	170	8.6 U	41 J	110	40 J
Acetonitrile	60 UJ	55 U	37 U	85 U	74 R	88 U	46 R	29 R	52 R
Acrolein	25 U	23 R	16 R	36 R	31 R	37 R	19 R	12 R	22 R
Acrylonitrile	31 U	28 U	19 U	43 UJ	38 U	45 UJ	23 U	15 U	27 U
Benzene	1 U	0.96 U	0.66 U	1.5 U	1.3 U	1.6 U	0.81 U	0.51 U	0.91 U
Bromoform	1.5 U	1.3 U	0.91 U	2.1 U	1.8 U	2.2 U	1.1 U	0.71 U	1.3 U
Bromomethane	2.1 U	2 UJ	1.3 UJ	3 U	2.6 UJ	3.1 U	1.6 UJ	1 UJ	1.8 UJ
Carbon disulfide	0.68 U	0.62 U	0.42 U	0.96 U	0.84 U	1 U	0.52 U	0.33 U	0.59 U
Carbon tetrachloride	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Chlorobenzene	0.97 U	0.89 U	0.61 U	1.4 U	1.2 U	1.4 U	0.75 U	0.47 U	0.84 U
Chlorodibromomethane	0.66 U	0.61 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
Chloroethane	1.6 U	1.5 U	1 U	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
Chloroform	0.66 U	0.61 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg) (Cont)									
Chloromethane	0.94 U	0.87 U	0.59 U	1.3 U	1.2 U	1.4 U	0.72 U	0.46 U	0.82 U
cis-1,3-Dichloropropene	1.2 U	1.1 U	0.72 U	1.6 U	1.4 U	1.7 U	0.89 U	0.56 U	1 U
Dibromomethane	1.6 U	1.5 U	1 U	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
Dichlorobromomethane	1.1 U	1 U	0.69 U	1.6 U	1.4 U	1.6 U	0.85 U	0.54 U	0.96 U
Dichlorodifluoromethane	1.2 U	1.1 U	0.74 U	1.7 U	1.5 U	1.7 U	0.91 U	0.58 U	1 U
Ethyl methacrylate	2.9 U	2.7 U	1.8 U	4.2 U	3.6 UJ	4.3 U	2.2 UJ	1.4 UJ	2.5 UJ
Ethylbenzene	1 U	0.91 U	0.62 U	1.4 U	1.2 U	1.5 U	0.77 U	0.48 U	0.87 U
Ethylene Dibromide	2 U	1.8 U	1.2 U	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Iodomethane	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Isobutyl alcohol	92 R	84 R	57 R	130 R	110 R	140 R	70 R	45 R	80 R
Methacrylonitrile	32 U	29 UJ	20 UJ	45 U	40 UJ	47 U	25 UJ	16 UJ	28 UJ
Methyl methacrylate	4.9 U	4.5 UJ	3.1 UJ	7 U	6.1 UJ	7.3 U	3.8 UJ	2.4 UJ	4.3 UJ
Methylene Chloride	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Pentachloroethane	2.9 UJ	2.7 U	1.8 U	4.2 UJ	3.6 U	4.3 UJ	2.2 U	1.4 U	2.5 U
Propionitrile	28 U	26 U	17 U	40 U	35 R	41 U	21 R	14 R	24 R
Styrene	0.88 U	0.8 U	0.55 U	1.2 U	1.1 U	1.3 U	0.67 U	0.43 U	0.76 U
Tetrachloroethene	0.97 U	0.89 U	0.61 U	1.4 U	1.2 U	1.4 U	0.75 U	0.47 U	0.84 U
Toluene	1 U	0.96 U	0.66 U	1.5 U	1.3 U	1.6 U	0.81 U	0.51 U	0.91 U
trans-1,2-Dichloroethene	1.3 U	1.2 U	0.8 U	1.8 U	1.6 U	1.9 U	0.99 U	0.63 U	1.1 U
trans-1,3-Dichloropropene	1.2 U	1.1 U	0.72 U	1.6 U	1.4 U	1.7 U	0.89 U	0.56 U	1 U
trans-1,4-Dichloro-2-butene	4.1 U	3.8 UJ	2.6 UJ	5.9 U	59 J	6.1 U	3.2 UJ	2 UJ	3.6 UJ
Trichloroethene	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Trichlorofluoromethane	2 U	1.8 U	1.2 U	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Vinyl acetate	2 U	1.8 UJ	1.2 UJ	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Vinyl chloride	0.77 U	0.71 U	0.48 U	1.1 U	0.96 U	1.1 U	0.59 U	0.37 U	0.67 U
Xylenes, Total	12 J	2.8 U	1.9 U	4.9 J	3.8 U	4.5 U	2.3 U	1.5 U	2.7 U

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg)									
1,1'-Biphenyl	9.8 U	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
1,2,4,5-Tetrachlorobenzene	8.3 U	29 J	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
1,2,4-Trichlorobenzene	9.8 U	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
1,2-Dichlorobenzene	9.2 U	8.3 U	8.3 U	8.7 U	11 U	10 U	8.1 U	9.9 UJ	9.4 U
1,3,5-Trinitrobenzene	22 U	20 U	20 U	21 U	26 U	25 U	20 U	24 UJ	23 U
1,3-Dichlorobenzene	7.9 U	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
1,3-Dinitrobenzene	5.2 U	4.6 U	4.6 U	4.9 U	5.9 U	5.7 U	4.5 U	5.5 UJ	5.2 U
1,4-Dichlorobenzene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
1,4-Dioxane	11 U	9.5 U	9.5 U	10 U	12 U	12 U	9.3 U	11 UJ	11 U
1,4-Naphthoquinone	5.2 UJ	4.6 U	4.6 U	4.9 UJ	5.9 UJ	5.7 UJ	4.5 UJ	5.5 UJ	5.2 UJ
2,2'-oxybis[1-chloropropane]	8.3 U	7.4 U	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
2,3,4,6-Tetrachlorophenol	5.5 U	5 U	5 U	5.2 U	6.4 U	6.1 UJ	4.9 UJ	5.9 UJ	5.6 UJ
2,4,5-Trichlorophenol	9 U	8 U	8.1 U	8.5 U	10 U	9.9 UJ	7.9 UJ	9.6 UJ	9.1 UJ
2,4,6-Trichlorophenol	10 U	9.3 U	9.4 U	9.8 U	12 U	11 UJ	9.2 UJ	11 UJ	11 UJ
2,4-Dichlorophenol	11 U	9.6 U	9.6 U	10 U	12 U	12 UJ	9.4 UJ	11 UJ	11 UJ
2,4-Dimethylphenol	22 U	20 U	20 U	21 U	26 U	25 UJ	20 UJ	24 UJ	23 UJ
2,4-Dinitrophenol	110 UJ	98 U	99 UJ	100 UJ	130 UJ	120 UJ	96 UJ	120 UJ	110 UJ
2,4-Dinitrotoluene	7.8 U	7 U	7 U	7.4 U	9 U	8.5 U	6.8 U	8.4 UJ	7.9 U
2,6-Dichlorophenol	8.5 U	7.6 U	7.6 U	8 U	9.7 U	9.3 UJ	7.4 UJ	9.1 UJ	8.6 UJ
2,6-Dinitrotoluene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
2-Acetylaminofluorene	6.7 U	6 U	6.1 U	6.4 U	7.8 U	7.4 U	5.9 U	7.2 UJ	6.9 U
2-Chloronaphthalene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
2-Chlorophenol	8.7 U	7.8 U	7.8 U	8.2 U	10 U	9.6 UJ	7.7 UJ	9.3 UJ	8.9 U
2-Methylnaphthalene	2.2 U	2.3 J	2 U	2.1 U	2.6 U	2.5 U	2 U	2.4 UJ	2.3 U
2-Methylphenol	11 U	9.6 U	9.6 U	10 U	12 U	12 UJ	9.4 UJ	11 UJ	11 UJ
2-Naphthylamine	26 U	24 UJ	24 UJ	25 U	30 U	29 U	23 U	28 UJ	27 U
2-Nitroaniline	8.6 U	7.7 U	7.7 U	8.1 U	9.9 U	9.4 U	7.5 U	9.2 UJ	8.7 U
2-Nitrophenol	9.6 U	8.6 U	8.7 U	9.1 U	11 U	11 UJ	8.5 UJ	10 UJ	9.8 UJ

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
2-Picoline	16 U	14 U	14 U	15 U	18 U	17 U	14 U	17 UJ	16 U
2-Toluidine	12 U	11 U	11 U	12 U	14 U	13 U	11 U	13 UJ	12 U
3 & 4 Methylphenol	9.6 U	8.6 U	8.7 U	9.1 U	11 U	11 UJ	8.5 UJ	10 UJ	9.8 UJ
3,3'-Dichlorobenzidine	12 UJ	11 U	11 U	11 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
3,3'-Dimethylbenzidine	240 U	210 UJ	210 UJ	220 U	270 U	260 U	210 U	250 UJ	240 U
3-Methylcholanthrene	8.1 U	7.2 U	7.2 U	7.6 U	9.3 U	8.8 U	7.1 U	8.6 UJ	8.2 U
3-Nitroaniline	5.9 U	5.3 U	5.3 U	5.6 U	6.8 U	6.5 U	5.2 U	6.4 UJ	6 U
4,6-Dinitro-2-methylphenol	7.7 UJ	6.9 UJ	6.9 UJ	7.2 UJ	8.8 UJ	8.4 UJ	6.7 UJ	8.2 UJ	7.8 UJ
4-Aminobiphenyl	17 U	15 U	15 U	16 U	20 U	19 U	15 U	18 UJ	17 U
4-Bromophenyl phenyl ether	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
4-Chloro-3-methylphenol	9.9 U	8.9 U	8.9 U	9.4 U	11 U	11 UJ	8.7 UJ	11 UJ	10 UJ
4-Chloroaniline	7.9 U	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
4-Chlorophenyl phenyl ether	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
4-Nitroaniline	10 U	9.1 U	9.2 U	9.6 U	12 U	11 U	8.9 U	11 UJ	10 U
4-Nitrophenol	44 U	39 U	39 U	41 U	50 U	48 UJ	38 UJ	47 UJ	44 UJ
4-Nitroquinoline-1-oxide	15 R	13 R	13 R	14 R	17 R	16 R	13 R	16 R	15 R
7,12-Dimethylbenz(a)anthracene	12 UJ	11 U	11 U	12 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
Acenaphthene	0.75 U	0.67 U	0.68 U	0.71 U	0.87 U	3 J	0.66 U	0.81 UJ	0.79 J
Acenaphthylene	2.2 U	2 U	2 U	2.1 U	2.6 U	2.5 U	2 U	2.4 UJ	2.3 U
Acetophenone	11 U	10 U	10 U	11 U	13 U	12 U	10 U	12 UJ	12 U
alpha,alpha-Dimethyl phenethylamine	78 U	70 U	70 U	74 U	90 U	85 U	68 U	84 UJ	79 U
Aniline	8.3 U	7.4 U	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
Anthracene	2.2 U	3.8 J	2 U	2.1 U	2.6 U	16	2 U	2.4 UJ	7.3 J
Aramite, Total	15 UJ	13 UJ	13 UJ	14 UJ	17 UJ	16 UJ	13 UJ	16 UJ	15 UJ
Benzo[a]anthracene	2.2 U	14 J	2 U	2.1 U	2.6 U	90	2 U	11 J	140 J
Benzo[a]pyrene	4.5 J	51 J	0.78 U	28	40	100	0.77 UJ	28 J	280 J
Benzo[b]fluoranthene	7.8 J	91 J	0.9 U	50	60	230	0.88 UJ	73 J	570 J
Benzo[g,h,i]perylene	2.2 UJ	190	2 U	39	39	99	2 UJ	76 J	290 J

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Benzo[k]fluoranthene	1.3 UJ	140	1.2 U	1.2 U	1.5 U	1.4 U	1.2 UJ	1.4 UJ	1.3 UJ
Benzyl alcohol	11 U	9.5 U	9.5 U	10 U	12 U	12 UJ	9.3 UJ	11 UJ	11 UJ
Bis(2-chloroethoxy)methane	9 U	8 U	8.1 U	8.5 U	10 U	9.9 U	7.9 U	9.6 UJ	9.1 U
Bis(2-chloroethyl)ether	7.5 U	6.7 U	6.8 U	7.1 U	8.7 U	8.3 U	6.6 U	8.1 UJ	7.7 U
Bis(2-ethylhexyl) phthalate	18 U	760 J	28 U	47 U	80 U	52 U	27 U	57 UJ	110 J
Butyl benzyl phthalate	9.5 U	180 J	8.6 U	110	11 U	21 J	8.3 U	16 J	51
Chrysene	6.1 J	66	0.72 U	55	38	180	0.71 U	26 J	290 J
Diallate	13 U	11 U	11 U	12 U	15 U	14 U	11 U	14 UJ	13 U
Dibenz(a,h)anthracene	0.78 UJ	28 J	0.7 U	9.9	9 J	39	0.68 U	8.6 J	75 J
Dibenzofuran	5.5 U	5 U	5 U	5.2 U	6.4 U	6.1 U	4.9 U	5.9 UJ	5.6 U
Diethyl phthalate	15 U	13 U	13 U	14 U	17 U	16 U	13 U	16 UJ	15 U
Dimethoate	4.4 U	3.9 U	3.9 U	4.1 U	5 U	4.8 U	3.8 U	4.7 UJ	4.4 U
Dimethyl phthalate	8.5 U	7.6 U	7.6 U	8 U	9.7 U	9.3 U	7.4 U	9.1 UJ	8.6 U
Di-n-butyl phthalate	33 U	30 U	30 U	31 U	38 U	36 U	29 U	35 UJ	34 U
Di-n-octyl phthalate	4.4 UJ	26 J	3.9 U	4.1 U	5 U	4.8 U	3.8 UJ	4.7 UJ	4.4 UJ
Dinoseb	22 U	20 U	20 U	21 U	26 U	25 U	20 U	24 UJ	23 U
Disulfoton	7.8 U	7 U	7 UJ	7.4 U	9 U	8.5 U	6.8 U	8.4 UJ	7.9 U
Ethyl methanesulfonate	15 U	13 U	13 U	14 U	17 U	16 U	13 U	16 UJ	15 U
Ethyl Parathion	10 U	9.1 U	9.2 U	9.6 U	12 U	11 U	8.9 U	11 UJ	10 U
Famphur	4.8 U	4.3 U	4.3 U	4.5 U	5.5 U	5.2 U	4.2 U	5.1 UJ	4.8 U
Fluoranthene	3.1 J	27	2 U	14	24	340	2 U	18 J	160
Fluorene	1 U	0.91 U	0.92 U	0.96 U	1.2 U	4.3 J	0.89 U	1.1 UJ	1 U
Hexachlorobenzene	9 U	8 U	8.1 U	8.5 U	10 U	9.9 U	7.9 U	9.6 UJ	9.1 U
Hexachlorobutadiene	12 U	11 U	11 U	11 U	14 U	13 U	11 U	13 UJ	12 U
Hexachlorocyclopentadiene	18 U	17 U	17 U	17 U	21 U	20 U	16 U	20 UJ	19 U
Hexachloroethane	9.8 U	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
Hexachlorophene	1100 R	980 R	990 R	1000 R	1300 R	1200 R	960 R	1200 R	1100 R
Hexachloropropene	9.5 UJ	8.5 UJ	8.6 UJ	9 UJ	11 UJ	10 UJ	8.3 UJ	10 UJ	9.7 UJ

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CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Indeno[1,2,3-cd]pyrene	1.6 UJ	94 J	1.4 UJ	17	21	52	1.4 UJ	23 J	190 J
Isophorone	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
Isosafrole	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
Methapyrilene	12 UJ	11 UJ	11 UJ	12 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
Methyl methanesulfonate	12 U	11 U	11 U	12 U	14 U	13 U	11 U	13 UJ	12 U
Methyl parathion	4.4 U	3.9 U	3.9 U	4.1 U	5 U	4.8 U	3.8 U	4.7 UJ	4.4 U
Naphthalene	0.79 U	1.1 J	0.71 U	0.75 U	0.91 U	0.87 U	0.7 U	0.85 UJ	0.81 U
Nitrobenzene	9.1 U	8.2 U	8.2 U	8.6 U	10 U	10 U	8 U	9.8 UJ	9.3 U
N-Nitro-o-toluidine	7.9 U	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
N-Nitrosodiethylamine	16 U	14 U	14 U	15 U	18 U	17 U	14 U	17 UJ	16 U
N-Nitrosodimethylamine	13 U	12 U	12 U	12 U	15 U	14 U	11 U	14 UJ	13 U
N-Nitrosodi-n-butylamine	12 UJ	11 UJ	11 UJ	11 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
N-Nitrosodi-n-propylamine	8.6 U	7.7 U	7.7 U	8.1 U	9.9 U	9.4 U	7.5 U	9.2 UJ	8.7 U
N-Nitrosodiphenylamine	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
N-Nitrosomethylethylamine	7.5 U	6.7 U	6.8 U	7.1 U	8.7 U	8.3 U	6.6 U	8.1 UJ	7.7 U
N-Nitrosomorpholine	8.7 UJ	7.8 UJ	7.8 UJ	8.2 UJ	10 UJ	9.6 UJ	7.7 UJ	9.3 UJ	8.9 UJ
N-Nitrosopiperidine	11 UJ	10 UJ	10 UJ	11 UJ	13 UJ	12 UJ	9.9 UJ	12 UJ	11 UJ
N-Nitrosopyrrolidine	12 U	11 UJ	11 UJ	11 U	14 U	13 U	10 U	13 UJ	12 U
o,o',o''-Triethylphosphorothioate	21 U	19 U	19 U	20 U	24 U	23 U	19 U	23 UJ	22 U
p-Dimethylamino azobenzene	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
Pentachlorobenzene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
Pentachloronitrobenzene	7.8 UJ	7 U	7 U	7.4 UJ	9 UJ	8.5 UJ	6.8 UJ	8.4 UJ	7.9 UJ
Pentachlorophenol	11 U	9.8 U	9.9 U	10 U	13 U	12 UJ	9.6 UJ	12 UJ	11 UJ
Phenacetin	6.2 U	5.6 U	5.6 U	5.9 U	7.1 U	6.8 U	5.5 U	6.7 UJ	6.3 U
Phenanthrene	2.2 U	20	2 U	3.8 J	6.1 J	110	2 U	4.2 J	21
Phenol	6.3 U	5.7 U	5.7 U	6 U	7.3 U	7 U	5.6 UJ	6.8 UJ	6.5 UJ
Phorate	11 U	9.7 U	9.7 U	10 U	12 U	12 U	9.5 U	12 UJ	11 U
p-Phenylene diamine	210 U	190 U	190 U	200 U	240 U	230 U	190 U	230 UJ	220 U

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Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Pronamide	12 U	11 U	11 U	11 U	14 U	13 U	10 U	13 UJ	12 U
Pyrene	4.2 J	41	2 U	24	30	320	2 U	23 J	200 J
Pyridine	15 U	13 U	13 U	14 U	17 U	16 U	13 U	16 UJ	15 U
Safrole, Total	11 U	9.8 U	9.9 U	10 U	13 U	12 U	9.6 U	12 UJ	11 U
Sulfotepp	12 U	11 U	11 U	11 U	14 U	13 U	10 U	13 UJ	12 U
Thionazin	12 U	11 U	11 U	11 U	14 U	13 U	11 U	13 UJ	12 U
Metals (mg/kg)									
Antimony	0.18 UJ	0.48 U	0.18 U	0.19 UJ	0.38 UJ	0.58 UJ	0.23 UJ	0.31 UJ	0.26 UJ
Arsenic	4	4.9 J	4.8	3.7	3.2	3.3	4	4.5	4.2
Barium	34	21	14	26	76	30	19	22	22
Beryllium	0.099 J	0.045 J	0.05 J	0.065 J	0.18	0.088 J	0.037 J	0.079 J	0.042 J
Cadmium	0.41 J	4.4 J	0.051 J	0.96 J	4.1 J	1.4 J	0.082 J	2.2 J	1.3 J
Chromium	25 J	34	39	23 J	26 J	17 J	34 J	35 J	31 J
Cobalt	10	6.5	14	8.4	13	6.4	8.2	9.8	7.5
Copper	42	23	32	33	68	36	16	42	23
Lead	6.8	220 J	0.71 U	36	73	34	0.93 J	48	12
Mercury	0.044	0.017 J	0.0098 J	0.023 J	0.039	0.036	0.0066 J	0.032	0.021 J
Nickel	8	9.3	12	7.8	10	5	10	12	9
Selenium	0.35 J	0.22 J	0.14 J	0.25 J	0.3 J	0.34 J	0.13 U	0.25 J	0.18 J
Silver	0.037 J	0.084 U	0.018 U	0.046 J	0.25 J	0.1 J	0.021 J	0.11 J	0.027 J
Thallium	0.15 U	0.13 U	0.13 U	0.14 U	0.17 U	0.16 U	0.13 U	0.16 U	0.16 U
Tin	4.9 U	4.3 U	4.4 U	4.5 U	5.6 U	5.3 U	4.4 U	5.2 U	5.2 U
Vanadium	110 J	53	87	78 J	99 J	46 J	96 J	110 J	86 J
Zinc	27	67	11	30	130	140	9	65	20

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)							
1,1,1,2-Tetrachloroethane	0.46 U	0.35 U	0.79 U	0.68 U	0.39 U	0.44 U	0.66 U
1,1,1-Trichloroethane	0.42 U	0.31 U	0.72 U	0.61 U	0.36 U	0.4 U	0.59 U
1,1,2,2-Tetrachloroethane	1 U	0.76 U	1.7 U	1.5 U	0.86 U	0.96 U	1.4 U
1,1,2-Trichloroethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U
1,1-Dichloroethane	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U
1,1-Dichloroethene	0.39 U	0.29 U	0.67 U	0.57 U	0.33 U	0.37 U	0.55 U
1,2,3-Trichloropropane	1 U	0.76 U	1.7 U	1.5 U	0.86 U	0.96 U	1.4 U
1,2-Dibromo-3-Chloropropane	2 U	1.5 U	3.5 U	3 U	1.7 U	1.9 U	2.9 U
1,2-Dichloroethane	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
1,2-Dichloropropane	0.8 U	0.6 U	1.4 U	1.2 U	0.67 U	0.76 U	1.1 U
2-Butanone (MEK)	5.5 U	1.5 U	3.4 U	19 U	12 U	6.2 U	19 U
2-Chloro-1,3-butadiene	0.41 U	0.31 U	0.71 U	0.6 U	0.35 U	0.39 U	0.58 U
2-Hexanone	1.5 U	1.1 U	2.6 U	2.2 U	1.3 U	1.4 U	2.1 U
3-Chloro-1-propene	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
4-Methyl-2-pentanone (MIBK)	2.1 U	1.6 U	3.6 U	7.7 J	1.8 U	2 U	3 U
Acetone	41 J	42	130	150	75	50	220
Acetonitrile	33 UJ	24 R	56 R	47 R	28 R	31 R	46 UJ
Acrolein	14 U	10 R	24 R	20 R	12 R	13 R	19 U
Acrylonitrile	17 U	12 U	29 U	24 U	14 UJ	16 UJ	24 U
Benzene	0.57 U	0.43 U	0.98 U	0.99 J	0.48 U	0.54 U	0.81 U
Bromoform	0.8 U	0.6 U	1.4 U	1.2 U	0.67 U	0.76 U	1.1 U
Bromomethane	1.2 U	0.87 UJ	2 UJ	1.7 UJ	0.98 UJ	1.1 UJ	1.6 U
Carbon disulfide	0.37 U	0.28 U	0.63 U	0.54 U	0.31 U	0.35 U	0.52 U
Carbon tetrachloride	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Chlorobenzene	0.53 U	0.4 U	0.91 U	0.77 U	0.45 U	0.5 U	0.75 U
Chlorodibromomethane	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U
Chloroethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U
Chloroform	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg) (Cont)							
Chloromethane	0.51 U	0.39 U	0.88 U	0.75 U	0.43 U	0.49 U	0.73 U
cis-1,3-Dichloropropene	0.63 U	0.47 U	1.1 U	0.92 U	0.53 U	0.6 U	0.89 U
Dibromomethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U
Dichlorobromomethane	0.6 U	0.45 U	1 U	0.88 U	0.51 U	0.57 U	0.85 U
Dichlorodifluoromethane	0.65 U	0.48 U	1.1 U	0.94 U	0.55 U	0.61 U	0.91 U
Ethyl methacrylate	1.6 U	1.2 UJ	2.7 UJ	2.3 UJ	1.3 UJ	1.5 UJ	2.3 U
Ethylbenzene	0.54 U	0.41 U	0.93 U	0.79 U	0.46 U	0.51 U	0.77 U
Ethylene Dibromide	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
Iodomethane	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Isobutyl alcohol	56 R	37 R	86 R	73 R	42 R	47 R	71 R
Methacrylonitrile	17 U	13 UJ	30 UJ	25 UJ	15 U	16 U	25 U
Methyl methacrylate	2.7 U	2 UJ	4.6 UJ	3.9 UJ	2.3 UJ	2.5 UJ	3.8 U
Methylene Chloride	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Pentachloroethane	1.6 UJ	1.2 U	2.7 U	2.3 U	1.3 U	1.5 U	2.3 UJ
Propionitrile	15 U	11 R	26 R	22 R	13 R	14 R	21 U
Styrene	0.48 U	0.36 U	0.82 U	0.7 U	0.4 U	0.45 U	0.68 U
Tetrachloroethene	0.53 U	0.4 U	0.91 U	0.77 U	0.45 U	0.5 U	0.75 U
Toluene	0.57 U	0.53 J	0.98 U	0.83 U	0.48 U	0.54 U	0.81 U
trans-1,2-Dichloroethene	0.7 U	0.53 U	1.2 U	1 U	0.59 U	0.67 U	0.99 U
trans-1,3-Dichloropropene	0.63 U	0.47 U	1.1 U	0.92 U	0.53 U	0.6 U	0.89 U
trans-1,4-Dichloro-2-butene	2.2 U	1.7 UJ	3.8 UJ	3.3 UJ	1.9 UJ	2.1 UJ	3.2 U
Trichloroethene	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U
Trichlorofluoromethane	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
Vinyl acetate	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U
Vinyl chloride	0.42 U	0.31 U	0.72 U	0.61 U	0.36 U	0.4 U	0.59 U
Xylenes, Total	1.7 U	1.2 U	2.9 U	2.4 U	1.4 U	1.6 U	2.4 U

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg)							
1,1'-Biphenyl	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
1,2,4,5-Tetrachlorobenzene	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
1,2,4-Trichlorobenzene	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
1,2-Dichlorobenzene	8.1 U	9.8 UJ	8.9 UJ	8.2 UJ	9.3 UJ	8.3 UJ	8.9 UJ
1,3,5-Trinitrobenzene	20 U	24 UJ	22 UJ	20 UJ	23 UJ	20 UJ	22 UJ
1,3-Dichlorobenzene	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ
1,3-Dinitrobenzene	4.5 U	5.4 UJ	5 UJ	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ
1,4-Dichlorobenzene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
1,4-Dioxane	9.2 U	11 UJ	10 UJ	9.4 UJ	11 UJ	9.4 UJ	10 UJ
1,4-Naphthoquinone	4.5 UJ	5.4 UJ	5 UJ	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ
2,2'-oxybis[1-chloropropane]	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
2,3,4,6-Tetrachlorophenol	4.8 U	5.9 UJ	5.4 UJ	4.9 U	5.6 UJ	5 UJ	5.3 UJ
2,4,5-Trichlorophenol	7.8 U	9.5 UJ	8.7 UJ	8 U	9.1 UJ	8 UJ	8.6 UJ
2,4,6-Trichlorophenol	9.1 U	11 UJ	10 UJ	9.3 U	11 UJ	9.3 UJ	10 UJ
2,4-Dichlorophenol	9.3 U	11 UJ	10 UJ	9.5 U	11 UJ	9.5 UJ	10 UJ
2,4-Dimethylphenol	20 U	24 UJ	22 UJ	20 U	23 UJ	20 UJ	22 UJ
2,4-Dinitrophenol	96 UJ	120 UJ	110 UJ	97 U	110 UJ	98 UJ	110 UJ
2,4-Dinitrotoluene	6.8 U	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
2,6-Dichlorophenol	7.4 U	8.9 UJ	8.2 UJ	7.5 U	8.5 UJ	7.5 UJ	8.1 UJ
2,6-Dinitrotoluene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
2-Acetylaminofluorene	5.9 U	7.1 UJ	6.5 UJ	6 UJ	6.8 UJ	6 UJ	6.5 UJ
2-Chloronaphthalene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
2-Chlorophenol	7.6 U	9.2 UJ	8.4 UJ	7.7 U	8.8 UJ	7.8 UJ	8.4 UJ
2-Methylnaphthalene	2 U	2.4 UJ	2.2 UJ	2 UJ	2.3 UJ	2 UJ	2.2 UJ
2-Methylphenol	9.3 U	11 UJ	10 UJ	9.5 U	11 UJ	9.5 UJ	10 UJ
2-Naphthylamine	23 U	28 UJ	25 UJ	23 UJ	27 UJ	24 UJ	25 UJ
2-Nitroaniline	7.5 U	9.1 UJ	8.3 UJ	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ
2-Nitrophenol	8.4 U	10 UJ	9.3 UJ	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)							
2-Picoline	14 U	17 UJ	15 UJ	14 UJ	16 UJ	14 UJ	15 UJ
2-Toluidine	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
3 & 4 Methylphenol	8.4 U	10 UJ	9.3 UJ	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ
3,3'-Dichlorobenzidine	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
3,3'-Dimethylbenzidine	210 U	250 UJ	230 UJ	210 UJ	240 UJ	210 UJ	230 UJ
3-Methylcholanthrene	7 U	8.5 UJ	7.8 UJ	7.2 UJ	8.1 UJ	7.2 UJ	7.8 UJ
3-Nitroaniline	5.2 U	6.3 UJ	5.7 UJ	5.3 UJ	6 UJ	5.3 UJ	5.7 UJ
4,6-Dinitro-2-methylphenol	6.7 UJ	8.1 UJ	7.4 UJ	6.8 U	7.7 UJ	6.8 UJ	7.4 UJ
4-Aminobiphenyl	15 U	18 UJ	17 UJ	15 UJ	17 UJ	15 UJ	17 UJ
4-Bromophenyl phenyl ether	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
4-Chloro-3-methylphenol	8.6 U	10 UJ	9.6 UJ	8.8 U	10 UJ	8.8 UJ	9.5 UJ
4-Chloroaniline	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ
4-Chlorophenyl phenyl ether	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
4-Nitroaniline	8.9 U	11 UJ	9.8 UJ	9 UJ	10 UJ	9.1 UJ	9.8 UJ
4-Nitrophenol	38 U	46 UJ	42 UJ	39 U	44 UJ	39 UJ	42 UJ
4-Nitroquinoline-1-oxide	13 R	15 R	14 R	13 R	15 R	13 R	14 R
7,12-Dimethylbenz(a)anthracene	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Acenaphthene	0.66 U	0.8 UJ	0.73 UJ	0.67 UJ	1.8 J	0.67 UJ	0.72 UJ
Acenaphthylene	2 U	2.4 UJ	2.2 UJ	2 UJ	2.3 UJ	2 UJ	2.2 UJ
Acetophenone	9.9 U	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	11 UJ
alpha,alpha-Dimethyl phenethylamine	68 U	82 UJ	75 UJ	69 UJ	79 UJ	70 UJ	75 UJ
Aniline	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ
Anthracene	2 U	2.4 UJ	2.2 UJ	2 UJ	6 J	2 UJ	2.2 UJ
Aramite, Total	13 UJ	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Benzo[a]anthracene	2 UJ	2.4 UJ	4.8 J	8 J	140 J	8 J	2.2 UJ
Benzo[a]pyrene	2.8 J	3.3 UJ	18 J	17 J	160 J	13 J	1.5 UJ
Benzo[b]fluoranthene	5.6 J	5.5 UJ	29 J	36 J	380 J	29 J	1.6 UJ
Benzo[g,h,i]perylene	7.8 J	14 UJ	35	26 J	220 J	26 J	3.2 UJ

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)							
Benzo[k]fluoranthene	1.2 UJ	2.9 J	2.8 UJ	1.2 UJ	1.3 UJ	1.2 UJ	1.8 UJ
Benzyl alcohol	9.2 U	11 UJ	10 UJ	9.4 U	11 UJ	9.4 UJ	10 UJ
Bis(2-chloroethoxy)methane	7.8 U	9.5 UJ	8.7 UJ	8 UJ	9.1 UJ	8 UJ	8.6 UJ
Bis(2-chloroethyl)ether	6.6 U	8 UJ	7.3 UJ	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ
Bis(2-ethylhexyl) phthalate	45 UJ	24 UJ	27 UJ	34 UJ	48 UJ	36 UJ	21 UJ
Butyl benzyl phthalate	8.3 U	10 UJ	9.2 UJ	18 J	34 J	72 J	9.1 UJ
Chrysene	3.9 J	4.2 UJ	15	21 J	210 J	12 J	0.78 UJ
Diallate	11 U	13 UJ	12 UJ	11 UJ	13 UJ	11 UJ	12 UJ
Dibenz(a,h)anthracene	0.68 UJ	0.82 UJ	3.4 J	4.5 UJ	33 J	3 J	1.8 UJ
Dibenzofuran	4.8 U	5.9 UJ	5.4 UJ	4.9 UJ	5.6 UJ	5 UJ	5.3 UJ
Diethyl phthalate	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Dimethoate	3.8 U	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ
Dimethyl phthalate	7.4 U	8.9 UJ	8.2 UJ	7.5 UJ	8.5 UJ	7.5 UJ	8.1 UJ
Di-n-butyl phthalate	29 U	35 UJ	32 UJ	29 UJ	33 UJ	29 UJ	32 UJ
Di-n-octyl phthalate	3.8 UJ	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ
Dinoseb	20 U	24 UJ	22 UJ	20 UJ	23 UJ	20 UJ	22 UJ
Disulfoton	6.8 U	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
Ethyl methanesulfonate	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Ethyl Parathion	8.9 U	11 UJ	9.8 UJ	9 UJ	10 UJ	9.1 UJ	9.8 UJ
Famphur	4.1 U	5 UJ	4.6 UJ	4.2 UJ	4.8 UJ	4.2 UJ	4.6 UJ
Fluoranthene	2.1 J	4.3 UJ	14 J	21 J	280 J	17 J	2.2 UJ
Fluorene	0.89 U	1.1 UJ	0.98 UJ	0.92 UJ	1.3 J	0.91 UJ	0.98 UJ
Hexachlorobenzene	7.8 U	9.5 UJ	8.7 UJ	8 UJ	9.1 UJ	8 UJ	8.6 UJ
Hexachlorobutadiene	10 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Hexachlorocyclopentadiene	16 U	20 UJ	18 UJ	16 UJ	19 UJ	17 UJ	18 UJ
Hexachloroethane	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ
Hexachlorophene	960 R	1200 UJ	1100 UJ	970 UJ	1100 UJ	980 UJ	1100 UJ
Hexachloropropene	8.3 UJ	10 UJ	9.2 UJ	8.5 UJ	9.6 UJ	8.5 UJ	9.1 UJ

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)							
Indeno[1,2,3-cd]pyrene	1.4 UJ	4.2 UJ	15 J	13 J	92 J	8.6 J	1.5 UJ
Isophorone	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
Isosafrole	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
Methapyrilene	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Methyl methanesulfonate	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Methyl parathion	3.8 U	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ
Naphthalene	0.69 U	0.84 UJ	0.76 UJ	0.7 UJ	0.8 UJ	0.75 J	0.76 UJ
Nitrobenzene	8 U	9.6 UJ	8.8 UJ	8.1 UJ	9.2 UJ	8.1 UJ	8.8 UJ
N-Nitro-o-toluidine	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ
N-Nitrosodiethylamine	14 U	17 UJ	15 UJ	14 UJ	16 UJ	14 UJ	15 UJ
N-Nitrosodimethylamine	11 U	14 UJ	12 U	12 UJ	13 UJ	12 UJ	12 UJ
N-Nitrosodi-n-butylamine	10 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
N-Nitrosodi-n-propylamine	7.5 U	9.1 UJ	8.3 UJ	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ
N-Nitrosodiphenylamine	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
N-Nitrosomethylethylamine	6.6 U	8 UJ	7.3 UJ	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ
N-Nitrosomorpholine	7.6 UJ	9.2 UJ	8.4 UJ	7.7 UJ	8.8 UJ	7.8 UJ	8.4 UJ
N-Nitrosopiperidine	9.8 UJ	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	11 UJ
N-Nitrosopyrrolidine	10 U	12 UJ	11 U	10 UJ	12 UJ	10 UJ	11 UJ
o,o',o''-Triethylphosphorothioate	18 U	22 UJ	20 UJ	19 UJ	21 UJ	19 UJ	20 UJ
p-Dimethylamino azobenzene	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ
Pentachlorobenzene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ
Pentachloronitrobenzene	6.8 UJ	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ
Pentachlorophenol	9.6 U	12 UJ	11 UJ	9.7 U	11 UJ	9.8 UJ	11 UJ
Phenacetin	5.4 U	6.6 UJ	6 UJ	5.5 UJ	6.3 UJ	5.5 UJ	6 UJ
Phenanthrene	2 U	2.4 UJ	2.2 UJ	5.8 J	34 J	2.4 J	2.2 UJ
Phenol	5.5 U	6.7 UJ	6.1 UJ	5.6 UJ	6.4 UJ	5.7 UJ	6.1 UJ
Phorate	9.4 U	11 UJ	10 UJ	9.6 UJ	11 UJ	9.7 UJ	10 UJ
p-Phenylene diamine	180 U	220 UJ	200 UJ	190 UJ	210 UJ	190 UJ	200 UJ

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)							
Pronamide	10 U	13 UJ	11 U	11 UJ	12 UJ	11 UJ	11 UJ
Pyrene	2.4 J	2.8 J	10 J	20 J	300 J	16 J	2.2 UJ
Pyridine	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ
Safrole, Total	9.6 U	12 UJ	11 UJ	9.7 UJ	11 UJ	9.8 UJ	11 UJ
Sulfotepp	10 U	13 UJ	11 UJ	11 UJ	12 UJ	11 UJ	11 UJ
Thionazin	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ
Metals (mg/kg)							
Antimony	0.096 UJ	0.18 UJ	0.24 UJ	0.17 UJ	0.35 UJ	0.22 UJ	0.09 UJ
Arsenic	2.7	1.5	3.7	2.5	3.4	3.7	1.4
Barium	14	15	26	17	410	66	90
Beryllium	0.045 J	0.038 J	0.067 J	0.051 J	0.047 J	0.056 J	0.26
Cadmium	0.2 J	0.29 J	0.8 J	0.61 J	1.7 J	0.69 J	0.13 J
Chromium	44 J	85 J	23 J	60 J	26	26	19
Cobalt	9.2	17	6	12	6.9	6.7	18
Copper	24	41	46 J	32	24	20	85
Lead	2.9 J	4.3 J	7.1 J	9.6	37	17	3.8 J
Mercury	0.012 J	0.022 J	0.026	0.011 J	0.0088 J	0.0087 J	0.056
Nickel	13	25	7.1	17	8.6	8.4	8.3
Selenium	0.13 J	0.16 U	0.58	0.13 U	0.19 J	0.16 J	0.52 J
Silver	0.017 U	0.021 U	0.044 J	0.028 J	0.053 J	0.062 J	0.054 J
Thallium	0.13 U	0.16 U	0.15 U	0.13 U	0.15 U	0.14 U	0.14 U
Tin	4.2 U	5.3 U	5 U	4.5 U	4.9 U	4.6 U	4.8 U
Vanadium	82 J	140 J	120 J	140 J	62	70	210
Zinc	25	20	13	36	69	22	50

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)									
1,1,1,2-Tetrachloroethane	0.57 U	2.7 UJ	1.6 U	0.88 U	0.51 U	1.9 U	0.42 U	0.5 U	4.8 UJ
1,1,1-Trichloroethane	0.52 U	2.4 UJ	1.4 U	0.8 U	0.46 U	1.7 U	0.38 U	0.46 U	4.3 UJ
1,1,2,2-Tetrachloroethane	1.2 U	5.8 UJ	3.4 U	1.9 U	1.1 U	4.1 U	0.93 U	1.1 U	10 UJ
1,1,2-Trichloroethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U	0.79 U	0.95 U	8.9 UJ
1,1-Dichloroethane	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U	0.33 U	0.39 U	3.7 UJ
1,1-Dichloroethene	0.48 U	2.2 UJ	1.3 U	0.74 U	0.43 U	1.6 U	0.36 U	0.43 U	4 UJ
1,2,3-Trichloropropane	1.2 U	5.8 UJ	3.4 U	1.9 U	1.1 U	4.1 U	0.93 U	1.1 U	10 UJ
1,2-Dibromo-3-Chloropropane	2.5 U	12 UJ	6.9 U	3.9 U	2.2 U	8.2 U	1.9 U	2.2 U	21 UJ
1,2-Dichloroethane	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
1,2-Dichloropropane	0.98 U	4.6 UJ	2.7 U	1.5 U	0.88 U	3.2 U	0.73 U	0.87 U	8.2 UJ
2-Butanone (MEK)	20 U	11 UJ	6.6 U	3.7 U	28 U	7.9 U	1.8 U	2.1 U	20 UJ
2-Chloro-1,3-butadiene	0.51 U	2.4 UJ	1.4 U	0.78 U	0.46 U	1.7 U	0.38 UJ	0.45 UJ	4.2 UJ
2-Hexanone	1.9 UJ	8.7 UJ	5.2 U	2.9 U	1.7 U	6.1 U	1.4 U	1.7 U	16 UJ
3-Chloro-1-propene	1.3 U	6.2 UJ	3.7 UJ	2.1 UJ	1.2 UJ	4.4 UJ	0.99 R	1.2 R	11 UJ
4-Methyl-2-pentanone (MIBK)	2.6 U	12 UJ	7.1 U	4 U	2.3 U	8.5 U	1.9 U	2.3 U	22 UJ
Acetone	190	18 UJ	11 U	6.1 R	260	33 U	9.1 J	29 J	33 UJ
Acetonitrile	26 U	190 UJ	110 U	62 UJ	36 U	130 U	30 UJ	36 UJ	330 UJ
Acrolein	17 R	79 R	47 R	26 R	15 R	56 R	13 R	15 R	140 R
Acrylonitrile	20 U	95 UJ	57 UJ	32 UJ	18 U	67 UJ	15 UJ	18 UJ	170 UJ
Benzene	0.7 U	3.3 UJ	1.9 U	1.1 U	0.63 U	2.3 U	0.52 U	0.62 U	5.9 UJ
Bromoform	0.98 U	4.6 UJ	2.7 U	1.5 U	0.88 U	3.2 U	0.73 U	0.87 U	8.2 UJ
Bromomethane	1.4 UJ	6.6 UJ	3.9 U	2.2 UJ	1.3 U	4.7 U	1.1 UJ	1.3 UJ	12 UJ
Carbon disulfide	0.45 U	2.1 UJ	1.3 U	0.7 U	0.41 U	1.5 U	0.34 U	0.4 U	3.8 UJ
Carbon tetrachloride	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
Chlorobenzene	0.65 U	3 UJ	1.8 U	1 U	0.58 U	2.1 U	0.48 U	0.58 U	5.4 UJ
Chlorodibromomethane	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U	0.33 U	0.39 U	3.7 UJ
Chloroethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U	0.79 U	0.95 U	8.9 UJ
Chloroform	0.44 U	2.1 UJ	1.2 U	0.69 U	0.4 U	1.5 U	0.33 U	0.39 U	3.7 UJ

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg) (Cont)									
Chloromethane	0.63 U	2.9 UJ	1.7 U	0.98 UJ	0.57 U	2.1 U	0.47 U	0.56 U	5.3 UJ
cis-1,3-Dichloropropene	0.77 U	3.6 UJ	2.1 U	1.2 U	0.69 U	2.5 U	0.57 U	0.69 U	6.5 UJ
Dibromomethane	1.1 U	5 UJ	3 U	1.7 U	0.96 U	3.5 U	0.79 U	0.95 U	8.9 UJ
Dichlorobromomethane	0.74 U	3.4 UJ	2 U	1.1 U	0.66 U	2.4 U	0.55 U	0.65 U	6.2 UJ
Dichlorodifluoromethane	0.79 U	3.7 UJ	2.2 U	1.2 U	0.71 U	2.6 U	0.59 U	0.7 U	6.6 UJ
Ethyl methacrylate	2 UJ	9.1 UJ	5.4 U	3 U	1.8 U	6.4 U	1.5 U	1.7 U	16 UJ
Ethylbenzene	0.67 U	3.1 UJ	1.8 U	1 U	0.6 U	2.2 J	0.5 U	0.59 U	6.2 J
Ethylene Dibromide	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U	0.99 U	1.2 U	11 UJ
Iodomethane	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 UJ	2.9 U	0.66 U	0.79 U	7.4 UJ
Isobutyl alcohol	61 R	290 R	170 R	95 R	55 R	200 R	46 R	54 R	510 R
Methacrylonitrile	21 UJ	99 UJ	59 U	33 U	19 UJ	70 U	16 U	19 U	180 UJ
Methyl methacrylate	3.3 UJ	15 UJ	9.1 U	5.1 U	3 UJ	11 U	2.4 U	2.9 U	27 UJ
Methylene Chloride	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
Pentachloroethane	2 U	9.1 UJ	5.4 UJ	3 UJ	1.8 UJ	6.4 UJ	1.5 U	1.7 U	16 UJ
Propionitrile	12 U	87 UJ	52 U	29 U	17 U	61 U	14 UJ	17 UJ	160 UJ
Styrene	0.59 U	2.7 UJ	1.6 U	0.91 U	0.53 U	1.9 U	0.44 U	0.52 U	4.9 UJ
Tetrachloroethene	0.65 U	3 UJ	1.8 U	1 U	0.58 U	2.1 U	0.48 U	0.58 U	5.4 UJ
Toluene	0.7 U	3.3 J	1.9 U	1.1 U	0.63 U	2.5 J	0.52 U	0.62 U	5.9 UJ
trans-1,2-Dichloroethene	0.86 U	4 UJ	2.4 U	1.3 U	0.77 U	2.8 U	0.64 U	0.77 U	7.2 UJ
trans-1,3-Dichloropropene	0.77 U	3.6 UJ	2.1 U	1.2 U	0.69 U	2.5 U	0.57 U	0.69 U	6.5 UJ
trans-1,4-Dichloro-2-butene	2.8 UJ	13 UJ	7.6 U	4.3 U	2.5 UJ	9.1 U	2 U	2.4 U	23 UJ
Trichloroethene	0.89 U	4.1 UJ	2.5 U	1.4 U	0.8 U	2.9 U	0.66 U	0.79 U	7.4 UJ
Trichlorofluoromethane	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U	0.99 U	1.2 U	11 UJ
Vinyl acetate	1.3 U	6.2 UJ	3.7 U	2.1 U	1.2 U	4.4 U	0.99 UJ	1.2 UJ	11 UJ
Vinyl chloride	0.52 U	2.4 UJ	1.4 U	0.8 U	0.46 U	1.7 U	0.38 U	0.46 U	4.3 UJ
Xylenes, Total	2 U	9.5 UJ	6.1 J	3.2 U	1.8 U	14 J	1.5 U	1.8 U	28 J

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg)									
1,1'-Biphenyl	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.2 U	9.5 U	27 UJ
1,2,4,5-Tetrachlorobenzene	9.5 U	13 UJ	9.9 UJ	8.6 UJ	26 J	9.2 UJ	7 U	8.1 U	23 UJ
1,2,4-Trichlorobenzene	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.2 U	9.5 U	27 UJ
1,2-Dichlorobenzene	11 U	14 UJ	11 UJ	9.6 UJ	14 UJ	10 UJ	7.8 U	9 U	26 UJ
1,3,5-Trinitrobenzene	26 U	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ	19 U	22 U	62 UJ
1,3-Dichlorobenzene	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ	6.6 U	7.7 U	22 UJ
1,3-Dinitrobenzene	5.9 U	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ	5.7 UJ	4.3 U	5 U	14 UJ
1,4-Dichlorobenzene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
1,4-Dioxane	12 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	8.9 U	10 U	29 UJ
1,4-Naphthoquinone	5.9 UJ	8.1 UJ	6.1 UJ	5.3 UJ	7.7 UJ	5.7 UJ	4.3 U	5 U	14 UJ
2,2'-oxybis[1-chloropropane]	9.5 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ	9.2 UJ	7 U	8.1 U	23 UJ
2,3,4,6-Tetrachlorophenol	6.4 UJ	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ	6.1 UJ	4.7 U	5.4 U	15 UJ
2,4,5-Trichlorophenol	10 UJ	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ	7.5 U	8.7 U	25 UJ
2,4,6-Trichlorophenol	12 UJ	16 UJ	12 UJ	11 UJ	16 UJ	12 UJ	8.8 U	10 U	29 UJ
2,4-Dichlorophenol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9 U	10 U	30 UJ
2,4-Dimethylphenol	26 UJ	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ	19 U	22 U	62 UJ
2,4-Dinitrophenol	130 UJ	170 UJ	130 UJ	110 UJ	160 UJ	120 UJ	92 UJ	110 UJ	300 UJ
2,4-Dinitrotoluene	8.9 U	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ	6.5 UJ	7.6 U	22 UJ
2,6-Dichlorophenol	9.7 UJ	13 UJ	10 UJ	8.8 UJ	13 UJ	9.3 UJ	7.1 U	8.2 U	23 UJ
2,6-Dinitrotoluene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
2-Acetylaminofluorene	7.7 U	11 UJ	8 UJ	7 UJ	10 UJ	7.4 UJ	5.7 U	6.5 U	19 UJ
2-Chloronaphthalene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
2-Chlorophenol	10 UJ	14 UJ	10 UJ	9 UJ	13 UJ	9.6 UJ	7.3 U	8.5 U	24 UJ
2-Methylnaphthalene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	9.2 J	2.5 UJ	1.9 U	2.2 U	6.2 UJ
2-Methylphenol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9 U	10 U	30 UJ
2-Naphthylamine	30 U	41 UJ	31 UJ	27 UJ	39 UJ	29 UJ	22 U	26 UJ	73 UJ
2-Nitroaniline	9.8 U	13 UJ	10 UJ	8.9 UJ	13 UJ	9.5 UJ	7.2 U	8.3 U	24 UJ
2-Nitrophenol	11 UJ	15 UJ	11 UJ	10 UJ	14 UJ	11 UJ	8.1 U	9.4 U	27 UJ

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
2-Picoline	18 U	25 UJ	19 UJ	16 UJ	24 UJ	18 UJ	13 U	15 U	44 UJ
2-Toluidine	14 U	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 U	12 U	34 UJ
3 & 4 Methylphenol	11 UJ	15 UJ	11 UJ	10 UJ	14 UJ	11 UJ	8.1 U	9.4 U	27 UJ
3,3'-Dichlorobenzidine	14 UJ	19 UJ	14 UJ	13 UJ	18 UJ	13 UJ	10 U	12 U	34 UJ
3,3'-Dimethylbenzidine	270 U	370 UJ	280 UJ	250 UJ	350 UJ	260 UJ	200 U	230 UJ	660 UJ
3-Methylcholanthrene	9.2 U	13 UJ	9.6 UJ	8.4 UJ	12 UJ	8.9 UJ	6.8 U	7.8 U	22 UJ
3-Nitroaniline	6.8 U	9.3 UJ	7.1 UJ	6.2 UJ	8.9 UJ	6.6 UJ	5 U	5.8 U	16 UJ
4,6-Dinitro-2-methylphenol	8.8 UJ	12 UJ	9.1 UJ	8 UJ	11 UJ	8.5 UJ	6.4 UJ	7.4 UJ	21 UJ
4-Aminobiphenyl	20 U	27 UJ	20 UJ	18 UJ	26 UJ	19 UJ	14 U	17 U	48 UJ
4-Bromophenyl phenyl ether	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
4-Chloro-3-methylphenol	11 UJ	16 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.3 U	9.6 U	27 UJ
4-Chloroaniline	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ	6.6 U	7.7 U	22 UJ
4-Chlorophenyl phenyl ether	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
4-Nitroaniline	12 U	16 UJ	12 UJ	11 UJ	15 UJ	11 UJ	8.5 UJ	9.9 U	28 UJ
4-Nitrophenol	50 UJ	68 UJ	52 UJ	45 UJ	65 UJ	48 UJ	37 UJ	42 U	120 UJ
4-Nitroquinoline-1-oxide	17 R	23 R	17 R	15 R	22 R	16 R	12 R	14 R	40 R
7,12-Dimethylbenz(a)anthracene	14 UJ	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 U	12 U	34 UJ
Acenaphthene	0.86 U	1.2 UJ	0.9 UJ	0.78 UJ	10 J	0.83 UJ	0.63 U	0.73 U	5.4 J
Acenaphthylene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	11 J	2.5 UJ	1.9 U	2.2 U	9.8 J
Acetophenone	13 U	18 UJ	14 UJ	12 UJ	17 UJ	13 UJ	9.5 U	11 U	31 UJ
alpha,alpha-Dimethyl phenethylamine	89 U	120 UJ	93 UJ	81 UJ	120 UJ	86 UJ	65 U	76 U	220 UJ
Aniline	9.5 U	13 UJ	9.9 UJ	8.6 UJ	12 UJ	9.2 UJ	7 U	8.1 U	23 UJ
Anthracene	2.6 U	3.5 UJ	2.7 UJ	2.3 UJ	34 J	2.5 UJ	1.9 U	2.2 U	22 J
Aramite, Total	17 UJ	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 UJ	40 UJ
Benzo[a]anthracene	73 J	10 J	2.7 UJ	8.3 J	460 J	5.5 J	1.9 U	2.2 U	200 J
Benzo[a]pyrene	69 J	22 J	1 UJ	13 J	530 J	0.96 UJ	0.73 U	0.85 U	330 J
Benzo[b]fluoranthene	160 J	50 J	1.2 UJ	20 J	1300 J	28 J	0.84 U	0.98 U	900 J
Benzo[g,h,i]perylene	57 J	38 J	2.7 UJ	30 J	1400 J	23 J	1.9 U	2.2 U	340 J

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Benzo[k]fluoranthene	1.5 U	2.1 UJ	1.6 UJ	14 J	2 UJ	1.5 UJ	1.1 U	1.3 U	3.7 UJ
Benzyl alcohol	12 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	8.9 U	10 U	29 UJ
Bis(2-chloroethoxy)methane	10 U	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ	7.5 U	8.7 U	25 UJ
Bis(2-chloroethyl)ether	7.8 U	12 UJ	9 UJ	7.8 UJ	11 UJ	8.3 UJ	6.3 U	7.3 U	21 UJ
Bis(2-ethylhexyl) phthalate	110	230 J	64 UJ	170 J	1000 J	47 UJ	14 J	9.4 J	260 J
Butyl benzyl phthalate	11 U	15 UJ	11 UJ	86 J	300 J	11 UJ	8 U	9.2 U	98 J
Chrysene	170 J	30 J	9 J	30 J	1000 J	16 J	0.68 U	0.78 U	520 J
Diallate	15 U	20 UJ	15 UJ	13 UJ	19 UJ	14 UJ	11 U	12 U	35 UJ
Dibenz(a,h)anthracene	19	6.3 J	0.93 UJ	8.1 J	220 J	5 UJ	0.65 U	0.76 U	65 J
Dibenzofuran	6.4 U	8.7 UJ	6.6 UJ	5.8 UJ	8.3 UJ	6.1 UJ	4.7 U	5.4 U	15 UJ
Diethyl phthalate	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 U	40 UJ
Dimethoate	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ	3.7 U	4.2 U	12 UJ
Dimethyl phthalate	9.7 U	13 UJ	10 UJ	8.8 UJ	13 UJ	9.3 UJ	7.1 U	8.2 U	23 UJ
Di-n-butyl phthalate	38 U	52 UJ	39 UJ	34 UJ	49 UJ	36 UJ	28 U	32 U	92 UJ
Di-n-octyl phthalate	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ	3.7 U	4.2 U	12 UJ
Dinoseb	26 U	35 UJ	27 UJ	23 UJ	33 UJ	25 UJ	19 U	22 U	62 UJ
Disulfoton	8.9 U	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ	6.5 UJ	7.6 UJ	22 UJ
Ethyl methanesulfonate	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 U	40 UJ
Ethyl Parathion	12 U	16 UJ	12 UJ	11 UJ	15 UJ	11 UJ	8.5 U	9.9 U	28 UJ
Famphur	5.4 U	7.4 UJ	5.7 UJ	4.9 UJ	7.1 UJ	5.3 UJ	4 UJ	4.6 U	13 UJ
Fluoranthene	300 J	27 J	3.1 J	21 J	1100 J	14 J	1.9 U	2.2 U	700 J
Fluorene	6.4 J	1.6 UJ	1.2 UJ	1.1 UJ	14 J	1.1 UJ	0.85 U	0.99 U	6.7 UJ
Hexachlorobenzene	10 U	14 UJ	11 UJ	9.3 UJ	13 UJ	9.9 UJ	7.5 U	8.7 U	25 UJ
Hexachlorobutadiene	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 U	12 U	33 UJ
Hexachlorocyclopentadiene	21 U	29 UJ	22 UJ	19 UJ	28 UJ	20 UJ	16 U	18 U	51 UJ
Hexachloroethane	11 U	15 UJ	12 UJ	10 UJ	15 UJ	11 UJ	8.2 U	9.5 U	27 UJ
Hexachlorophene	1300 R	1700 R	1300 R	1100 R	1600 R	1200 R	920 R	1100 R	3000 R
Hexachloropropene	11 UJ	15 UJ	11 UJ	9.9 UJ	14 UJ	11 UJ	8 UJ	9.2 UJ	26 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Indeno[1,2,3-cd]pyrene	37	21 J	1.9 UJ	22 J	1400 J	11 J	1.3 UJ	1.5 UJ	170 J
Isophorone	9.4 U	13 UJ	9.8 UJ	8.5 UJ	12 UJ	9 UJ	6.9 U	8 U	23 UJ
Isosafrole	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
Methapyrilene	14 UJ	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 UJ	12 UJ	34 UJ
Methyl methanesulfonate	14 U	19 UJ	15 UJ	13 UJ	18 UJ	14 UJ	10 U	12 U	34 UJ
Methyl parathion	5 U	6.8 UJ	5.2 UJ	4.5 UJ	6.5 UJ	4.8 UJ	3.7 U	4.2 U	12 UJ
Naphthalene	0.91 U	1.2 UJ	0.94 UJ	0.82 UJ	3.4 J	0.88 UJ	0.66 U	0.77 U	2.2 UJ
Nitrobenzene	10 U	14 UJ	11 UJ	9.5 UJ	14 UJ	10 UJ	7.6 U	8.9 U	25 UJ
N-Nitro-o-toluidine	9.1 U	12 UJ	9.4 UJ	8.2 UJ	12 UJ	8.8 UJ	6.6 U	7.7 U	22 UJ
N-Nitrosodiethylamine	18 U	25 UJ	19 UJ	16 UJ	24 UJ	18 UJ	13 U	15 U	44 UJ
N-Nitrosodimethylamine	15 U	20 UJ	15 UJ	13 UJ	19 UJ	14 UJ	11 U	13 U	36 UJ
N-Nitrosodi-n-butylamine	14 UJ	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 UJ	12 UJ	33 UJ
N-Nitrosodi-n-propylamine	9.8 U	13 UJ	10 UJ	8.9 UJ	13 UJ	9.5 UJ	7.2 U	8.3 U	24 UJ
N-Nitrosodiphenylamine	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
N-Nitrosomethylethylamine	8.6 U	12 UJ	9 UJ	7.8 UJ	11 UJ	8.3 UJ	6.3 U	7.3 U	21 UJ
N-Nitrosomorpholine	10 UJ	14 UJ	10 UJ	9 UJ	13 UJ	9.6 UJ	7.3 UJ	8.5 UJ	24 UJ
N-Nitrosopiperidine	13 UJ	18 UJ	13 UJ	12 UJ	17 UJ	12 UJ	9.4 U	11 UJ	31 UJ
N-Nitrosopyrrolidine	13 U	18 UJ	14 UJ	12 UJ	18 UJ	13 UJ	9.9 U	11 UJ	33 UJ
o,o',o''-Triethylphosphorothioate	24 U	33 UJ	25 UJ	22 UJ	32 UJ	23 UJ	18 U	21 U	59 UJ
p-Dimethylamino azobenzene	11 U	15 UJ	11 UJ	9.7 UJ	14 UJ	10 UJ	7.9 U	9.1 U	26 UJ
Pentachlorobenzene	9.4 U	13 UJ	9.8 UJ	8.5 UJ	13 J	9 UJ	6.9 U	8 U	23 UJ
Pentachloronitrobenzene	8.9 UJ	12 UJ	9.3 UJ	8.1 UJ	12 UJ	8.6 UJ	6.5 U	7.6 U	22 UJ
Pentachlorophenol	13 UJ	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9.2 U	11 U	30 UJ
Phenacetin	7.1 U	9.7 UJ	7.4 UJ	6.4 UJ	9.3 UJ	6.9 UJ	5.2 U	6 U	17 UJ
Phenanthrene	170 J	4.9 J	2.7 UJ	8.6 J	270 J	5.4 J	1.9 UJ	2.2 U	160 J
Phenol	7.3 U	9.9 UJ	7.5 UJ	6.6 UJ	9.5 UJ	7 UJ	5.3 U	6.2 U	18 UJ
Phorate	12 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9.1 U	11 U	30 UJ
p-Phenylene diamine	240 U	330 UJ	250 UJ	220 UJ	320 UJ	230 UJ	180 U	210 U	590 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB01	69SB02	69SB03	69SB04	69SB05	69SB06	69SB07	69SB08	69SB09
Sample ID	69SB01-00	69SB02-00	69SB03-00	69SB04-00	69SB05-00	69SB06-00	69SB07-00	69SB08-00	69SB09-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Pronamide	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 U	12 U	33 UJ
Pyrene	290 J	30 J	4 J	22 J	1200 J	17 J	1.9 U	2.2 U	690 J
Pyridine	17 U	23 UJ	17 UJ	15 UJ	22 UJ	16 UJ	12 U	14 U	40 UJ
Safrole, Total	13 U	17 UJ	13 UJ	11 UJ	16 UJ	12 UJ	9.2 U	11 U	30 UJ
Sulfotepp	14 U	19 UJ	14 UJ	12 UJ	18 UJ	13 UJ	10 U	12 U	33 UJ
Thionazin	14 U	19 UJ	14 UJ	13 UJ	18 UJ	13 UJ	10 U	12 U	34 UJ
Metals (mg/kg)									
Antimony	0.24 UJ	0.3 UJ	0.18 UJ	0.15 UJ	2 J	0.23 UJ	0.21 U	0.094 U	0.83 UJ
Arsenic	2.1	3 J	4.6	1.6	5.4	2.1	4.6	1.6	3.9 J
Barium	29	38 J	21	18	800	42	18	17	61 J
Beryllium	0.098 J	0.12 J	0.066 J	0.099 J	0.35	0.16	0.07 J	0.19	0.17 J
Cadmium	1.3 J	3.5 J	0.68 J	0.61 J	36 J	0.87 J	0.65 J	0.039 UJ	18 J
Chromium	58 J	42 J	33 J	15 J	89 J	24 J	21	24	38 J
Cobalt	14	13 J	9.5	12	17	9.6	6	5.7	12 J
Copper	50	47 J	28	36	130	73	16	82	130 J
Lead	59 J	41 J	20	7.7	520	15	8.9	2.8 J	250 J
Mercury	0.026 J	0.022 J	0.011 J	0.16	0.12	0.13	0.0099 J	0.057	0.077 J
Nickel	17	13 J	8.7	4	34	6.1	7.1	5.9	14 J
Selenium	0.34 J	0.36 J	0.18 U	1.8	0.72 J	0.81	0.14 J	0.79	0.67 J
Silver	0.056 J	0.08 J	0.024 U	0.19 J	0.54	0.065 J	0.022 J	0.037 J	0.25 J
Thallium	0.17 U	0.23 UJ	0.18 U	0.15 U	0.22 U	0.16 U	0.12 U	0.15 U	0.42 UJ
Tin	5.5 U	7.6 UJ	6.1 U	5.1 U	9 J	5.2 U	4 U	5 U	14 UJ
Vanadium	140 J	140 J	110 J	170 J	100 J	230 J	58	280	92 J
Zinc	51	83 J	23	34	650	41	16	34	270 J

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)									
1,1,1,2-Tetrachloroethane	0.85 U	0.78 U	0.53 U	1.2 U	1.1 U	1.3 U	0.65 U	0.41 U	0.74 U
1,1,1-Trichloroethane	0.77 U	0.71 U	0.48 U	1.1 U	0.96 U	1.1 U	0.59 U	0.37 U	0.67 U
1,1,2,2-Tetrachloroethane	1.9 U	1.7 U	1.2 U	2.6 U	2.3 U	2.7 U	1.4 U	0.9 U	1.6 U
1,1,2-Trichloroethane	1.6 U	1.5 U	1 U	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
1,1-Dichloroethane	0.66 U	0.61 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
1,1-Dichloroethene	0.72 U	0.66 U	0.45 U	1 U	0.89 U	1.1 U	0.55 U	0.35 U	0.62 U
1,2,3-Trichloropropane	1.9 U	1.7 U	1.2 U	2.6 U	2.3 U	2.7 U	1.4 U	0.9 U	1.6 U
1,2-Dibromo-3-Chloropropane	3.7 U	3.4 UJ	2.3 UJ	5.3 U	4.6 U	5.5 U	2.9 U	1.8 U	3.2 U
1,2-Dichloroethane	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
1,2-Dichloropropane	1.5 U	1.3 U	0.91 U	2.1 U	1.8 U	2.2 U	1.1 U	0.71 U	1.3 U
2-Butanone (MEK)	3.6 U	3.3 U	3.7 U	5.1 U	4.5 U	5.3 U	2.8 U	22 U	3.1 U
2-Chloro-1,3-butadiene	0.76 U	0.69 U	0.47 U	1.1 U	0.94 U	1.1 U	0.58 U	0.37 U	0.66 U
2-Hexanone	2.8 U	2 J	1.7 U	4 U	3.5 U	4.1 U	2.1 U	1.4 U	2.4 U
3-Chloro-1-propene	2 U	1.8 UJ	1.2 UJ	2.8 UJ	2.5 U	2.9 UJ	1.5 U	0.97 U	1.7 U
4-Methyl-2-pentanone (MIBK)	3.8 U	3.5 U	2.4 U	5.5 U	4.8 U	5.7 U	3 U	1.9 U	3.3 U
Acetone	5.8 U	13 J	24 R	8.3 U	170	8.6 U	41 J	110	40 J
Acetonitrile	60 UJ	55 U	37 U	85 U	74 R	88 U	46 R	29 R	52 R
Acrolein	25 U	23 R	16 R	36 R	31 R	37 R	19 R	12 R	22 R
Acrylonitrile	31 U	28 U	19 U	43 UJ	38 U	45 UJ	23 U	15 U	27 U
Benzene	1 U	0.96 U	0.66 U	1.5 U	1.3 U	1.6 U	0.81 U	0.51 U	0.91 U
Bromoform	1.5 U	1.3 U	0.91 U	2.1 U	1.8 U	2.2 U	1.1 U	0.71 U	1.3 U
Bromomethane	2.1 U	2 UJ	1.3 UJ	3 U	2.6 UJ	3.1 U	1.6 UJ	1 UJ	1.8 UJ
Carbon disulfide	0.68 U	0.62 U	0.42 U	0.96 U	0.84 U	1 U	0.52 U	0.33 U	0.59 U
Carbon tetrachloride	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Chlorobenzene	0.97 U	0.89 U	0.61 U	1.4 U	1.2 U	1.4 U	0.75 U	0.47 U	0.84 U
Chlorodibromomethane	0.66 U	0.61 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U
Chloroethane	1.6 U	1.5 U	1 U	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
Chloroform	0.66 U	0.61 U	0.41 U	0.94 U	0.83 U	0.98 U	0.51 U	0.32 U	0.58 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg) (Cont)									
Chloromethane	0.94 U	0.87 U	0.59 U	1.3 U	1.2 U	1.4 U	0.72 U	0.46 U	0.82 U
cis-1,3-Dichloropropene	1.2 U	1.1 U	0.72 U	1.6 U	1.4 U	1.7 U	0.89 U	0.56 U	1 U
Dibromomethane	1.6 U	1.5 U	1 U	2.3 U	2 U	2.4 U	1.2 U	0.78 U	1.4 U
Dichlorobromomethane	1.1 U	1 U	0.69 U	1.6 U	1.4 U	1.6 U	0.85 U	0.54 U	0.96 U
Dichlorodifluoromethane	1.2 U	1.1 U	0.74 U	1.7 U	1.5 U	1.7 U	0.91 U	0.58 U	1 U
Ethyl methacrylate	2.9 U	2.7 U	1.8 U	4.2 U	3.6 UJ	4.3 U	2.2 UJ	1.4 UJ	2.5 UJ
Ethylbenzene	1 U	0.91 U	0.62 U	1.4 U	1.2 U	1.5 U	0.77 U	0.48 U	0.87 U
Ethylene Dibromide	2 U	1.8 U	1.2 U	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Iodomethane	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Isobutyl alcohol	92 R	84 R	57 R	130 R	110 R	140 R	70 R	45 R	80 R
Methacrylonitrile	32 U	29 UJ	20 UJ	45 U	40 UJ	47 U	25 UJ	16 UJ	28 UJ
Methyl methacrylate	4.9 U	4.5 UJ	3.1 UJ	7 U	6.1 UJ	7.3 U	3.8 UJ	2.4 UJ	4.3 UJ
Methylene Chloride	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Pentachloroethane	2.9 UJ	2.7 U	1.8 U	4.2 UJ	3.6 U	4.3 UJ	2.2 U	1.4 U	2.5 U
Propionitrile	28 U	26 U	17 U	40 U	35 R	41 U	21 R	14 R	24 R
Styrene	0.88 U	0.8 U	0.55 U	1.2 U	1.1 U	1.3 U	0.67 U	0.43 U	0.76 U
Tetrachloroethene	0.97 U	0.89 U	0.61 U	1.4 U	1.2 U	1.4 U	0.75 U	0.47 U	0.84 U
Toluene	1 U	0.96 U	0.66 U	1.5 U	1.3 U	1.6 U	0.81 U	0.51 U	0.91 U
trans-1,2-Dichloroethene	1.3 U	1.2 U	0.8 U	1.8 U	1.6 U	1.9 U	0.99 U	0.63 U	1.1 U
trans-1,3-Dichloropropene	1.2 U	1.1 U	0.72 U	1.6 U	1.4 U	1.7 U	0.89 U	0.56 U	1 U
trans-1,4-Dichloro-2-butene	4.1 U	3.8 UJ	2.6 UJ	5.9 U	59 J	6.1 U	3.2 UJ	2 UJ	3.6 UJ
Trichloroethene	1.3 U	1.2 U	0.83 U	1.9 U	1.7 U	2 U	1 U	0.65 U	1.2 U
Trichlorofluoromethane	2 U	1.8 U	1.2 U	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Vinyl acetate	2 U	1.8 UJ	1.2 UJ	2.8 U	2.5 U	2.9 U	1.5 U	0.97 U	1.7 U
Vinyl chloride	0.77 U	0.71 U	0.48 U	1.1 U	0.96 U	1.1 U	0.59 U	0.37 U	0.67 U
Xylenes, Total	12 J	2.8 U	1.9 U	4.9 J	3.8 U	4.5 U	2.3 U	1.5 U	2.7 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg)									
1,1'-Biphenyl	9.8 U	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
1,2,4,5-Tetrachlorobenzene	8.3 U	29 J	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
1,2,4-Trichlorobenzene	9.8 U	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
1,2-Dichlorobenzene	9.2 U	8.3 U	8.3 U	8.7 U	11 U	10 U	8.1 U	9.9 UJ	9.4 U
1,3,5-Trinitrobenzene	22 U	20 U	20 U	21 U	26 U	25 U	20 U	24 UJ	23 U
1,3-Dichlorobenzene	7.9 U	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
1,3-Dinitrobenzene	5.2 U	4.6 U	4.6 U	4.9 U	5.9 U	5.7 U	4.5 U	5.5 UJ	5.2 U
1,4-Dichlorobenzene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
1,4-Dioxane	11 U	9.5 U	9.5 U	10 U	12 U	12 U	9.3 U	11 UJ	11 U
1,4-Naphthoquinone	5.2 UJ	4.6 U	4.6 U	4.9 UJ	5.9 UJ	5.7 UJ	4.5 UJ	5.5 UJ	5.2 UJ
2,2'-oxybis[1-chloropropane]	8.3 U	7.4 U	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
2,3,4,6-Tetrachlorophenol	5.5 U	5 U	5 U	5.2 U	6.4 U	6.1 UJ	4.9 UJ	5.9 UJ	5.6 UJ
2,4,5-Trichlorophenol	9 U	8 U	8.1 U	8.5 U	10 U	9.9 UJ	7.9 UJ	9.6 UJ	9.1 UJ
2,4,6-Trichlorophenol	10 U	9.3 U	9.4 U	9.8 U	12 U	11 UJ	9.2 UJ	11 UJ	11 UJ
2,4-Dichlorophenol	11 U	9.6 U	9.6 U	10 U	12 U	12 UJ	9.4 UJ	11 UJ	11 UJ
2,4-Dimethylphenol	22 U	20 U	20 U	21 U	26 U	25 UJ	20 UJ	24 UJ	23 UJ
2,4-Dinitrophenol	110 UJ	98 U	99 UJ	100 UJ	130 UJ	120 UJ	96 UJ	120 UJ	110 UJ
2,4-Dinitrotoluene	7.8 U	7 U	7 U	7.4 U	9 U	8.5 U	6.8 U	8.4 UJ	7.9 U
2,6-Dichlorophenol	8.5 U	7.6 U	7.6 U	8 U	9.7 U	9.3 UJ	7.4 UJ	9.1 UJ	8.6 UJ
2,6-Dinitrotoluene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
2-Acetylaminofluorene	6.7 U	6 U	6.1 U	6.4 U	7.8 U	7.4 U	5.9 U	7.2 UJ	6.9 U
2-Chloronaphthalene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
2-Chlorophenol	8.7 U	7.8 U	7.8 U	8.2 U	10 U	9.6 UJ	7.7 UJ	9.3 UJ	8.9 U
2-Methylnaphthalene	2.2 U	2.3 J	2 U	2.1 U	2.6 U	2.5 U	2 U	2.4 UJ	2.3 U
2-Methylphenol	11 U	9.6 U	9.6 U	10 U	12 U	12 UJ	9.4 UJ	11 UJ	11 UJ
2-Naphthylamine	26 U	24 UJ	24 UJ	25 U	30 U	29 U	23 U	28 UJ	27 U
2-Nitroaniline	8.6 U	7.7 U	7.7 U	8.1 U	9.9 U	9.4 U	7.5 U	9.2 UJ	8.7 U
2-Nitrophenol	9.6 U	8.6 U	8.7 U	9.1 U	11 U	11 UJ	8.5 UJ	10 UJ	9.8 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
2-Picoline	16 U	14 U	14 U	15 U	18 U	17 U	14 U	17 UJ	16 U
2-Toluidine	12 U	11 U	11 U	12 U	14 U	13 U	11 U	13 UJ	12 U
3 & 4 Methylphenol	9.6 U	8.6 U	8.7 U	9.1 U	11 U	11 UJ	8.5 UJ	10 UJ	9.8 UJ
3,3'-Dichlorobenzidine	12 UJ	11 U	11 U	11 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
3,3'-Dimethylbenzidine	240 U	210 UJ	210 UJ	220 U	270 U	260 U	210 U	250 UJ	240 U
3-Methylcholanthrene	8.1 U	7.2 U	7.2 U	7.6 U	9.3 U	8.8 U	7.1 U	8.6 UJ	8.2 U
3-Nitroaniline	5.9 U	5.3 U	5.3 U	5.6 U	6.8 U	6.5 U	5.2 U	6.4 UJ	6 U
4,6-Dinitro-2-methylphenol	7.7 UJ	6.9 UJ	6.9 UJ	7.2 UJ	8.8 UJ	8.4 UJ	6.7 UJ	8.2 UJ	7.8 UJ
4-Aminobiphenyl	17 U	15 U	15 U	16 U	20 U	19 U	15 U	18 UJ	17 U
4-Bromophenyl phenyl ether	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
4-Chloro-3-methylphenol	9.9 U	8.9 U	8.9 U	9.4 U	11 U	11 UJ	8.7 UJ	11 UJ	10 UJ
4-Chloroaniline	7.9 U	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
4-Chlorophenyl phenyl ether	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
4-Nitroaniline	10 U	9.1 U	9.2 U	9.6 U	12 U	11 U	8.9 U	11 UJ	10 U
4-Nitrophenol	44 U	39 U	39 U	41 U	50 U	48 UJ	38 UJ	47 UJ	44 UJ
4-Nitroquinoline-1-oxide	15 R	13 R	13 R	14 R	17 R	16 R	13 R	16 R	15 R
7,12-Dimethylbenz(a)anthracene	12 UJ	11 U	11 U	12 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
Acenaphthene	0.75 U	0.67 U	0.68 U	0.71 U	0.87 U	3 J	0.66 U	0.81 UJ	0.79 J
Acenaphthylene	2.2 U	2 U	2 U	2.1 U	2.6 U	2.5 U	2 U	2.4 UJ	2.3 U
Acetophenone	11 U	10 U	10 U	11 U	13 U	12 U	10 U	12 UJ	12 U
alpha,alpha-Dimethyl phenethylamine	78 U	70 U	70 U	74 U	90 U	85 U	68 U	84 UJ	79 U
Aniline	8.3 U	7.4 U	7.5 U	7.9 U	9.6 U	9.1 U	7.3 U	8.9 UJ	8.5 U
Anthracene	2.2 U	3.8 J	2 U	2.1 U	2.6 U	16	2 U	2.4 UJ	7.3 J
Aramite, Total	15 UJ	13 UJ	13 UJ	14 UJ	17 UJ	16 UJ	13 UJ	16 UJ	15 UJ
Benzo[a]anthracene	2.2 U	14 J	2 U	2.1 U	2.6 U	90	2 U	11 J	140 J
Benzo[a]pyrene	4.5 J	51 J	0.78 U	28	40	100	0.77 UJ	28 J	280 J
Benzo[b]fluoranthene	7.8 J	91 J	0.9 U	50	60	230	0.88 UJ	73 J	570 J
Benzo[g,h,i]perylene	2.2 UJ	190	2 U	39	39	99	2 UJ	76 J	290 J

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Benzo[k]fluoranthene	1.3 UJ	140	1.2 U	1.2 U	1.5 U	1.4 U	1.2 UJ	1.4 UJ	1.3 UJ
Benzyl alcohol	11 U	9.5 U	9.5 U	10 U	12 U	12 UJ	9.3 UJ	11 UJ	11 UJ
Bis(2-chloroethoxy)methane	9 U	8 U	8.1 U	8.5 U	10 U	9.9 U	7.9 U	9.6 UJ	9.1 U
Bis(2-chloroethyl)ether	7.5 U	6.7 U	6.8 U	7.1 U	8.7 U	8.3 U	6.6 U	8.1 UJ	7.7 U
Bis(2-ethylhexyl) phthalate	18 U	760 J	28 U	47 U	80 U	52 U	27 U	57 UJ	110 J
Butyl benzyl phthalate	9.5 U	180 J	8.6 U	110	11 U	21 J	8.3 U	16 J	51
Chrysene	6.1 J	66	0.72 U	55	38	180	0.71 U	26 J	290 J
Diallate	13 U	11 U	11 U	12 U	15 U	14 U	11 U	14 UJ	13 U
Dibenz(a,h)anthracene	0.78 UJ	28 J	0.7 U	9.9	9 J	39	0.68 U	8.6 J	75 J
Dibenzofuran	5.5 U	5 U	5 U	5.2 U	6.4 U	6.1 U	4.9 U	5.9 UJ	5.6 U
Diethyl phthalate	15 U	13 U	13 U	14 U	17 U	16 U	13 U	16 UJ	15 U
Dimethoate	4.4 U	3.9 U	3.9 U	4.1 U	5 U	4.8 U	3.8 U	4.7 UJ	4.4 U
Dimethyl phthalate	8.5 U	7.6 U	7.6 U	8 U	9.7 U	9.3 U	7.4 U	9.1 UJ	8.6 U
Di-n-butyl phthalate	33 U	30 U	30 U	31 U	38 U	36 U	29 U	35 UJ	34 U
Di-n-octyl phthalate	4.4 UJ	26 J	3.9 U	4.1 U	5 U	4.8 U	3.8 UJ	4.7 UJ	4.4 UJ
Dinoseb	22 U	20 U	20 U	21 U	26 U	25 U	20 U	24 UJ	23 U
Disulfoton	7.8 U	7 U	7 UJ	7.4 U	9 U	8.5 U	6.8 U	8.4 UJ	7.9 U
Ethyl methanesulfonate	15 U	13 U	13 U	14 U	17 U	16 U	13 U	16 UJ	15 U
Ethyl Parathion	10 U	9.1 U	9.2 U	9.6 U	12 U	11 U	8.9 U	11 UJ	10 U
Famphur	4.8 U	4.3 U	4.3 U	4.5 U	5.5 U	5.2 U	4.2 U	5.1 UJ	4.8 U
Fluoranthene	3.1 J	27	2 U	14	24	340	2 U	18 J	160
Fluorene	1 U	0.91 U	0.92 U	0.96 U	1.2 U	4.3 J	0.89 U	1.1 UJ	1 U
Hexachlorobenzene	9 U	8 U	8.1 U	8.5 U	10 U	9.9 U	7.9 U	9.6 UJ	9.1 U
Hexachlorobutadiene	12 U	11 U	11 U	11 U	14 U	13 U	11 U	13 UJ	12 U
Hexachlorocyclopentadiene	18 U	17 U	17 U	17 U	21 U	20 U	16 U	20 UJ	19 U
Hexachloroethane	9.8 U	8.7 U	8.8 U	9.2 U	11 U	11 U	8.6 U	10 UJ	9.9 U
Hexachlorophene	1100 R	980 R	990 R	1000 R	1300 R	1200 R	960 R	1200 R	1100 R
Hexachloropropene	9.5 UJ	8.5 UJ	8.6 UJ	9 UJ	11 UJ	10 UJ	8.3 UJ	10 UJ	9.7 UJ

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Indeno[1,2,3-cd]pyrene	1.6 UJ	94 J	1.4 UJ	17	21	52	1.4 UJ	23 J	190 J
Isophorone	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
Isosafrole	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
Methapyrilene	12 UJ	11 UJ	11 UJ	12 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
Methyl methanesulfonate	12 U	11 U	11 U	12 U	14 U	13 U	11 U	13 UJ	12 U
Methyl parathion	4.4 U	3.9 U	3.9 U	4.1 U	5 U	4.8 U	3.8 U	4.7 UJ	4.4 U
Naphthalene	0.79 U	1.1 J	0.71 U	0.75 U	0.91 U	0.87 U	0.7 U	0.85 UJ	0.81 U
Nitrobenzene	9.1 U	8.2 U	8.2 U	8.6 U	10 U	10 U	8 U	9.8 UJ	9.3 U
N-Nitro-o-toluidine	7.9 U	7.1 U	7.1 U	7.5 U	9.1 U	8.7 U	7 U	8.5 UJ	8.1 U
N-Nitrosodiethylamine	16 U	14 U	14 U	15 U	18 U	17 U	14 U	17 UJ	16 U
N-Nitrosodimethylamine	13 U	12 U	12 U	12 U	15 U	14 U	11 U	14 UJ	13 U
N-Nitrosodi-n-butylamine	12 UJ	11 UJ	11 UJ	11 UJ	14 UJ	13 UJ	11 UJ	13 UJ	12 UJ
N-Nitrosodi-n-propylamine	8.6 U	7.7 U	7.7 U	8.1 U	9.9 U	9.4 U	7.5 U	9.2 UJ	8.7 U
N-Nitrosodiphenylamine	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
N-Nitrosomethylethylamine	7.5 U	6.7 U	6.8 U	7.1 U	8.7 U	8.3 U	6.6 U	8.1 UJ	7.7 U
N-Nitrosomorpholine	8.7 UJ	7.8 UJ	7.8 UJ	8.2 UJ	10 UJ	9.6 UJ	7.7 UJ	9.3 UJ	8.9 UJ
N-Nitrosopiperidine	11 UJ	10 UJ	10 UJ	11 UJ	13 UJ	12 UJ	9.9 UJ	12 UJ	11 UJ
N-Nitrosopyrrolidine	12 U	11 UJ	11 UJ	11 U	14 U	13 U	10 U	13 UJ	12 U
o,o',o''-Triethylphosphorothioate	21 U	19 U	19 U	20 U	24 U	23 U	19 U	23 UJ	22 U
p-Dimethylamino azobenzene	9.4 U	8.4 U	8.4 U	8.9 U	11 U	10 U	8.2 U	10 UJ	9.5 U
Pentachlorobenzene	8.2 U	7.3 U	7.4 U	7.7 U	9.4 U	9 U	7.2 U	8.8 UJ	8.3 U
Pentachloronitrobenzene	7.8 UJ	7 U	7 U	7.4 UJ	9 UJ	8.5 UJ	6.8 UJ	8.4 UJ	7.9 UJ
Pentachlorophenol	11 U	9.8 U	9.9 U	10 U	13 U	12 UJ	9.6 UJ	12 UJ	11 UJ
Phenacetin	6.2 U	5.6 U	5.6 U	5.9 U	7.1 U	6.8 U	5.5 U	6.7 UJ	6.3 U
Phenanthrene	2.2 U	20	2 U	3.8 J	6.1 J	110	2 U	4.2 J	21
Phenol	6.3 U	5.7 U	5.7 U	6 U	7.3 U	7 U	5.6 UJ	6.8 UJ	6.5 UJ
Phorate	11 U	9.7 U	9.7 U	10 U	12 U	12 U	9.5 U	12 UJ	11 U
p-Phenylene diamine	210 U	190 U	190 U	200 U	240 U	230 U	190 U	230 UJ	220 U

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB10	69SB11	69SB12	69SB13	69SB14	69SB15	69SB16	69SB17	69SB18
Sample ID	69SB10-00	69SB11-00	69SB12-00	69SB13-00	69SB14-00	69SB15-00	69SB16-00	69SB17-00	69SB18-00
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/kg) (Cont)									
Pronamide	12 U	11 U	11 U	11 U	14 U	13 U	10 U	13 UJ	12 U
Pyrene	4.2 J	41	2 U	24	30	320	2 U	23 J	200 J
Pyridine	15 U	13 U	13 U	14 U	17 U	16 U	13 U	16 UJ	15 U
Safrole, Total	11 U	9.8 U	9.9 U	10 U	13 U	12 U	9.6 U	12 UJ	11 U
Sulfotepp	12 U	11 U	11 U	11 U	14 U	13 U	10 U	13 UJ	12 U
Thionazin	12 U	11 U	11 U	11 U	14 U	13 U	11 U	13 UJ	12 U
Metals (mg/kg)									
Antimony	0.18 UJ	0.48 U	0.18 U	0.19 UJ	0.38 UJ	0.58 UJ	0.23 UJ	0.31 UJ	0.26 UJ
Arsenic	4	4.9 J	4.8	3.7	3.2	3.3	4	4.5	4.2
Barium	34	21	14	26	76	30	19	22	22
Beryllium	0.099 J	0.045 J	0.05 J	0.065 J	0.18	0.088 J	0.037 J	0.079 J	0.042 J
Cadmium	0.41 J	4.4 J	0.051 J	0.96 J	4.1 J	1.4 J	0.082 J	2.2 J	1.3 J
Chromium	25 J	34	39	23 J	26 J	17 J	34 J	35 J	31 J
Cobalt	10	6.5	14	8.4	13	6.4	8.2	9.8	7.5
Copper	42	23	32	33	68	36	16	42	23
Lead	6.8	220 J	0.71 U	36	73	34	0.93 J	48	12
Mercury	0.044	0.017 J	0.0098 J	0.023 J	0.039	0.036	0.0066 J	0.032	0.021 J
Nickel	8	9.3	12	7.8	10	5	10	12	9
Selenium	0.35 J	0.22 J	0.14 J	0.25 J	0.3 J	0.34 J	0.13 U	0.25 J	0.18 J
Silver	0.037 J	0.084 U	0.018 U	0.046 J	0.25 J	0.1 J	0.021 J	0.11 J	0.027 J
Thallium	0.15 U	0.13 U	0.13 U	0.14 U	0.17 U	0.16 U	0.13 U	0.16 U	0.16 U
Tin	4.9 U	4.3 U	4.4 U	4.5 U	5.6 U	5.3 U	4.4 U	5.2 U	5.2 U
Vanadium	110 J	53	87	78 J	99 J	46 J	96 J	110 J	86 J
Zinc	27	67	11	30	130	140	9	65	20

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Volatile Organic Compounds (ug/kg)									
1,1,1,2-Tetrachloroethane	0.46 U	0.35 U	0.79 U	0.68 U	0.39 U	0.44 U	0.66 U	0.71 U	0.81 U
1,1,1-Trichloroethane	0.42 U	0.31 U	0.72 U	0.61 U	0.36 U	0.4 U	0.59 U	0.65 U	0.73 U
1,1,2,2-Tetrachloroethane	1 U	0.76 U	1.7 U	1.5 U	0.86 U	0.96 U	1.4 U	1.6 U	1.8 U
1,1,2-Trichloroethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U	1.3 U	1.5 U
1,1-Dichloroethane	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U	0.56 U	0.63 U
1,1-Dichloroethene	0.39 U	0.29 U	0.67 U	0.57 U	0.33 U	0.37 U	0.55 U	0.6 U	0.68 U
1,2,3-Trichloropropane	1 U	0.76 U	1.7 U	1.5 U	0.86 U	0.96 U	1.4 U	1.6 U	1.8 U
1,2-Dibromo-3-Chloropropane	2 U	1.5 U	3.5 U	3 U	1.7 U	1.9 U	2.9 U	3.1 U	3.5 U
1,2-Dichloroethane	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U	1.1 U	1.3 U
1,2-Dichloropropane	0.8 U	0.6 U	1.4 U	1.2 U	0.67 U	0.76 U	1.1 U	1.2 U	1.4 U
2-Butanone (MEK)	5.5 U	1.5 U	3.4 U	19 U	12 U	6.2 U	19 U	3 U	3.4 U
2-Chloro-1,3-butadiene	0.41 U	0.31 U	0.71 U	0.6 U	0.35 U	0.39 U	0.58 U	0.64 UJ	7.6 J
2-Hexanone	1.5 U	1.1 U	2.6 U	2.2 U	1.3 U	1.4 U	2.1 U	2.3 U	2.7 U
3-Chloro-1-propene	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U	1.7 R	1.9 R
4-Methyl-2-pentanone (MIBK)	2.1 U	1.6 U	3.6 U	7.7 J	1.8 U	2 U	3 U	3.2 U	3.7 U
Acetone	41 J	42	130	150	75	50	220	9 J	7 J
Acetonitrile	33 UJ	24 R	56 R	47 R	28 R	31 R	46 UJ	50 UJ	57 UJ
Acrolein	14 U	10 R	24 R	20 R	12 R	13 R	19 U	21 R	24 R
Acrylonitrile	17 U	12 U	29 U	24 U	14 UJ	16 UJ	24 U	26 UJ	29 UJ
Benzene	0.57 U	0.43 U	0.98 U	0.99 J	0.48 U	0.54 U	0.81 U	0.88 U	1 U
Bromoform	0.8 U	0.6 U	1.4 U	1.2 U	0.67 U	0.76 U	1.1 U	1.2 U	1.4 U
Bromomethane	1.2 U	0.87 UJ	2 UJ	1.7 UJ	0.98 UJ	1.1 UJ	1.6 U	1.8 UJ	2 UJ
Carbon disulfide	0.37 U	0.28 U	0.63 U	0.54 U	0.31 U	0.35 U	0.52 U	0.57 U	0.64 U
Carbon tetrachloride	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U	1.1 U	1.3 U
Chlorobenzene	0.53 U	0.4 U	0.91 U	0.77 U	0.45 U	0.5 U	0.75 U	0.81 U	0.92 U
Chlorodibromomethane	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U	0.56 U	0.63 U
Chloroethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U	1.3 U	1.5 U
Chloroform	0.36 U	0.27 U	0.62 U	0.53 U	0.31 U	0.34 U	0.51 U	0.56 U	0.63 U

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Volatile Organic Compounds (ug/kg) (Cont)									
Chloromethane	0.51 U	0.39 U	0.88 U	0.75 U	0.43 U	0.49 U	0.73 U	0.79 U	0.9 U
cis-1,3-Dichloropropene	0.63 U	0.47 U	1.1 U	0.92 U	0.53 U	0.6 U	0.89 U	0.97 U	1.1 U
Dibromomethane	0.87 U	0.65 U	1.5 U	1.3 U	0.74 U	0.82 U	1.2 U	1.3 U	1.5 U
Dichlorobromomethane	0.6 U	0.45 U	1 U	0.88 U	0.51 U	0.57 U	0.85 U	0.92 U	1 U
Dichlorodifluoromethane	0.65 U	0.48 U	1.1 U	0.94 U	0.55 U	0.61 U	0.91 U	0.99 U	1.1 U
Ethyl methacrylate	1.6 U	1.2 UJ	2.7 UJ	2.3 UJ	1.3 UJ	1.5 UJ	2.3 U	2.5 U	2.8 U
Ethylbenzene	0.54 U	0.41 U	0.93 U	0.79 U	0.46 U	0.51 U	0.77 U	0.84 U	0.95 U
Ethylene Dibromide	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U	1.7 U	1.9 U
Iodomethane	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U	1.1 U	1.3 U
Isobutyl alcohol	56 R	37 R	86 R	73 R	42 R	47 R	71 R	77 R	87 R
Methacrylonitrile	17 U	13 UJ	30 UJ	25 UJ	15 U	16 U	25 U	27 U	30 U
Methyl methacrylate	2.7 U	2 UJ	4.6 UJ	3.9 UJ	2.3 UJ	2.5 UJ	3.8 U	4.1 U	4.7 U
Methylene Chloride	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U	1.1 U	1.3 U
Pentachloroethane	1.6 UJ	1.2 U	2.7 U	2.3 U	1.3 U	1.5 U	2.3 UJ	2.5 U	2.8 U
Propionitrile	15 U	11 R	26 R	22 R	13 R	14 R	21 U	23 UJ	27 UJ
Styrene	0.48 U	0.36 U	0.82 U	0.7 U	0.4 U	0.45 U	0.68 U	0.74 U	0.83 U
Tetrachloroethene	0.53 U	0.4 U	0.91 U	0.77 U	0.45 U	0.5 U	0.75 U	0.81 U	0.92 U
Toluene	0.57 U	0.53 J	0.98 U	0.83 U	0.48 U	0.54 U	0.81 U	0.88 U	1 U
trans-1,2-Dichloroethene	0.7 U	0.53 U	1.2 U	1 U	0.59 U	0.67 U	0.99 U	1.1 U	1.2 U
trans-1,3-Dichloropropene	0.63 U	0.47 U	1.1 U	0.92 U	0.53 U	0.6 U	0.89 U	0.97 U	1.1 U
trans-1,4-Dichloro-2-butene	2.2 U	1.7 UJ	3.8 UJ	3.3 UJ	1.9 UJ	2.1 UJ	3.2 U	3.5 U	3.9 U
Trichloroethene	0.73 U	0.54 U	1.2 U	1.1 U	0.61 U	0.69 U	1 U	1.1 U	1.3 U
Trichlorofluoromethane	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U	1.7 U	1.9 U
Vinyl acetate	1.1 U	0.81 U	1.9 U	1.6 U	0.92 U	1 U	1.5 U	1.7 UJ	1.9 UJ
Vinyl chloride	0.42 U	0.31 U	0.72 U	0.61 U	0.36 U	0.4 U	0.59 U	0.65 U	0.73 U
Xylenes, Total	1.7 U	1.2 U	2.9 U	2.4 U	1.4 U	1.6 U	2.4 U	2.6 U	2.9 U

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Semivolatile Organic Compounds (ug/kg)									
1,1'-Biphenyl	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ	9.6 UJ	10 U
1,2,4,5-Tetrachlorobenzene	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ	8.1 UJ	8.8 U
1,2,4-Trichlorobenzene	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ	9.6 UJ	10 U
1,2-Dichlorobenzene	8.1 U	9.8 UJ	8.9 UJ	8.2 UJ	9.3 UJ	8.3 UJ	8.9 UJ	9 UJ	9.8 U
1,3,5-Trinitrobenzene	20 U	24 UJ	22 UJ	20 UJ	23 UJ	20 UJ	22 UJ	22 UJ	24 U
1,3-Dichlorobenzene	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ	7.8 UJ	8.4 U
1,3-Dinitrobenzene	4.5 U	5.4 UJ	5 UJ	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ	5 UJ	5.5 U
1,4-Dichlorobenzene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ	8 UJ	8.7 U
1,4-Dioxane	9.2 U	11 UJ	10 UJ	9.4 UJ	11 UJ	9.4 UJ	10 UJ	10 UJ	11 U
1,4-Naphthoquinone	4.5 UJ	5.4 UJ	5 UJ	4.6 UJ	5.2 UJ	4.6 UJ	5 UJ	5 UJ	5.5 U
2,2'-oxybis[1-chloropropane]	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ	8.1 UJ	8.8 U
2,3,4,6-Tetrachlorophenol	4.8 U	5.9 UJ	5.4 UJ	4.9 U	5.6 UJ	5 UJ	5.3 UJ	5.4 UJ	5.9 U
2,4,5-Trichlorophenol	7.8 U	9.5 UJ	8.7 UJ	8 U	9.1 UJ	8 UJ	8.6 UJ	8.8 UJ	9.5 U
2,4,6-Trichlorophenol	9.1 U	11 UJ	10 UJ	9.3 U	11 UJ	9.3 UJ	10 UJ	10 UJ	11 U
2,4-Dichlorophenol	9.3 U	11 UJ	10 UJ	9.5 U	11 UJ	9.5 UJ	10 UJ	10 UJ	11 U
2,4-Dimethylphenol	20 U	24 UJ	22 UJ	20 U	23 UJ	20 UJ	22 UJ	22 UJ	24 U
2,4-Dinitrophenol	96 UJ	120 UJ	110 UJ	97 U	110 UJ	98 UJ	110 UJ	110 UJ	120 UJ
2,4-Dinitrotoluene	6.8 U	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ	7.6 UJ	8.3 U
2,6-Dichlorophenol	7.4 U	8.9 UJ	8.2 UJ	7.5 U	8.5 UJ	7.5 UJ	8.1 UJ	8.3 UJ	9 U
2,6-Dinitrotoluene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ	8 UJ	8.7 U
2-Acetylaminofluorene	5.9 U	7.1 UJ	6.5 UJ	6 UJ	6.8 UJ	6 UJ	6.5 UJ	6.6 UJ	7.2 U
2-Chloronaphthalene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ	8 UJ	8.7 U
2-Chlorophenol	7.6 U	9.2 UJ	8.4 UJ	7.7 U	8.8 UJ	7.8 UJ	8.4 UJ	8.5 UJ	9.3 U
2-Methylnaphthalene	2 U	2.4 UJ	2.2 UJ	2 UJ	2.3 UJ	2 UJ	2.2 UJ	2.2 UJ	2.4 U
2-Methylphenol	9.3 U	11 UJ	10 UJ	9.5 U	11 UJ	9.5 UJ	10 UJ	10 UJ	11 U
2-Naphthylamine	23 U	28 UJ	25 UJ	23 UJ	27 UJ	24 UJ	25 UJ	26 UJ	28 UJ
2-Nitroaniline	7.5 U	9.1 UJ	8.3 UJ	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ	8.4 UJ	9.1 U
2-Nitrophenol	8.4 U	10 UJ	9.3 UJ	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ	9.4 UJ	10 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)									
2-Picoline	14 U	17 UJ	15 UJ	14 UJ	16 UJ	14 UJ	15 UJ	16 UJ	17 U
2-Toluidine	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 U
3 & 4 Methylphenol	8.4 U	10 UJ	9.3 UJ	8.6 U	9.7 UJ	8.6 UJ	9.3 UJ	9.4 UJ	10 U
3,3'-Dichlorobenzidine	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 U
3,3'-Dimethylbenzidine	210 U	250 UJ	230 UJ	210 UJ	240 UJ	210 UJ	230 UJ	230 UJ	250 UJ
3-Methylcholanthrene	7 U	8.5 UJ	7.8 UJ	7.2 UJ	8.1 UJ	7.2 UJ	7.8 UJ	7.9 UJ	8.6 U
3-Nitroaniline	5.2 U	6.3 UJ	5.7 UJ	5.3 UJ	6 UJ	5.3 UJ	5.7 UJ	5.8 UJ	6.3 U
4,6-Dinitro-2-methylphenol	6.7 UJ	8.1 UJ	7.4 UJ	6.8 U	7.7 UJ	6.8 UJ	7.4 UJ	7.5 UJ	8.1 UJ
4-Aminobiphenyl	15 U	18 UJ	17 UJ	15 UJ	17 UJ	15 UJ	17 UJ	17 UJ	18 U
4-Bromophenyl phenyl ether	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ	9.2 UJ	10 U
4-Chloro-3-methylphenol	8.6 U	10 UJ	9.6 UJ	8.8 U	10 UJ	8.8 UJ	9.5 UJ	9.7 UJ	11 U
4-Chloroaniline	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ	7.8 UJ	8.4 U
4-Chlorophenyl phenyl ether	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ	8 UJ	8.7 U
4-Nitroaniline	8.9 U	11 UJ	9.8 UJ	9 UJ	10 UJ	9.1 UJ	9.8 UJ	9.9 UJ	11 U
4-Nitrophenol	38 U	46 UJ	42 UJ	39 U	44 UJ	39 UJ	42 UJ	43 UJ	46 U
4-Nitroquinoline-1-oxide	13 R	15 R	14 R	13 R	15 R	13 R	14 R	14 R	15 R
7,12-Dimethylbenz(a)anthracene	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 U
Acenaphthene	0.66 U	0.8 UJ	0.73 UJ	0.67 UJ	1.8 J	0.67 UJ	0.72 UJ	0.74 UJ	0.8 U
Acenaphthylene	2 U	2.4 UJ	2.2 UJ	2 UJ	2.3 UJ	2 UJ	2.2 UJ	2.2 UJ	2.4 U
Acetophenone	9.9 U	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	11 UJ	11 UJ	12 U
alpha,alpha-Dimethyl phenethylamine	68 U	82 UJ	75 UJ	69 UJ	79 UJ	70 UJ	75 UJ	76 UJ	83 U
Aniline	7.3 U	8.8 UJ	8 UJ	7.4 UJ	8.4 UJ	7.4 UJ	8 UJ	8.1 UJ	8.8 U
Anthracene	2 U	2.4 UJ	2.2 UJ	2 UJ	6 J	2 UJ	2.2 UJ	2.2 UJ	2.4 U
Aramite, Total	13 UJ	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ	14 UJ	15 UJ
Benzo[a]anthracene	2 UJ	2.4 UJ	4.8 J	8 J	140 J	8 J	2.2 UJ	2.2 UJ	2.4 U
Benzo[a]pyrene	2.8 J	3.3 UJ	18 J	17 J	160 J	13 J	1.5 UJ	0.85 UJ	0.93 U
Benzo[b]fluoranthene	5.6 J	5.5 UJ	29 J	36 J	380 J	29 J	1.6 UJ	0.98 UJ	1.1 U
Benzo[g,h,i]perylene	7.8 J	14 UJ	35	26 J	220 J	26 J	3.2 UJ	2.2 UJ	2.4 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)									
Benzo[k]fluoranthene	1.2 UJ	2.9 J	2.8 UJ	1.2 UJ	1.3 UJ	1.2 UJ	1.8 UJ	1.3 UJ	1.4 U
Benzyl alcohol	9.2 U	11 UJ	10 UJ	9.4 U	11 UJ	9.4 UJ	10 UJ	10 UJ	11 U
Bis(2-chloroethoxy)methane	7.8 U	9.5 UJ	8.7 UJ	8 UJ	9.1 UJ	8 UJ	8.6 UJ	8.8 UJ	9.5 U
Bis(2-chloroethyl)ether	6.6 U	8 UJ	7.3 UJ	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ	7.4 UJ	8 U
Bis(2-ethylhexyl) phthalate	45 UJ	24 UJ	27 UJ	34 UJ	48 UJ	36 UJ	21 UJ	47 UJ	14 J
Butyl benzyl phthalate	8.3 U	10 UJ	9.2 UJ	18 J	34 J	72 J	9.1 UJ	9.3 UJ	10 U
Chrysene	3.9 J	4.2 UJ	15	21 J	210 J	12 J	0.78 UJ	0.79 UJ	0.86 U
Diallate	11 U	13 UJ	12 UJ	11 UJ	13 UJ	11 UJ	12 UJ	12 UJ	13 U
Dibenz(a,h)anthracene	0.68 UJ	0.82 UJ	3.4 J	4.5 UJ	33 J	3 J	1.8 UJ	0.76 UJ	0.83 U
Dibenzofuran	4.8 U	5.9 UJ	5.4 UJ	4.9 UJ	5.6 UJ	5 UJ	5.3 UJ	5.4 UJ	5.9 U
Diethyl phthalate	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ	14 UJ	15 U
Dimethoate	3.8 U	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ	4.3 UJ	4.6 U
Dimethyl phthalate	7.4 U	8.9 UJ	8.2 UJ	7.5 UJ	8.5 UJ	7.5 UJ	8.1 UJ	8.3 UJ	9 U
Di-n-butyl phthalate	29 U	35 UJ	32 UJ	29 UJ	33 UJ	29 UJ	32 UJ	32 UJ	35 U
Di-n-octyl phthalate	3.8 UJ	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ	4.3 UJ	4.6 U
Dinoseb	20 U	24 UJ	22 UJ	20 UJ	23 UJ	20 UJ	22 UJ	22 UJ	24 U
Disulfoton	6.8 U	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ	7.6 UJ	8.3 UJ
Ethyl methanesulfonate	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ	14 UJ	15 U
Ethyl Parathion	8.9 U	11 UJ	9.8 UJ	9 UJ	10 UJ	9.1 UJ	9.8 UJ	9.9 UJ	11 U
Famphur	4.1 U	5 UJ	4.6 UJ	4.2 UJ	4.8 UJ	4.2 UJ	4.6 UJ	4.7 UJ	5.1 U
Fluoranthene	2.1 J	4.3 UJ	14 J	21 J	280 J	17 J	2.2 UJ	2.2 UJ	2.4 U
Fluorene	0.89 U	1.1 UJ	0.98 UJ	0.92 UJ	1.3 J	0.91 UJ	0.98 UJ	0.99 UJ	1.1 U
Hexachlorobenzene	7.8 U	9.5 UJ	8.7 UJ	8 UJ	9.1 UJ	8 UJ	8.6 UJ	8.8 UJ	9.5 U
Hexachlorobutadiene	10 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 U
Hexachlorocyclopentadiene	16 U	20 UJ	18 UJ	16 UJ	19 UJ	17 UJ	18 UJ	18 UJ	20 U
Hexachloroethane	8.5 U	10 UJ	9.4 UJ	8.7 UJ	9.9 UJ	8.7 UJ	9.4 UJ	9.6 UJ	10 U
Hexachlorophene	960 R	1200 UJ	1100 UJ	970 UJ	1100 UJ	980 UJ	1100 UJ	1100 UJ	1200 R
Hexachloropropene	8.3 UJ	10 UJ	9.2 UJ	8.5 UJ	9.6 UJ	8.5 UJ	9.1 UJ	9.3 UJ	10 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)									
Indeno[1,2,3-cd]pyrene	1.4 UJ	4.2 UJ	15 J	13 J	92 J	8.6 J	1.5 UJ	1.6 UJ	1.7 UJ
Isophorone	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ	8 UJ	8.7 U
Isosafrole	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ	9.2 UJ	10 U
Methapyrilene	11 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 UJ
Methyl methanesulfonate	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 U
Methyl parathion	3.8 U	4.6 UJ	4.2 UJ	3.9 UJ	4.4 UJ	3.9 UJ	4.2 UJ	4.3 UJ	4.6 U
Naphthalene	0.69 U	0.84 UJ	0.76 UJ	0.7 UJ	0.8 UJ	0.75 J	0.76 UJ	0.78 UJ	0.84 U
Nitrobenzene	8 U	9.6 UJ	8.8 UJ	8.1 UJ	9.2 UJ	8.1 UJ	8.8 UJ	8.9 UJ	9.7 U
N-Nitro-o-toluidine	6.9 U	8.4 UJ	7.6 UJ	7 UJ	8 UJ	7.1 UJ	7.6 UJ	7.8 UJ	8.4 U
N-Nitrosodiethylamine	14 U	17 UJ	15 UJ	14 UJ	16 UJ	14 UJ	15 UJ	16 UJ	17 U
N-Nitrosodimethylamine	11 U	14 UJ	12 U	12 UJ	13 UJ	12 UJ	12 UJ	13 UJ	14 U
N-Nitrosodi-n-butylamine	10 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 UJ
N-Nitrosodi-n-propylamine	7.5 U	9.1 UJ	8.3 UJ	7.6 UJ	8.7 UJ	7.7 UJ	8.3 UJ	8.4 UJ	9.1 U
N-Nitrosodiphenylamine	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ	9.2 UJ	10 U
N-Nitrosomethylethylamine	6.6 U	8 UJ	7.3 UJ	6.7 UJ	7.6 UJ	6.7 UJ	7.2 UJ	7.4 UJ	8 U
N-Nitrosomorpholine	7.6 UJ	9.2 UJ	8.4 UJ	7.7 UJ	8.8 UJ	7.8 UJ	8.4 UJ	8.5 UJ	9.3 UJ
N-Nitrosopiperidine	9.8 UJ	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	11 UJ	11 UJ	12 UJ
N-Nitrosopyrrolidine	10 U	12 UJ	11 U	10 UJ	12 UJ	10 UJ	11 UJ	11 UJ	12 UJ
o,o',o''-Triethylphosphorothioate	18 U	22 UJ	20 UJ	19 UJ	21 UJ	19 UJ	20 UJ	21 UJ	22 U
p-Dimethylamino azobenzene	8.2 U	9.9 UJ	9.1 UJ	8.3 UJ	9.5 UJ	8.4 UJ	9 UJ	9.2 UJ	10 U
Pentachlorobenzene	7.1 U	8.7 UJ	7.9 UJ	7.3 UJ	8.3 UJ	7.3 UJ	7.9 UJ	8 UJ	8.7 U
Pentachloronitrobenzene	6.8 UJ	8.2 UJ	7.5 UJ	6.9 UJ	7.9 UJ	7 UJ	7.5 UJ	7.6 UJ	8.3 U
Pentachlorophenol	9.6 U	12 UJ	11 UJ	9.7 U	11 UJ	9.8 UJ	11 UJ	11 UJ	12 U
Phenacetin	5.4 U	6.6 UJ	6 UJ	5.5 UJ	6.3 UJ	5.5 UJ	6 UJ	6.1 UJ	6.6 U
Phenanthrene	2 U	2.4 UJ	2.2 UJ	5.8 J	34 J	2.4 J	2.2 UJ	2.2 UJ	2.4 U
Phenol	5.5 U	6.7 UJ	6.1 UJ	5.6 UJ	6.4 UJ	5.7 UJ	6.1 UJ	6.2 UJ	6.7 U
Phorate	9.4 U	11 UJ	10 UJ	9.6 UJ	11 UJ	9.7 UJ	10 UJ	11 UJ	12 U
p-Phenylene diamine	180 U	220 UJ	200 UJ	190 UJ	210 UJ	190 UJ	200 UJ	210 UJ	220 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB19	69SB20	69SB21	69SB22	69SB23	69SB24	69SB27	69SB07	69SB07
Sample ID	69SB19-00	69SB20-00	69SB21-00	69SB22-00	69SB23-00	69SB24-00	69SB27-00	69SB07-01	69SB07-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	4/29/2008	4/29/2008
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)									
Pronamide	10 U	13 UJ	11 U	11 UJ	12 UJ	11 UJ	11 UJ	12 UJ	13 U
Pyrene	2.4 J	2.8 J	10 J	20 J	300 J	16 J	2.2 UJ	2.2 UJ	2.4 U
Pyridine	13 U	15 UJ	14 UJ	13 UJ	15 UJ	13 UJ	14 UJ	14 UJ	15 U
Safrole, Total	9.6 U	12 UJ	11 UJ	9.7 UJ	11 UJ	9.8 UJ	11 UJ	11 UJ	12 U
Sulfotepp	10 U	13 UJ	11 UJ	11 UJ	12 UJ	11 UJ	11 UJ	12 UJ	13 U
Thionazin	11 U	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	13 U
Metals (mg/kg)									
Antimony	0.096 UJ	0.18 UJ	0.24 UJ	0.17 UJ	0.35 UJ	0.22 UJ	0.09 UJ	0.096 U	0.098 U
Arsenic	2.7	1.5	3.7	2.5	3.4	3.7	1.4	1.3	0.83
Barium	14	15	26	17	410	66	90	18 J	10 J
Beryllium	0.045 J	0.038 J	0.067 J	0.051 J	0.047 J	0.056 J	0.26	0.18	0.18
Cadmium	0.2 J	0.29 J	0.8 J	0.61 J	1.7 J	0.69 J	0.13 J	0.035 UJ	0.041 UJ
Chromium	44 J	85 J	23 J	60 J	26	26	19	25	9
Cobalt	9.2	17	6	12	6.9	6.7	18	7.9 J	2.4 J
Copper	24	41	46 J	32	24	20	85	72 J	120 J
Lead	2.9 J	4.3 J	7.1 J	9.6	37	17	3.8 J	2.5 J	2.7 J
Mercury	0.012 J	0.022 J	0.026	0.011 J	0.0088 J	0.0087 J	0.056	0.11	0.0057 U
Nickel	13	25	7.1	17	8.6	8.4	8.3	5.7	3.1
Selenium	0.13 J	0.16 U	0.58	0.13 U	0.19 J	0.16 J	0.52 J	0.58	0.97
Silver	0.017 U	0.021 U	0.044 J	0.028 J	0.053 J	0.062 J	0.054 J	0.068 J	0.047 J
Thallium	0.13 U	0.16 U	0.15 U	0.13 U	0.15 U	0.14 U	0.14 U	0.14 U	0.16 U
Tin	4.2 U	5.3 U	5 U	4.5 U	4.9 U	4.6 U	4.8 U	4.6 U	5.2 U
Vanadium	82 J	140 J	120 J	140 J	62	70	210	250	390
Zinc	25	20	13	36	69	22	50	29 J	11 J

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Volatile Organic Compounds (ug/kg)								
1,1,1,2-Tetrachloroethane	0.7 U	0.76 U	0.69 U	0.6 U	0.69 U	0.6 U	0.65 U	24 U
1,1,1-Trichloroethane	0.63 U	0.69 U	0.62 U	0.55 U	0.62 U	0.55 U	0.59 U	22 U
1,1,2,2-Tetrachloroethane	1.5 U	1.7 U	1.5 U	1.3 U	1.5 U	1.3 U	1.4 U	53 U
1,1,2-Trichloroethane	1.3 U	1.4 U	1.3 U	1.1 U	1.3 U	1.1 U	1.2 U	46 U
1,1-Dichloroethane	0.54 U	0.6 U	0.54 U	0.47 U	0.54 U	0.47 U	0.51 U	19 U
1,1-Dichloroethene	0.59 U	0.64 U	0.58 U	0.51 U	0.58 U	0.51 U	0.55 U	21 U
1,2,3-Trichloropropane	1.5 U	1.7 U	1.5 U	1.3 U	1.5 U	1.3 U	1.4 U	53 U
1,2-Dibromo-3-Chloropropane	3 U	3.3 UJ	3 UJ	2.6 UJ	3 UJ	2.6 UJ	2.8 U	110 U
1,2-Dichloroethane	1.1 U	1.2 UJ	1.1 UJ	0.94 UJ	1.1 UJ	0.94 UJ	1 U	38 U
1,2-Dichloropropane	1.2 U	1.3 U	1.2 U	1 U	1.2 U	1 U	1.1 U	42 U
2-Butanone (MEK)	2.9 U	8.1 UJ	4.5 UJ	2.5 UJ	2.9 UJ	2.5 UJ	2.7 U	100 U
2-Chloro-1,3-butadiene	0.62 UJ	0.68 UJ	0.61 UJ	0.54 UJ	0.61 UJ	0.54 UJ	0.58 U	22 UJ
2-Hexanone	2.3 U	6.3 J	2.3 UJ	2 UJ	2.3 UJ	2 UJ	2.1 U	80 U
3-Chloro-1-propene	1.6 R	1.8 R	1.6 U	1.4 U	1.6 U	1.4 U	1.5 UJ	57 UJ
4-Methyl-2-pentanone (MIBK)	3.2 U	3.7 J	3.1 U	2.7 U	3.1 U	2.7 U	3 U	110 U
Acetone	28 J	16 J	26 J	4.1 UJ	10 J	4.1 UJ	47 J	520 R
Acetonitrile	49 UJ	54 UJ	48 U	42 U	48 U	42 U	46 U	1700 UJ
Acrolein	21 R	23 R	20 R	18 R	20 R	18 R	19 R	730 R
Acrylonitrile	25 UJ	27 UJ	25 UJ	22 UJ	25 UJ	22 UJ	23 U	880 UJ
Benzene	0.86 U	0.94 U	0.85 U	0.74 U	0.85 U	0.74 U	0.8 U	30 U
Bromoform	1.2 U	1.3 U	1.2 U	1 U	1.2 U	1 U	1.1 U	42 U
Bromomethane	1.7 UJ	1.9 UJ	1.7 UJ	1.5 UJ	1.7 UJ	1.5 UJ	1.6 U	61 U
Carbon disulfide	0.55 U	0.61 U	0.55 U	0.48 U	0.55 U	0.48 U	0.59 J	19 U
Carbon tetrachloride	1.1 U	1.2 U	1.1 U	0.94 U	1.1 U	0.94 U	1 U	38 U
Chlorobenzene	0.79 U	0.87 U	0.79 U	0.69 U	0.78 U	0.69 U	0.74 U	28 U
Chlorodibromomethane	0.54 U	0.6 U	0.54 U	0.47 U	0.54 U	0.47 U	0.51 U	19 U
Chloroethane	1.3 U	1.4 U	1.3 U	1.1 U	1.3 U	1.1 U	1.2 U	46 U
Chloroform	0.54 U	0.6 U	0.54 U	0.47 U	0.54 U	0.47 U	0.51 U	19 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Volatile Organic Compounds (ug/kg) (Cont)								
Chloromethane	0.77 U	0.85 U	0.76 U	0.67 U	0.76 U	0.67 U	0.72 U	27 U
cis-1,3-Dichloropropene	0.95 U	1 U	0.94 U	0.82 U	0.93 U	0.82 U	0.89 U	33 U
Dibromomethane	1.3 U	1.4 U	1.3 U	1.1 U	1.3 U	1.1 U	1.2 U	46 U
Dichlorobromomethane	0.9 U	0.99 U	0.89 U	0.78 U	0.89 U	0.78 U	0.84 U	32 U
Dichlorodifluoromethane	0.97 U	1.1 U	0.96 U	0.84 U	0.95 U	0.84 U	0.91 U	34 U
Ethyl methacrylate	2.4 U	2.6 UJ	2.4 UJ	2.1 UJ	2.4 UJ	2.1 UJ	2.2 U	84 U
Ethylbenzene	0.82 U	0.89 U	0.81 U	0.71 U	0.8 U	0.71 U	0.76 U	29 U
Ethylene Dibromide	1.6 U	1.8 U	1.6 U	1.4 U	1.6 U	1.4 U	1.5 U	57 U
Iodomethane	1.1 U	1.2 UJ	1.1 UJ	0.94 UJ	1.1 UJ	0.94 UJ	1 UJ	38 U
Isobutyl alcohol	75 R	82 R	74 R	65 R	74 R	65 R	70 R	2600 R
Methacrylonitrile	26 U	29 U	26 UJ	23 UJ	26 UJ	23 UJ	24 UJ	920 U
Methyl methacrylate	4 U	4.4 U	4 UJ	3.5 UJ	4 UJ	3.5 UJ	3.8 UJ	140 U
Methylene Chloride	1.1 U	1.2 U	1.1 U	0.94 U	1.1 U	0.94 U	1 U	38 U
Pentachloroethane	2.4 U	2.6 U	2.4 U	2.1 U	2.4 U	2.1 U	2.2 UJ	84 UJ
Propionitrile	23 UJ	25 U	23 U	20 U	23 U	20 U	21 U	800 UJ
Styrene	0.72 U	0.79 U	0.71 U	0.62 U	0.71 U	0.62 U	0.67 U	25 U
Tetrachloroethene	0.79 U	0.87 U	0.79 U	0.69 U	0.78 U	0.69 U	0.74 U	28 U
Toluene	0.86 U	0.94 U	0.85 U	0.74 U	0.85 U	0.74 U	0.8 U	30 U
trans-1,2-Dichloroethene	1.1 U	1.2 U	1 U	0.91 U	1 U	0.91 U	0.99 U	37 U
trans-1,3-Dichloropropene	0.95 U	1 U	0.94 U	0.82 U	0.93 U	0.82 U	0.89 U	33 U
trans-1,4-Dichloro-2-butene	3.4 U	3.7 U	3.3 U	2.9 U	3.3 U	2.9 U	3.2 UJ	120 U
Trichloroethene	1.1 U	1.2 U	1.1 U	0.94 U	1.1 U	0.94 U	1 U	38 U
Trichlorofluoromethane	1.6 U	1.8 U	1.6 U	1.4 U	1.6 U	1.4 U	1.5 U	57 U
Vinyl acetate	1.6 UJ	1.8 UJ	1.6 UJ	1.4 UJ	1.6 UJ	1.4 UJ	1.5 U	57 U
Vinyl chloride	0.63 U	0.69 U	0.62 U	0.55 U	0.62 U	0.55 U	0.59 U	22 U
Xylenes, Total	2.5 U	2.7 U	2.5 U	2.2 U	2.5 U	2.2 U	2.3 U	88 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Semivolatile Organic Compounds (ug/kg)								
1,1'-Biphenyl	9.5 U	11 U	9.5 U	8.9 U	9.6 U	9.1 U	9.1 UJ	9 UJ
1,2,4,5-Tetrachlorobenzene	8.1 U	8.9 U	8.1 U	7.6 U	8.2 U	7.7 U	7.8 UJ	7.7 UJ
1,2,4-Trichlorobenzene	9.5 U	11 U	9.5 U	8.9 U	9.6 U	9.1 U	9.1 UJ	9 UJ
1,2-Dichlorobenzene	9 U	9.9 U	9 U	8.4 U	9.1 U	8.6 U	8.6 UJ	8.6 UJ
1,3,5-Trinitrobenzene	22 U	24 U	22 U	20 U	22 U	21 U	21 UJ	21 UJ
1,3-Dichlorobenzene	7.7 U	8.5 U	7.7 U	7.2 U	7.8 U	7.3 U	7.4 UJ	7.3 UJ
1,3-Dinitrobenzene	5 U	5.5 U	5 U	4.7 U	5.1 U	4.8 U	4.8 UJ	4.8 UJ
1,4-Dichlorobenzene	8 U	8.8 U	8 U	7.5 U	8 U	7.6 U	7.6 UJ	7.6 UJ
1,4-Dioxane	10 U	11 U	10 U	9.6 U	10 U	9.8 U	9.9 UJ	9.8 UJ
1,4-Naphthoquinone	5 U	5.5 U	5 U	4.7 U	5.1 U	4.8 U	4.8 UJ	4.8 UJ
2,2'-oxybis[1-chloropropane]	8.1 U	8.9 U	8.1 U	7.6 U	8.2 U	7.7 U	7.8 UJ	7.7 UJ
2,3,4,6-Tetrachlorophenol	5.4 U	6 U	5.4 U	5.1 U	5.4 U	5.1 U	5.2 UJ	5.1 UJ
2,4,5-Trichlorophenol	8.8 U	9.7 U	8.7 U	8.2 U	8.8 U	8.3 U	8.4 UJ	8.3 UJ
2,4,6-Trichlorophenol	10 U	11 U	10 U	9.5 U	10 U	9.7 U	9.7 UJ	9.6 UJ
2,4-Dichlorophenol	10 U	11 U	10 U	9.8 U	10 U	9.9 U	10 UJ	9.9 UJ
2,4-Dimethylphenol	22 U	24 U	22 U	20 U	22 U	21 U	21 UJ	21 UJ
2,4-Dinitrophenol	110 U	120 UJ	110 U	100 UJ	110 UJ	100 U	100 UJ	100 UJ
2,4-Dinitrotoluene	7.6 U	8.4 U	7.6 U	7.1 U	7.6 U	7.2 U	7.3 UJ	7.2 UJ
2,6-Dichlorophenol	8.2 U	9.1 U	8.2 U	7.7 U	8.3 U	7.8 U	7.9 UJ	7.8 UJ
2,6-Dinitrotoluene	8 U	8.8 U	8 U	7.5 U	8 U	7.6 U	7.6 UJ	7.6 UJ
2-Acetylaminofluorene	6.6 U	7.2 U	6.6 U	6.1 U	6.6 U	6.2 U	6.3 UJ	6.2 UJ
2-Chloronaphthalene	8 U	8.8 U	8 U	7.5 U	8 U	7.6 U	7.6 UJ	7.6 UJ
2-Chlorophenol	8.5 U	9.4 U	8.5 U	7.9 U	8.6 U	8.1 U	8.1 UJ	8.1 UJ
2-Methylnaphthalene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
2-Methylphenol	10 U	11 U	10 U	9.8 U	10 U	9.9 U	10 UJ	9.9 UJ
2-Naphthylamine	26 UJ	28 UJ	26 UJ	24 UJ	26 UJ	24 UJ	25 UJ	24 UJ
2-Nitroaniline	8.4 U	9.2 U	8.4 U	7.8 U	8.4 U	8 U	8 UJ	7.9 UJ
2-Nitrophenol	9.4 U	10 U	9.4 U	8.8 U	9.5 U	8.9 U	9 UJ	8.9 UJ

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)								
2-Picoline	15 U	17 U	15 U	14 U	16 U	15 U	15 UJ	15 UJ
2-Toluidine	12 U	13 U	12 U	11 U	12 U	11 U	11 UJ	11 UJ
3 & 4 Methylphenol	9.4 U	10 U	9.4 U	8.8 U	9.5 U	8.9 U	9 UJ	8.9 UJ
3,3'-Dichlorobenzidine	12 U	13 U	12 U	11 UJ	12 UJ	11 U	11 UJ	11 UJ
3,3'-Dimethylbenzidine	230 UJ	260 UJ	230 UJ	220 UJ	230 U	220 UJ	220 UJ	220 UJ
3-Methylcholanthrene	7.9 U	8.7 U	7.8 U	7.3 U	7.9 UJ	7.5 U	7.5 UJ	7.5 UJ
3-Nitroaniline	5.8 U	6.4 U	5.8 U	5.4 U	5.8 U	5.5 U	5.6 UJ	5.5 UJ
4,6-Dinitro-2-methylphenol	7.5 UJ	8.2 UJ	7.5 UJ	7 UJ	7.5 UJ	7.1 UJ	7.2 UJ	7.1 UJ
4-Aminobiphenyl	17 U	18 U	17 U	16 U	17 U	16 U	16 UJ	16 UJ
4-Bromophenyl phenyl ether	9.1 U	10 U	9.1 U	8.6 U	9.2 U	8.7 U	8.8 UJ	8.7 UJ
4-Chloro-3-methylphenol	9.7 U	11 U	9.6 U	9 U	9.7 U	9.2 U	9.3 UJ	9.2 UJ
4-Chloroaniline	7.7 U	8.5 U	7.7 U	7.2 U	7.8 U	7.3 U	7.4 UJ	7.3 UJ
4-Chlorophenyl phenyl ether	8 U	8.8 U	8 U	7.5 U	8 U	7.6 U	7.6 UJ	7.6 UJ
4-Nitroaniline	9.9 U	11 U	9.9 U	9.3 U	10 U	9.4 U	9.5 UJ	9.4 UJ
4-Nitrophenol	42 UJ	47 U	42 UJ	40 U	43 U	40 UJ	41 UJ	40 UJ
4-Nitroquinoline-1-oxide	14 R	16 R	14 R	13 R	14 R	13 R	14 R	13 R
7,12-Dimethylbenz(a)anthracene	12 U	13 U	12 U	11 UJ	12 UJ	11 U	11 UJ	11 UJ
Acenaphthene	0.73 U	0.81 U	0.73 U	0.69 U	0.74 U	0.7 U	0.7 UJ	0.7 UJ
Acenaphthylene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
Acetophenone	11 U	12 U	11 U	10 U	11 U	11 U	11 UJ	11 UJ
alpha,alpha-Dimethyl phenethylamine	76 U	84 U	76 U	71 U	76 U	72 U	73 UJ	72 UJ
Aniline	8.1 U	8.9 U	8.1 U	7.6 U	8.2 U	7.7 U	7.8 UJ	7.7 UJ
Anthracene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
Aramite, Total	14 UJ	16 UJ	14 UJ	13 UJ	14 UJ	13 UJ	14 UJ	13 UJ
Benzo[a]anthracene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
Benzo[a]pyrene	0.85 U	0.94 U	0.85 U	0.79 UJ	0.86 UJ	0.81 U	0.81 UJ	0.81 UJ
Benzo[b]fluoranthene	0.98 U	1.1 U	0.98 U	0.92 UJ	0.98 UJ	0.93 U	0.94 UJ	0.93 UJ
Benzo[g,h,i]perylene	2.2 U	2.4 U	2.2 U	2 UJ	2.2 UJ	2.1 U	2.1 UJ	2.1 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)								
Benzo[k]fluoranthene	1.3 U	1.4 U	1.3 U	1.2 UJ	1.3 UJ	1.2 U	1.2 UJ	1.2 UJ
Benzyl alcohol	10 U	11 U	10 U	9.6 U	10 U	9.8 U	9.9 UJ	9.8 UJ
Bis(2-chloroethoxy)methane	8.8 U	9.7 U	8.7 U	8.2 U	8.8 U	8.3 U	8.4 UJ	8.3 UJ
Bis(2-chloroethyl)ether	7.3 U	8.1 U	7.3 U	6.9 U	7.4 U	7 U	7 UJ	7 UJ
Bis(2-ethylhexyl) phthalate	18 U	31 U	32 U	24 U	20 U	29 U	22 UJ	30 UJ
Butyl benzyl phthalate	9.3 U	10 U	9.2 U	8.7 U	9.3 U	8.8 U	8.9 UJ	8.8 UJ
Chrysene	0.79 U	0.87 U	0.78 U	0.73 U	0.79 UJ	0.75 U	0.75 UJ	0.75 UJ
Diallate	12 U	14 U	12 U	12 U	12 U	12 U	12 UJ	12 UJ
Dibenz(a,h)anthracene	0.76 U	0.84 U	0.76 U	0.71 UJ	0.76 UJ	0.72 U	0.73 UJ	0.72 UJ
Dibenzofuran	5.4 U	6 U	5.4 U	5.1 U	5.4 U	5.1 U	5.2 UJ	5.1 UJ
Diethyl phthalate	14 U	16 U	14 U	13 U	14 U	13 U	14 UJ	13 UJ
Dimethoate	4.2 U	4.7 U	4.2 U	4 U	4.3 U	4 U	4.1 UJ	4 UJ
Dimethyl phthalate	8.2 U	9.1 U	8.2 U	7.7 U	8.3 U	7.8 U	7.9 UJ	7.8 UJ
Di-n-butyl phthalate	32 U	35 U	32 U	30 U	32 U	31 U	31 UJ	31 UJ
Di-n-octyl phthalate	4.2 U	4.7 U	4.2 U	4 UJ	4.3 UJ	4 U	4.1 UJ	4 UJ
Dinoseb	22 U	24 U	22 U	20 U	22 U	21 U	21 UJ	21 UJ
Disulfoton	7.6 U	8.4 UJ	7.6 U	7.1 UJ	7.6 UJ	7.2 U	7.3 UJ	7.2 UJ
Ethyl methanesulfonate	14 U	16 U	14 U	13 U	14 U	13 U	14 UJ	13 UJ
Ethyl Parathion	9.9 U	11 U	9.9 U	9.3 U	10 U	9.4 U	9.5 UJ	9.4 UJ
Famphur	4.6 U	5.1 U	4.6 U	4.3 U	4.7 U	4.4 U	4.4 UJ	4.4 UJ
Fluoranthene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
Fluorene	0.99 U	1.1 U	0.99 U	0.93 U	1 U	0.94 U	0.95 UJ	0.94 UJ
Hexachlorobenzene	8.8 U	9.7 U	8.7 U	8.2 U	8.8 U	8.3 U	8.4 UJ	8.3 UJ
Hexachlorobutadiene	12 U	13 U	12 U	11 U	12 U	11 U	11 UJ	11 UJ
Hexachlorocyclopentadiene	18 U	20 U	18 U	17 U	18 U	17 U	17 UJ	17 UJ
Hexachloroethane	9.5 U	11 U	9.5 U	8.9 U	9.6 U	9.1 U	9.1 UJ	9 UJ
Hexachlorophene	1100 R	1200 R	1100 R	1000 R	1100 R	1000 R	1000 UJ	1000 UJ
Hexachloropropene	9.3 UJ	10 UJ	9.2 UJ	8.7 UJ	9.3 UJ	8.8 UJ	8.9 UJ	8.8 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)								
Indeno[1,2,3-cd]pyrene	1.5 U	1.7 UJ	1.5 U	1.4 UJ	1.6 UJ	1.5 U	1.5 UJ	1.5 UJ
Isophorone	8 U	8.8 U	8 U	7.5 UJ	8 UJ	7.6 U	7.6 UJ	7.6 UJ
Isosafrole	9.1 U	10 U	9.1 U	8.6 U	9.2 U	8.7 U	8.8 UJ	8.7 UJ
Methapyrilene	12 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	11 UJ	11 UJ
Methyl methanesulfonate	12 U	13 U	12 U	11 U	12 U	11 U	11 UJ	11 UJ
Methyl parathion	4.2 U	4.7 U	4.2 U	4 U	4.3 U	4 U	4.1 UJ	4 UJ
Naphthalene	0.77 U	0.85 U	0.77 U	0.72 U	0.78 U	0.73 U	0.74 UJ	0.73 UJ
Nitrobenzene	8.9 U	9.8 U	8.9 U	8.3 U	8.9 U	8.4 U	8.5 UJ	8.4 UJ
N-Nitro-o-toluidine	7.7 U	8.5 U	7.7 U	7.2 U	7.8 U	7.3 U	7.4 UJ	7.3 UJ
N-Nitrosodiethylamine	15 U	17 U	15 U	14 U	16 U	15 U	15 UJ	15 UJ
N-Nitrosodimethylamine	13 U	14 U	13 U	12 U	13 U	12 U	12 UJ	12 UJ
N-Nitrosodi-n-butylamine	12 UJ	13 UJ	12 UJ	11 UJ	12 UJ	11 UJ	11 UJ	11 UJ
N-Nitrosodi-n-propylamine	8.4 U	9.2 U	8.4 U	7.8 U	8.4 U	8 U	8 UJ	7.9 UJ
N-Nitrosodiphenylamine	9.1 U	10 U	9.1 U	8.6 U	9.2 U	8.7 U	8.8 UJ	8.7 UJ
N-Nitrosomethylethylamine	7.3 U	8.1 U	7.3 U	6.9 U	7.4 U	7 U	7 UJ	7 UJ
N-Nitrosomorpholine	8.5 UJ	9.4 UJ	8.5 UJ	7.9 UJ	8.6 UJ	8.1 UJ	8.1 UJ	8.1 UJ
N-Nitrosopiperidine	11 UJ	12 UJ	11 UJ	10 UJ	11 UJ	10 UJ	10 UJ	10 UJ
N-Nitrosopyrrolidine	11 U	13 UJ	11 U	11 UJ	12 UJ	11 U	11 UJ	11 UJ
o,o',o''-Triethylphosphorothioate	21 U	23 U	21 U	19 U	21 U	20 U	20 UJ	20 UJ
p-Dimethylamino azobenzene	9.1 U	10 U	9.1 U	8.6 U	9.2 U	8.7 U	8.8 UJ	8.7 UJ
Pentachlorobenzene	8 U	8.8 U	8 U	7.5 U	8 U	7.6 U	7.6 UJ	7.6 UJ
Pentachloronitrobenzene	7.6 U	8.4 U	7.6 U	7.1 U	7.6 U	7.2 U	7.3 UJ	7.2 UJ
Pentachlorophenol	11 U	12 U	11 U	10 U	11 U	10 U	10 UJ	10 UJ
Phenacetin	6.1 U	6.7 U	6 U	5.7 U	6.1 U	5.7 U	5.8 UJ	5.7 UJ
Phenanthrene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
Phenol	6.2 U	6.8 U	6.2 U	5.8 U	6.2 U	5.9 U	5.9 UJ	5.9 UJ
Phorate	11 U	12 U	11 U	9.9 U	11 U	10 U	10 UJ	10 UJ
p-Phenylene diamine	210 U	230 U	210 U	190 U	210 U	200 U	200 UJ	200 UJ

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SUMMARY OF ANALYTICAL RESULTS - 2008 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB08	69SB08	69SB11	69SB11	69SB12	69SB12	69SB27	69SB27
Sample ID	69SB08-01	69SB08-05	69SB11-01	69SB11-05	69SB12-01	69SB12-05	69SB27-01	69SB27-05
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	5/1/2008
Depth Range	1-3	9-11	1-3	9-11	1-3	9-11	1-3	9-11
Semivolatile Organic Compounds (ug/kg) (Cont)								
Pronamide	12 U	13 U	12 U	11 U	12 U	11 U	11 UJ	11 UJ
Pyrene	2.2 U	2.4 U	2.2 U	2 U	2.2 U	2.1 U	2.1 UJ	2.1 UJ
Pyridine	14 U	16 U	14 U	13 U	14 U	13 U	14 UJ	13 UJ
Safrole, Total	11 U	12 U	11 U	10 U	11 U	10 U	10 UJ	10 UJ
Sulfotepp	12 U	13 U	12 U	11 U	12 U	11 U	11 UJ	11 UJ
Thionazin	12 U	13 U	12 U	11 U	12 U	11 U	11 UJ	11 UJ
Metals (mg/kg)								
Antimony	0.096 U	0.1 U	0.089 U	0.1 U	0.094 U	0.083 U	0.085 UJ	0.11 UJ
Arsenic	2	0.93	0.84	1.5	1.3	1.1	0.85	2.2
Barium	73 J	10 J	120 J	64 J	96 J	78 J	64 J	11 J
Beryllium	0.16	0.26	0.27	0.26	0.26	0.28	0.26	0.35
Cadmium	0.051 J	0.041 UJ	0.037 UJ	0.034 UJ	0.2 J	0.046 J	0.035 UJ	0.036 UJ
Chromium	29	12 J	18	21	17	18	20	20
Cobalt	8.1 J	5 J	17	13	27	16	13	3.3 J
Copper	87 J	240 J	97 J	76 J	110 J	79 J	88 J	270
Lead	3.4 J	2.9 J	2.8 J	2.9 J	3 J	2.8 J	2.7 J	4.3 J
Mercury	0.06	0.0086 J	0.024	0.059	0.049	0.03	0.067	0.0081 J
Nickel	4.6	4	10	8	11	9	9.6	2.7
Selenium	1.2	1.1	0.17 J	0.25 J	0.32 J	0.23 J	0.37 J	1.2
Silver	0.03 J	0.071 J	0.053 U	0.042 U	0.084 U	0.04 U	0.057 J	0.088 J
Thallium	0.15 U	0.16 U	0.14 U	0.13 U	0.15 U	0.13 U	0.14 U	0.14 U
Tin	5 U	5.3 U	4.7 U	4.3 U	5 U	4.4 U	4.6 U	4.7 U
Vanadium	380	460 J	170	230	240	230	180	430
Zinc	26 J	16 J	76 J	43 J	82 J	45 J	64 J	14 J

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SUMMARY OF ANALYTICAL RESULTS - 2008 GROUNDWATER
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L)							
1,1,1,2-Tetrachloroethane	0.29 U	0.29 U	0.29 U	0.29 UJ	0.29 UJ	0.29 U	0.29 U
1,1,1-Trichloroethane	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ	0.39 U	0.39 U
1,1,2,2-Tetrachloroethane	0.26 U	0.26 U	0.26 U	0.26 UJ	0.26 UJ	0.26 U	0.26 U
1,1,2-Trichloroethane	0.51 U	0.51 U	0.51 U	0.51 UJ	0.51 UJ	0.51 U	0.51 U
1,1-Dichloroethane	0.32 U	0.32 U	0.32 U	0.32 UJ	0.32 UJ	0.32 U	0.32 U
1,1-Dichloroethene	0.36 U	0.36 U	0.36 U	0.36 UJ	0.36 UJ	0.36 U	0.36 U
1,2,3-Trichloropropane	0.42 U	0.42 U	0.42 U	0.42 UJ	0.42 UJ	0.42 U	0.42 U
1,2-Dibromo-3-Chloropropane	0.48 U	0.48 U	0.48 U	0.48 UJ	0.48 UJ	0.48 U	0.48 U
1,2-Dichloroethane	0.31 U	0.31 U	0.31 U	0.31 UJ	0.31 UJ	0.31 U	0.31 U
1,2-Dichloropropane	0.36 U	0.36 U	0.36 U	0.36 UJ	0.36 UJ	0.36 U	0.36 U
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.6 UJ	0.6 UJ	0.6 U	0.6 U
2-Chloro-1,3-butadiene	0.35 UJ	0.35 UJ	0.35 UJ	0.35 UJ	0.35 UJ	0.35 U	0.35 U
2-Hexanone	0.68 U	0.68 U	0.68 U	0.68 UJ	0.68 UJ	1.1 J	0.68 U
3-Chloro-1-propene	0.46 U	0.46 U	0.46 U	0.46 UJ	0.46 UJ	0.46 U	0.46 U
4-Methyl-2-pentanone (MIBK)	0.6 U	0.6 U	0.6 U	0.6 UJ	0.6 UJ	0.6 U	0.6 U
Acetone	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	15 J
Acetonitrile	15 UJ	15 UJ	15 UJ	15 UJ	15 UJ	15 U	15 U
Acrolein	18 U	18 U	18 U	18 UJ	18 UJ	18 R	18 R
Acrylonitrile	3.8 U	3.8 U	3.8 U	3.8 UJ	3.8 UJ	3.8 UJ	3.8 UJ
Benzene	0.32 U	0.32 U	0.32 U	0.32 UJ	0.32 UJ	0.32 U	0.32 U
Bromoform	0.41 U	0.41 U	0.41 U	0.41 UJ	0.41 UJ	0.41 U	0.41 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Carbon disulfide	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 U	0.17 U
Carbon tetrachloride	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 UJ	0.27 U	0.27 U
Chlorobenzene	0.34 U	0.34 U	0.34 U	0.34 UJ	0.34 UJ	0.34 U	0.34 U
Chlorodibromomethane	0.3 U	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 U	0.3 U
Chloroethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U
Chloroform	0.29 U	0.29 U	0.29 U	0.29 UJ	0.29 UJ	0.29 U	0.29 U
Chloromethane	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	1.5 J	0.28 U	0.28 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 GROUNDWATER
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Volatile Organic Compounds (ug/L) (Cont)							
cis-1,3-Dichloropropene	0.37 U	0.37 U	0.37 U	0.37 UJ	0.37 UJ	0.37 U	0.37 U
Dibromomethane	0.29 U	0.29 U	0.29 U	0.29 UJ	0.29 UJ	0.29 U	0.29 U
Dichlorobromomethane	0.34 U	0.34 U	0.34 U	0.34 UJ	0.34 UJ	0.34 U	0.34 U
Dichlorodifluoromethane	0.33 U	0.33 U	0.33 U	0.33 UJ	0.33 UJ	0.33 UJ	0.33 UJ
Ethyl methacrylate	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U
Ethylbenzene	0.3 U	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 U	0.3 U
Ethylene Dibromide	0.3 U	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 U	0.3 U
Iodomethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U
Isobutyl alcohol	19 R	19 R	19 R	19 UJ	19 UJ	19 U	19 U
Methacrylonitrile	6.6 U	6.6 U	6.6 U	6.6 UJ	6.6 UJ	6.6 U	6.6 U
Methyl methacrylate	0.38 UJ	0.38 UJ	0.38 UJ	0.38 UJ	0.38 UJ	0.38 U	0.38 U
Methylene Chloride	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U
Pentachloroethane	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 U	9.2 U	9.2 U	9.2 UJ	9.2 UJ	9.2 U	9.2 U
Styrene	0.36 U	0.36 U	0.36 U	0.36 UJ	0.36 UJ	0.36 U	0.36 U
Tetrachloroethene	0.28 U	0.28 U	0.28 U	0.28 UJ	0.28 UJ	0.28 U	0.28 U
Toluene	0.31 U	0.31 U	0.31 U	0.31 UJ	0.31 UJ	0.31 U	0.31 U
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 U	0.3 U
trans-1,3-Dichloropropene	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 UJ	0.27 UJ	0.27 UJ
trans-1,4-Dichloro-2-butene	0.83 UJ	0.83 UJ	0.83 UJ	0.83 UJ	0.83 UJ	0.83 U	0.83 U
Trichloroethene	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 U	0.4 U
Trichlorofluoromethane	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 U	0.29 U
Vinyl acetate	0.62 U	0.62 U	0.62 U	0.62 UJ	0.62 UJ	0.62 UJ	0.62 UJ
Vinyl chloride	0.2 U	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Xylenes, Total	0.87 U	0.87 U	0.87 U	0.87 UJ	0.87 UJ	0.87 U	0.87 U

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SUMMARY OF ANALYTICAL RESULTS - 2008 GROUNDWATER
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L)							
1,1'-Biphenyl	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 U	0.17 U
1,2,4,5-Tetrachlorobenzene	0.23 U	0.23 U	0.23 U	0.23 UJ	0.23 UJ	0.23 U	0.23 U
1,2,4-Trichlorobenzene	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 UJ	0.13 U	0.13 U
1,2-Dichlorobenzene	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 UJ	0.13 U	0.13 U
1,3,5-Trinitrobenzene	0.2 U	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
1,3-Dichlorobenzene	0.12 U	0.12 U	0.12 U	0.12 UJ	0.12 UJ	0.12 U	0.12 U
1,3-Dinitrobenzene	0.22 U	0.22 U	0.22 U	0.22 UJ	0.22 UJ	0.22 U	0.22 U
1,4-Dichlorobenzene	0.12 U	0.12 U	0.12 U	0.12 UJ	0.12 UJ	0.12 U	0.12 U
1,4-Dioxane	0.49 U	0.49 U	0.49 U	0.49 UJ	0.49 UJ	0.49 U	0.49 U
1,4-Naphthoquinone	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U
2,2'-oxybis[1-chloropropane]	0.097 U	0.097 U	0.097 U	0.097 UJ	0.097 UJ	0.097 U	0.097 U
2,3,4,6-Tetrachlorophenol	0.29 U	0.29 U	0.29 U	0.29 UJ	0.29 UJ	0.29 U	0.29 U
2,4,5-Trichlorophenol	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U
2,4,6-Trichlorophenol	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U
2,4-Dichlorophenol	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
2,4-Dimethylphenol	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 U	0.4 U
2,4-Dinitrophenol	2.4 UJ	2.4 U	2.4 UJ	2.4 UJ	2.4 UJ	2.4 U	2.4 U
2,4-Dinitrotoluene	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ
2,6-Dichlorophenol	0.21 U	0.21 U	0.21 U	0.21 UJ	0.21 UJ	0.21 U	0.21 U
2,6-Dinitrotoluene	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
2-Acetylaminofluorene	0.19 UJ	0.19 U	0.19 UJ	0.19 UJ	0.19 UJ	0.19 U	0.19 U
2-Chloronaphthalene	0.12 U	0.12 U	0.12 U	0.12 UJ	0.12 UJ	0.12 U	0.12 U
2-Chlorophenol	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
2-Methylnaphthalene	0.022 U	0.022 U	0.022 U	0.022 UJ	0.022 UJ	0.022 U	0.022 U
2-Methylphenol	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
2-Naphthylamine	1.1 U	1.1 U	1.1 U	1.1 UJ	1.1 UJ	1.1 U	1.1 U
2-Nitroaniline	0.14 U	0.14 U	0.14 U	0.14 UJ	0.14 UJ	0.14 U	0.14 U
2-Nitrophenol	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 U	0.17 U
2-Picoline	0.57 U	0.57 U	0.57 U	0.57 UJ	0.57 UJ	0.57 U	0.57 U

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L) (Cont)							
2-Toluidine	0.32 U	0.32 U	0.32 U	0.32 UJ	0.32 UJ	0.32 U	0.32 U
3 & 4 Methylphenol	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	2.1
3,3'-Dichlorobenzidine	3.7 U	3.7 UJ	3.7 U	3.7 UJ	3.7 UJ	3.7 U	3.7 U
3,3'-Dimethylbenzidine	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ	3.7 U	3.7 U
3-Methylcholanthrene	0.2 U	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
3-Nitroaniline	0.28 U	0.28 U	0.28 U	0.28 UJ	0.28 UJ	0.28 U	0.28 U
4,6-Dinitro-2-methylphenol	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ
4-Aminobiphenyl	0.68 UJ	0.68 U	0.68 UJ	0.68 UJ	0.68 UJ	0.68 U	0.68 U
4-Bromophenyl phenyl ether	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U
4-Chloro-3-methylphenol	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U
4-Chloroaniline	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 U	0.4 U
4-Chlorophenyl phenyl ether	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
4-Nitroaniline	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ	0.26 U	0.26 U
4-Nitrophenol	0.18 U	0.18 U	0.18 U	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ
4-Nitroquinoline-1-oxide	0.26 R	0.26 R	0.26 R	0.26 R	0.26 R	0.26 R	0.26 R
7,12-Dimethylbenz(a)anthracene	0.2 U	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Acenaphthene	0.019 U	0.019 U	0.019 U	0.019 UJ	0.019 UJ	0.019 U	0.11 J
Acenaphthylene	0.049 U	0.049 U	0.049 U	0.049 UJ	0.049 UJ	0.049 U	0.049 U
Acetophenone	0.19 U	0.19 U	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U
alpha,alpha-Dimethyl phenethylamine	1.3 UJ	1.3 U	1.3 UJ	1.3 UJ	1.3 UJ	1.3 U	1.3 U
Aniline	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 U	0.4 U
Anthracene	0.021 U	0.021 U	0.021 U	0.021 UJ	0.021 UJ	0.021 U	0.021 U
Aramite, Total	0.49 UJ	0.49 U	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ
Benzo[a]anthracene	0.025 U	0.025 U	0.025 U	0.025 UJ	0.025 UJ	0.025 U	0.025 U
Benzo[a]pyrene	0.024 U	0.024 U	0.024 U	0.024 UJ	0.024 UJ	0.024 U	0.024 U
Benzo[b]fluoranthene	0.036 U	0.036 U	0.036 U	0.036 UJ	0.036 UJ	0.036 U	0.036 U
Benzo[g,h,i]perylene	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ
Benzo[k]fluoranthene	0.019 U	0.019 U	0.019 U	0.019 UJ	0.019 UJ	0.019 U	0.019 U
Benzyl alcohol	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L) (Cont)							
Bis(2-chloroethoxy)methane	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
Bis(2-chloroethyl)ether	0.14 U	0.14 U	0.14 U	0.14 UJ	0.14 UJ	0.14 U	0.14 U
Bis(2-ethylhexyl) phthalate	0.34 U	0.34 U	0.34 U	0.34 UJ	0.6 J	0.61 U	0.78 U
Butyl benzyl phthalate	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 U	0.17 U
Chrysene	0.027 U	0.027 U	0.027 U	0.027 UJ	0.027 UJ	0.027 U	0.027 U
Diallate	0.19 U	0.19 U	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U
Dibenz(a,h)anthracene	0.023 U	0.023 U	0.023 U	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ
Dibenzofuran	0.097 U	0.097 U	0.097 U	0.097 UJ	0.097 UJ	0.097 U	0.36 J
Diethyl phthalate	0.18 U	0.18 U	0.18 U	0.18 UJ	0.18 UJ	0.18 U	0.18 U
Dimethoate	0.49 U	0.49 U	0.49 U	0.49 UJ	0.49 UJ	0.49 U	0.49 U
Dimethyl phthalate	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 U	0.17 U
Di-n-butyl phthalate	0.26 U	0.21 U	0.19 U	0.44 UJ	0.31 UJ	0.11 U	0.72 U
Di-n-octyl phthalate	0.097 U	0.097 U	0.097 U	0.097 UJ	0.097 UJ	0.097 U	0.097 U
Dinoseb	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 U	0.49 U
Disulfoton	0.17 UJ	0.17 U	0.17 UJ	0.17 UJ	0.17 UJ	0.17 U	0.17 U
Ethyl methanesulfonate	0.23 U	0.23 U	0.23 U	0.23 UJ	0.23 UJ	0.23 U	0.23 U
Ethyl Parathion	0.19 U	0.19 U	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U
Famphur	0.32 U	0.32 U	0.32 U	0.32 UJ	0.32 UJ	0.32 U	0.32 U
Fluoranthene	0.049 U	0.049 U	0.049 U	0.049 UJ	0.049 UJ	0.049 U	0.049 U
Fluorene	0.018 U	0.018 U	0.018 U	0.018 UJ	0.018 UJ	0.083 J	0.018 U
Hexachlorobenzene	0.16 U	0.16 U	0.16 U	0.16 UJ	0.16 UJ	0.16 U	0.16 U
Hexachlorobutadiene	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 UJ	0.13 U	0.13 U
Hexachlorocyclopentadiene	0.49 U	0.49 U	0.49 U	0.49 UJ	0.49 UJ	0.49 U	0.49 U
Hexachloroethane	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
Hexachlorophene	49 R	49 R	49 R	49 R	49 R	49 R	49 R
Hexachloropropene	0.12 U	0.12 U	0.12 U	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ
Indeno[1,2,3-cd]pyrene	0.022 U	0.022 UJ	0.022 U	0.022 UJ	0.022 UJ	0.022 U	0.022 U
Isophorone	0.15 U	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 U
Isosafrole	0.3 U	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 U	0.3 U

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L) (Cont)							
Methapyrilene	0.26 UJ	0.26 U	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ	0.26 UJ
Methyl methanesulfonate	0.46 U	0.46 U	0.46 U	0.46 UJ	0.46 UJ	0.46 U	0.46 U
Methyl parathion	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 U	0.17 U
Naphthalene	0.049 U	0.049 U	0.049 U	0.049 UJ	0.049 UJ	0.049 U	0.049 U
Nitrobenzene	0.14 U	0.14 U	0.14 U	0.14 UJ	0.14 UJ	0.14 U	0.14 U
N-Nitro-o-toluidine	0.24 U	0.24 U	0.24 U	0.24 UJ	0.24 UJ	0.24 U	0.24 U
N-Nitrosodiethylamine	0.32 U	0.32 U	0.32 U	0.32 UJ	0.32 UJ	0.32 U	0.32 U
N-Nitrosodimethylamine	0.19 U	0.19 U	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U
N-Nitrosodi-n-butylamine	0.18 U	0.18 U	0.18 U	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ
N-Nitrosodi-n-propylamine	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 UJ	0.13 U	0.13 U
N-Nitrosodiphenylamine	0.17 U	0.17 U	0.17 U	0.17 UJ	0.17 UJ	0.17 U	0.17 U
N-Nitrosomethylethylamine	0.28 U	0.28 U	0.28 U	0.28 UJ	0.28 UJ	0.28 U	0.28 U
N-Nitrosomorpholine	0.19 U	0.19 U	0.19 U	0.19 UJ	0.19 UJ	0.19 UJ	0.19 UJ
N-Nitrosopiperidine	0.22 U	0.22 U	0.22 U	0.22 UJ	0.22 UJ	0.22 UJ	0.22 UJ
N-Nitrosopyrrolidine	0.25 U	0.25 U	0.25 U	0.25 UJ	0.25 UJ	0.25 U	0.25 U
o,o',o''-Triethylphosphorothioate	0.26 U	0.26 U	0.26 U	0.26 UJ	0.26 UJ	0.26 U	0.26 U
p-Dimethylamino azobenzene	0.6 U	0.6 U	0.6 U	0.6 UJ	0.6 UJ	0.6 U	0.6 U
Pentachlorobenzene	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 UJ	0.27 U	0.27 U
Pentachloronitrobenzene	0.3 U	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 U	0.3 U
Pentachlorophenol	0.18 U	0.18 U	0.18 U	0.18 UJ	0.18 UJ	0.18 U	0.18 U
Phenacetin	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Phenanthrene	0.017 U	0.017 U	0.017 U	0.017 UJ	0.017 UJ	0.28	0.017 U
Phenol	0.14 U	0.14 U	0.14 U	0.14 UJ	0.14 UJ	0.14 U	0.14 U
Phorate	0.18 UJ	0.18 U	0.18 UJ	0.18 UJ	0.18 UJ	0.18 U	0.18 U
p-Phenylene diamine	2.4 U	2.4 U	2.4 U	2.4 UJ	2.4 UJ	2.4 U	2.4 U
Pronamide	0.25 U	0.25 U	0.25 U	0.25 UJ	0.25 UJ	0.25 U	0.25 U
Pyrene	0.026 U	0.026 U	0.026 U	0.026 UJ	0.026 UJ	0.026 U	0.026 U
Pyridine	0.22 U	0.22 U	0.22 U	0.22 UJ	0.22 UJ	0.22 U	0.22 U
Safrole, Total	0.23 U	0.23 U	0.23 U	0.23 UJ	0.23 UJ	0.23 U	0.23 U

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Semivolatile Organic Compounds (ug/L) (Cont)							
Sulfotepp	0.22 UJ	0.22 U	0.22 UJ	0.22 UJ	0.22 UJ	0.22 U	0.22 U
Thionazin	0.2 U	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Total Metals (ug/L)							
Antimony	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
Arsenic	1.7 U	1.5 U	1.7 U	0.43 J	0.34 J	0.46 J	0.56 J
Barium	23	23	570	580	12	28	42
Beryllium	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Cadmium	0.12 J	0.12 UJ	0.12 UJ	0.16 J	0.12 UJ	0.12 UJ	0.12 UJ
Chromium	1.3 U	1.4 U	1.3 U	0.6 U	0.6 U	0.6 U	0.6 U
Cobalt	0.24 U	0.32 U	11	9.9	1.7 J	0.81 J	0.27 U
Copper	1.2 U	1.2 U	1.2 U	1.4 U	1.8 U	1.2 U	2.5 U
Lead	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Mercury	0.08 UJ	0.08 UJ	0.08 UJ	0.08 U	0.08 U	0.08 U	0.08 U
Nickel	0.47 J	0.44 J	0.55 J	0.52 J	0.9 J	0.74 J	0.57 J
Selenium	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
Tin	0.9 U	0.9 U	0.9 U	0.98 U	0.9 U	0.9 U	0.9 U
Vanadium	6.9	5.7	6.6	4.8 J	5.1	2.7 J	3.3 J
Zinc	7.7 J	6.5 U	6.5 U	7.2 J	6.5 U	10 J	8.9 J

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NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Sample ID	69GW07	69GW08	69GW11	69GW12	69GW25	69GW26	69GW27
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/3/2008	5/3/2008
Dissolved Metals (ug/L)							
Antimony	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U	0.36 U
Arsenic	1.5 U	1.3 U	1.4 U	0.32 J	0.28 U	0.37 J	0.38 J
Barium	23	23	540	570	12	27	40
Beryllium	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U	0.065 U
Cadmium	0.14 J	0.12 UJ	0.12 UJ	0.16 J	0.12 U	0.12 U	0.12 U
Chromium	1.1 U	1.2 U	1.3 U	0.6 U	0.6 U	0.6 U	0.6 U
Cobalt	0.41 U	0.43 U	11	12 J	2.4 J	1.2 J	0.71 J
Copper	1.2 U	1.2 U	1.5 U	1.2 U	1.7 U	1.2 U	1.8 U
Lead	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Mercury	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
Nickel	0.42 J	0.42 J	0.67 J	0.78 J	0.89 J	0.85 J	0.59 J
Selenium	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Silver	0.09 UJ	0.09 UJ	0.09 UJ	0.09 U	0.09 U	0.09 U	0.09 U
Thallium	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
Tin	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U
Vanadium	6.1	5.4	6.6	4.2 J	4.8 J	2.5 J	2.4 J
Zinc	6.5 U	6.5 U	6.5 U	7.2 J	13 J	16 J	7.5 J

2010 DISTURBED SOIL SAMPLING INVESTIGATION HHRA

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SUMMARY OF ANALYTICAL RESULTS - 2010 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB101	69SB102	69SB103	69SB104	69SB105	69SB106	69SB107	69SB108	69SB109	69SB110	69SB111
Sample ID	69SB101-00	69SB102-00	69SB103-00	69SB104-00	69SB105-00	69SB106-00	69SB107-00	69SB108-00	69SB109-00	69SB110-00	69SB111-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (Mg/kg)											
Antimony	2.2 U	2.3 U	2 U	2.2 U	2.1 U	2.1 U	2.3 UJ	2.4 UJ	2.2 UJ	2.3 UJ	2.6 UJ
Arsenic	6.2	3.7	2.6	4	2.1	2.9	3.9	4.1	2.3	3.4	4.1 J
Barium	17 J	9.7 J	16 J	9 J	35 J	14 J	17	21	34	24	19
Beryllium	0.11 U	0.12 U	0.063 J	0.11 U	0.057 J	0.1 U	0.11 U	0.12 U	0.11 U	0.06 J	0.13 U
Cadmium	0.047 J	0.12 U	0.1 U	0.11 U	0.29	0.1 U	0.066 J	1.4	0.62	0.082 J	0.45
Chromium	18 J	20 J	21 J	5.9 J	14 J	13 J	26	23	15	23	18
Cobalt	5.3	5	4.1	1.3	7.9	4.2	7	6.6	4.9	7.6	5.8
Copper	15	17	44	3	33	14	15	19	24	28	16
Lead	0.59	0.67	2.6	0.25 J	9.7	1.7	2.5	12	6	7	6.4 R
Mercury	0.029	0.013 J	0.021	0.021 U	0.0096 J	0.02 U	0.022 U	0.024 U	0.013 J	0.022 U	0.028 U
Nickel	6.4	7.3	5	2	6.2	4.9	8.6	7.6	5.2	7.4	6.3
Selenium	1.1 U	1.2 U	1 U	1.1 U	1.1 U	1 U	1.1 U	1.2 U	1.1 U	1.2 U	1.3 U
Silver	0.22 U	0.23 U	0.2 U	0.22 U	0.21 U	0.21 U	0.23 U	0.24 U	0.22 U	0.23 U	0.26 U
Thallium	0.054 J	0.46 U	0.41 U	0.43 U	0.43 U	0.42 U	0.45 U	0.47 U	0.44 U	0.47 U	0.52 U
Tin	22 U	23 U	20 U	22 U	21 U	21 U	23 U	24 U	22 U	23 U	26 U
Vanadium	70 J	110	75	9	76	44	65 J	62 J	66 J	76 J	52 J
Zinc	7.5	10	8.6	4.3 U	21	7.2	11	16	19	18	14

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SUMMARY OF ANALYTICAL RESULTS - 2010 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB112	69SB113	69SB114	69SB115	69SB116	69SB117	69SB118	69SB119	69SB120	69SB121	69SB122
Sample ID	69SB112-00	69SB113-00	69SB114-00	69SB115-00	69SB116-00	69SB117-00	69SB118-00	69SB119-00	69SB120-00	69SB121-00	69SB122-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/5/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (Mg/kg)											
Antimony	2.2 UJ	2.1 U	2.5 U	2.3 U	2.5 U	2.1 U	2.1 U	2.8 U	2.4 U	2.4 U	2.5 U
Arsenic	3.9	3.9	3.7	3.5	4	4.3	5.8	3	4	4.3	3.6
Barium	11	19	41	130	29	20	18	13	41	27	32
Beryllium	0.11 U	0.058 J	0.24	0.21	0.067 J	0.11 U	0.056 J	0.14 U	0.13	0.072 J	0.09 J
Cadmium	0.086 J	0.16	0.72	5.3	0.35	0.063 J	0.15	0.32	0.55	0.72	4.4
Chromium	38	26	20	35	14	26	26	36	22	27	33
Cobalt	9.8	5.9	12	11	5.5	6.5	6.1	6.7	12	7.9	8.3
Copper	32	17 J	32 J	57 J	20 J	16 J	18 J	20	82	24	43
Lead	1.1	3.6 J	17 J	53 J	6.8 J	2.5 J	9.1 J	5.4 J	11 J	12 J	71 J
Mercury	0.021 U	0.0086 J	0.036	0.1	0.012 J	0.021 U	0.009 J	0.03 J	0.025 J	0.029 J	0.034 J
Nickel	12	7.9	6.7	13	5.3	7.7	7.4	7.8	9.1	8.9	10
Selenium	1.1 U	1.1 U	1.2 U	1.2 U	1.3 U	1.1 U	1 U	1.4 U	1.2 U	1.2 U	1.3 U
Silver	0.22 U	0.21 U	0.25 U	0.15 J	0.25 U	0.21 U	0.21 U	0.28 U	0.24 U	0.24 U	0.25 U
Thallium	0.43 U	0.071 J	0.5 U	0.061 J	0.5 U	0.43 U	0.42 U	0.57 U	0.077 J	0.12 J	0.51 U
Tin	22 U	21 U	25 U	23 U	25 U	21 U	21 U	28 U	24 U	24 U	25 U
Vanadium	100 J	71 J	100 J	93 J	52 J	74 J	71 J	77	100	73	100
Zinc	10	8.7	88	200	27	9.9	9.2	13 J	29 J	25 J	77 J

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SUMMARY OF ANALYTICAL RESULTS - 2010 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB123	69SB124	69SB125	69SB126	69SB127	69SB128	69SB129	69SB130	69SB131	69SB132	69SB133
Sample ID	69SB123-00	69SB124-00	69SB125-00	69SB126-00	69SB127-00	69SB128-00	69SB129-00	69SB130-00	69SB131-00	69SB132-00	69SB133-00
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010	8/4/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (Mg/kg)											
Antimony	2.3 U	3.2 U	2.7 UJ	2.8 UJ	2.8 UJ	2.9 UJ	3 UJ	2.5 UJ	3 UJ	2.6 UJ	2.6 UJ
Arsenic	2.3	2.7	2.8	3	2.2	1.4	1.6	1.7	1.8	2	2.6
Barium	28	80	59 J	470 J	50 J	16 J	26 J	20 J	50 J	10 J	29 J
Beryllium	0.067 J	0.25	0.23	0.25	0.2	0.15	0.12 J	0.13	0.19	0.11 J	0.13
Cadmium	0.79	1.7	0.28	0.47	1.3	0.059 J	0.26	0.22	1.5 J	0.044 J	0.34
Chromium	68	27	18 J	27 J	22 J	27 J	19 J	36 J	22 J	17	19
Cobalt	16	13	64	45	10	4.5	3.8	2.3	11	2 J	6.4 J
Copper	37	87	67	89	70	120	84	55	68 J	95	86
Lead	7.3 J	16 J	7.1	8.2	19	3.8	3.6	4.6	32 J	2.2	8.6
Mercury	0.032 J	0.053 J	0.18	0.17	0.15	0.12	0.093	0.18	0.047	0.11	0.066
Nickel	19	13	7.3	5.7	7.6	3.3	3.7	3.6	5.6	2.6	4.5
Selenium	1.1 U	1.6 U	2	2.1	0.83 J	1 J	0.91 J	0.71 J	1.5 U	0.67 J	1 J
Silver	0.23 U	0.18 J	0.27	0.2 J	0.28 U	0.29 U	0.3 U	0.25 U	0.3 U	0.26 U	0.26 U
Thallium	0.46 U	0.14 J	0.26 J	0.32 J	0.57 U	0.58 U	0.6 U	0.49 U	0.11 J	0.51 U	0.53 U
Tin	23 U	32 U	27 U	28 U	28 U	29 U	30 U	25 U	30 U	26 U	26 U
Vanadium	110	100	270	310	240	410	330	240	160 J	550	370
Zinc	26 J	110 J	60	52	44	12	24	12	51	11	21

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SUMMARY OF ANALYTICAL RESULTS - 2010 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB134	69SB135	69SB136	69SB137	69SB138	69SB139	69SB140	69SB141	69SB142	69SB143	69SB144
Sample ID	69SB134-00	69SB135-00	69SB136-00	69SB137-00	69SB138-00	69SB139-00	69SB140-00	69SB141-00	69SB142-00	69SB143-00	69SB144-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (Mg/kg)											
Antimony	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.4 U	2.6 U	2.7 U	2.6 U	3.2 U	2.3 U	2.2 U
Arsenic	2.4	2	1	0.93	1.3	5.1	1.2	4.7	2.6	1.8	2.1
Barium	54 J	63 J	68 J	40 J	86	15	29	15	22	12	62
Beryllium	0.13	0.16	0.29	0.23	0.25	0.13 U	0.17	0.13 U	0.15 J	0.079 J	0.2
Cadmium	0.75	1.5	0.092 J	0.097 J	0.49	0.095 J	0.36	0.43	0.14 J	0.16	0.18
Chromium	18	16	12	12	20 J	7.8 J	17 J	35 J	60 J	19 J	14
Cobalt	11 J	13 J	17 J	11 J	19	2.1	8	13 J	12	4.5	14
Copper	48	64	73	74	88 J	7.4 J	90 J	44 J	79 J	55 J	57 J
Lead	13	35	3.4	4.1	15 J	2.6 J	8.5 J	5.6 J	4.8 J	2 J	7.4
Mercury	0.028	0.04	0.073	0.14	0.042 J	0.024 UJ	0.08 J	0.022 J	0.034 UJ	0.08 J	0.099 R
Nickel	6.9	7.4	7.3	6.4	6.6	2.5	5.1	14 J	10	4.7	6
Selenium	1.3 U	1.3 U	1.2 U	1.2 U	1.2 U	1.3 U	1.4 U	1.3 U	1.6 U	1.1 U	0.58 J
Silver	0.25 U	0.25 U	0.25 U	0.25 U	0.24 U	0.26 U	0.27 U	0.26 U	0.32 U	0.23 U	0.22 U
Thallium	0.073 J	0.07 J	0.099 J	0.067 J	0.15 J	0.51 U	0.54 U	0.53 U	0.083 J	0.063 J	0.13 J
Tin	25 U	25 U	25 U	25 U	24 U	26 U	27 U	26 U	32 U	23 U	22 U
Vanadium	100	120	160	190	210 J	18 J	210 J	94 J	210 J	180 J	150
Zinc	43	70	71	49	110	13	35	21 J	24	12	42

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SUMMARY OF ANALYTICAL RESULTS - 2010 SURFACE SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB145	69SB146	69SB147	69SB148	69SB149	69SB150	69SB151	69SB152
Sample ID	69SB145-00	69SB146-00	69SB147-00	69SB148-00	69SB149-00	69SB150-00	69SB151-00	69SB152-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Inorganics (Mg/kg)								
Antimony	2.3 U	2.3 U	2.5 U	2.4 U	2.4 U	2.4 UJ	2.4 UJ	2.2 UJ
Arsenic	1.8	0.89	0.96	1.3	0.65	0.86	1.5	1.4
Barium	12	21	16	22	22	47	50	82
Beryllium	0.11 U	0.073 J	0.13 U	0.12	0.12 U	0.19	0.19	0.24
Cadmium	0.14	0.055 J	0.13 U	0.089 J	0.12 U	0.079 J	0.31	0.19
Chromium	68	7.6	9.7	14	4.2	16	13	13
Cobalt	14	3.2	0.61	3.7	1	15	13	17
Copper	33 J	65 J	37 J	88 J	55 J	96	68	59
Lead	1.4	2.6	1.8	2.8	1.3	3.6	7	5.3
Mercury	0.025 R	0.023 R	0.025 R	0.079 R	0.071 R	0.077	0.053	0.024
Nickel	19	1.9	1.2 J	4.2	1.3	7.2	11	7.3
Selenium	1.1 U	0.65 J	0.98 J	0.78 J	1.2 U	1.2 U	1.2 U	1.1 U
Silver	0.23 U	0.23 U	0.25 U	0.24 U	0.24 U	0.24 U	0.24 U	0.22 U
Thallium	0.46 U	0.057 J	0.5 U	0.079 J	0.48 U	0.083 J	0.062 J	0.11 J
Tin	23 U	23 U	25 U	24 U	24 U	24 U	24 U	22 U
Vanadium	120	150	310	160	70	160 J	120 J	140 J
Zinc	18	10	5.1	13	4.9	49	51	58

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SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB07	69SB08	69SB11	69SB12	69SB27	69SB101	69SB101	69SB101	69SB102	69SB102	69SB102
Sample ID	69SB07-05	69SB08-05	69SB11-05	69SB12-05	69SB27-05	69SB101-00	69SB101-01	69SB101-02	69SB102-00	69SB102-01	69SB102-02
Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	5/1/2008	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	9-11	9-11	9-11	9-11	9-11	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Antimony	0.098 U	0.1 U	0.1 U	0.083 U	0.11 UJ	2.2 U	2.4 U	2.3 U	2.3 U	2.6 U	2.3 U
Arsenic	0.83	0.93	1.5	1.1	2.2	6.2	1.6	0.73	3.7	1.5	0.84
Barium	10 R	10 R	64 J	78 J	11 R	17 J	17 J	15 J	9.7 J	13 J	12 J
Beryllium	0.18	0.26	0.26	0.28	0.35	0.11 U	0.12	0.11 U	0.12 U	0.12 J	0.057 J
Cadmium	0.041 UJ	0.041 UJ	0.034 UJ	0.046 J	0.036 UJ	0.047 J	0.12 U	0.11 U	0.12 U	0.13 U	0.11 U
Chromium	9	12 J	21	18	20	18 J	17 J	5.3 J	20 J	12 J	7.6 J
Cobalt	2.4 J	5 J	13	16	3.3 J	5.3	4.1	1.5	5	3.7	4.2
Copper	120 J	240 J	76 J	79 J	270	15	130	57	17	120	54
Lead	2.7 R	2.9 R	2.9 R	2.8 R	4.3 R	0.59	3.6	0.92	0.67	2.2	0.99
Mercury	0.006 U	0.009 J	0.059	0.03	0.008 J	0.029	0.074	0.099	0.013 J	0.017 J	0.021 J
Nickel	3.1	4	8	9	2.7	6.4	3.9	1.8	7.3	4.4	2.7
Selenium	0.97	1.1	0.25 J	0.23 J	1.2	1.1 U	1.9	0.73 J	1.2 U	1.8	0.88 J
Silver	0.047 J	0.071 J	0.042 U	0.04 U	0.088 J	0.22 U	0.24 U	0.23 U	0.23 U	0.26 U	0.23 U
Thallium	0.16 U	0.16 U	0.13 U	0.13 U	0.14 U	0.054 J	0.11 J	0.46 U	0.46 U	0.13 J	0.097 J
Tin	5.2 U	5.3 U	4.3 U	4.4 U	4.7 U	22 U	24 U	23 U	23 U	26 U	23 U
Vanadium	390	460 J	230	230	430	70 J	270	170	110	220	120
Zinc	11 R	16 R	43 R	45 R	14 R	7.5	14	7.2	10	13	5.4

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SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB103	69SB103	69SB103	69SB104	69SB104	69SB104	69SB105	69SB105	69SB105	69SB106	69SB106
Sample ID	69SB103-00	69SB103-01	69SB103-02	69SB104-00	69SB104-01	69SB104-02	69SB105-00	69SB105-01	69SB105-02	69SB106-00	69SB106-01
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0
Inorganics (mg/kg)											
Antimony	2 U	2.5 U	2.6 U	2.2 U	2.8 U	2.5 U	2.1 U	2.3 U	2.4 U	2.1 U	2.8 U
Arsenic	2.6	1.2	0.76	4	0.7	0.27 J	2.1	1	0.72	2.9	0.45 J
Barium	16 J	27 J	24 J	9 J	80 J	76 J	35 J	15 J	9.8 J	14 J	12 J
Beryllium	0.063 J	0.09 J	0.17	0.11 U	0.22	0.074 J	0.057 J	0.058 J	0.12 U	0.1 U	0.14 U
Cadmium	0.1 U	0.12 U	0.13 U	0.11 U	0.14 U	0.12 U	0.29	0.11 U	0.12 U	0.1 U	0.14 U
Chromium	21 J	11 J	5.1 J	5.9 J	8.1 J	4 J	14 J	8.8 J	6.1 J	13 J	4.1 J
Cobalt	4.1	3.6	3.5	1.3	4.5 J	0.6	7.9	1.9	0.97	4.2	0.39
Copper	44	140	180	3	200 J	26	33	91	90	14	43
Lead	2.6	1.3	1.4	0.25 J	4.2 R	0.48 J	9.7	1.1	0.83	1.7	1
Mercury	0.021	0.026	0.026 U	0.021 U	0.011 J	0.016 J	0.0096 J	0.012 J	0.01 J	0.02 U	0.11
Nickel	5	2.4	2.1	2	3.2	2.2	6.2	1.1	1.2	4.9	1 J
Selenium	1 U	0.85 J	1.3 U	1.1 U	1.4 U	1.2 U	1.1 U	1.3	0.88 J	1 U	1.4 U
Silver	0.2 U	0.25 U	0.26 U	0.22 U	0.28 U	0.25 U	0.21 U	0.23 U	0.24 U	0.21 U	0.28 U
Thallium	0.41 U	0.071 J	0.52 U	0.43 U	0.068 J	0.078 J	0.43 U	0.46 U	0.48 U	0.42 U	0.56 U
Tin	20 U	25 U	26 U	22 U	28 U	25 U	21 U	23 U	24 U	21 U	28 U
Vanadium	75	130	330	9	290	140	76	300	130	44	240
Zinc	8.6	9.8	11	4.3 U	18 J	4.9 U	21	5.6	6.5	7.2	5.6 U

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SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB106	69SB107	69SB107	69SB107	69SB108	69SB108	69SB108	69SB109	69SB109	69SB109	69SB110
Sample ID	69SB106-02	69SB107-00	69SB107-01	69SB107-02	69SB108-00	69SB108-01	69SB108-02	69SB109-00	69SB109-01	69SB109-02	69SB110-00
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1
Inorganics (mg/kg)											
Antimony	2.5 U	2.3 UJ	2.2 UJ	3.2 UJ	2.4 UJ	2.5 UJ	2.1 UJ	2.2 UJ	2.6 UJ	2.6 UJ	2.3 UJ
Arsenic	0.41 J	3.9	4.1	4.3 J	4.1	4	3.4	2.3	0.99	0.95	3.4
Barium	11 J	17	20	22	21	17	17	34	26	32	24
Beryllium	0.13 U	0.11 U	0.055 J	0.16 U	0.12 U	0.13 U	0.071 J	0.11 U	0.16	0.18	0.06 J
Cadmium	0.13 U	0.066 J	0.058 J	0.052 J	1.4	0.06 J	0.073 J	0.62	0.13 U	0.13 U	0.082 J
Chromium	3 J	26	27	17	23	18	28	15	8.6	9.5	23
Cobalt	0.38	7	7.3	4.1	6.6	5.4	5.2	4.9	6.6	6.1	7.6
Copper	39	15	16	48 J	19	12	23	24	110	130	28
Lead	0.87	2.5	1.4	0.86	12	1.5	2.6	6	1.4	1.4	7
Mercury	0.021 J	0.022 U	0.023 U	0.03 U	0.024 U	0.024 U	0.02 U	0.013 J	0.1	0.084	0.022 U
Nickel	0.76 J	8.6	9.3	6.7	7.6	6.5	5.8	5.2	3.8	4.5	7.4
Selenium	1.3 U	1.1 U	1.1 U	1.6 U	1.2 U	1.3 U	1.1 U	1.1 U	1.3 U	1.3 U	1.2 U
Silver	0.25 U	0.23 U	0.22 U	0.32 U	0.24 U	0.25 U	0.21 U	0.22 U	0.26 U	0.26 U	0.23 U
Thallium	0.51 U	0.45 U	0.44 U	0.64 U	0.47 U	0.5 U	0.43 U	0.44 U	0.52 U	0.51 U	0.47 U
Tin	25 U	23 U	22 U	32 U	24 U	25 U	21 U	22 U	26 U	26 U	23 U
Vanadium	48	65 J	65 J	150 J	62 J	51 J	110 J	66 J	200 J	220 J	76 J
Zinc	5.1 U	11	10	7.7	16	8.1	9.5	19	23	26	18

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB110	69SB110	69SB111	69SB111	69SB111	69SB112	69SB112	69SB112	69SB113	69SB113	69SB113
Sample ID	69SB110-01	69SB110-02	69SB111-00	69SB111-01	69SB111-02	69SB112-00	69SB112-01	69SB112-02	69SB113-00	69SB113-01	69SB113-02
Date	8/3/2010	8/3/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Antimony	2.4 UJ	2.4 UJ	2.6 UJ	2.9 UJ	2.3 UJ	2.2 UJ	2.5 UJ	2.6 UJ	2.1 U	2.2 U	2.4 U
Arsenic	1.5	0.45 J	4.1 J	0.77	1.1	3.9	1.2	1.2	3.9	3.9	1.6
Barium	9.1	7.1	19	220	100	11	90	46	19	17	190
Beryllium	0.089 J	0.12 U	0.13 U	0.25	0.22	0.11 U	0.25	0.21	0.058 J	0.11 U	0.31
Cadmium	0.12 U	0.12 U	0.45	0.18	0.093 J	0.086 J	0.08 J	0.082 J	0.16	0.044 J	0.049 J
Chromium	9.2	3.2	18	15	15	38	15	14	26	28	18
Cobalt	3.3	0.76	5.8	29	22	9.8	18	16	5.9	6.5	21
Copper	97	42	16	76	94	32	87	89	17 J	13 J	77 J
Lead	1.9	0.5	6.4 R	2.2	2.2	1.1	2.3	2.4	3.6 J	0.75 J	3.3 J
Mercury	0.18	0.1	0.028 U	0.034	0.067	0.021 U	0.036	0.062	0.0086 J	0.021 U	0.025
Nickel	3	1.2	6.3	9.3	6.2	12	7.6	6	7.9	9.1	9.1
Selenium	1.2 U	1.2 U	1.3 U	1.5 U	1.2 U	1.1 U	1.3 U	1.3 U	1.1 U	1.1 U	1.2 U
Silver	0.24 U	0.24 U	0.26 U	0.29 U	0.23 U	0.22 U	0.25 U	0.26 U	0.21 U	0.22 U	0.24 U
Thallium	0.07 J	0.48 U	0.52 U	0.094 J	0.099 J	0.43 U	0.09 J	0.087 J	0.071 J	0.44 U	0.11 J
Tin	24 U	24 U	26 U	29 U	23 U	22 U	25 U	26 U	21 U	22 U	24 U
Vanadium	320 J	110 J	52 J	180 J	220 J	100 J	210 J	270 J	71 J	83 J	210 J
Zinc	10	5.4	14	59	48	10	60	45	8.7	9.4	58

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB114	69SB114	69SB114	69SB115	69SB115	69SB115	69SB116	69SB116	69SB116	69SB117	69SB117
Sample ID	69SB114-00	69SB114-01	69SB114-02	69SB115-00	69SB115-01	69SB115-02	69SB116-00	69SB116-01	69SB116-02	69SB117-00	69SB117-01
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0
Inorganics (mg/kg)											
Antimony	2.5 U	2.6 U	2.5 U	2.3 U	2.1 U	2.5 U	2.5 U	2.5 U	2.4 U	2.1 U	2.6 U
Arsenic	3.7	5.4	1.1	3.5	4.7	1.4	4	1.2	0.89	4.3	1.1
Barium	41	33 J	150	130	14	110	29	66	76	20	100
Beryllium	0.24	0.1 J	0.27	0.21	0.11 U	0.33	0.067 J	0.35	0.29	0.11 U	0.32
Cadmium	0.72	0.15	0.12 J	5.3	0.044 J	0.084 J	0.35	0.076 J	0.069 J	0.063 J	0.072 J
Chromium	20	29	18	35	22	18	14	19	15	26	17
Cobalt	12	7.2 J	20	11	3.6	27	5.5	16	15	6.5	16
Copper	32 J	26 J	110 J	57 J	8.1 J	120 J	20 J	120 J	100 J	16 J	94 J
Lead	17 J	3.6 J	3 J	53 J	0.67 J	2.8 J	6.8 J	3 J	2.4 J	2.5 J	2.7 J
Mercury	0.036	0.032	0.072	0.1	0.02 U	0.045	0.012 J	0.037	0.035	0.021 U	0.032
Nickel	6.7	8.2 J	9.2	13	4.9	10	5.3	10	9.7	7.7	9.7
Selenium	1.2 U	1.3 U	1.3 U	1.2 U	1.1 U	1.3 U	1.3 U	1.3 U	1.2 U	1.1 U	1.3 U
Silver	0.25 U	0.26 U	0.25 U	0.15 J	0.21 U	0.25 U	0.25 U	0.25 U	0.24 U	0.21 U	0.26 U
Thallium	0.5 U	0.53 U	0.16 J	0.061 J	0.42 U	0.11 J	0.5 U	0.12 J	0.083 J	0.43 U	0.14 J
Tin	25 U	26 U	25 U	23 U	21 U	25 U	25 U	25 U	24 U	21 U	26 U
Vanadium	100 J	88 J	210 J	93 J	49 J	230 J	52 J	220 J	170 J	74 J	180 J
Zinc	88	28 J	76	200	6.4	72	27	50	72	9.9	79

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB117	69SB118	69SB118	69SB118	69SB119	69SB119	69SB119	69SB120	69SB120	69SB120	69SB121
Sample ID	69SB117-02	69SB118-00	69SB118-01	69SB118-02	69SB119-00	69SB119-01	69SB119-02	69SB120-00	69SB120-01	69SB120-02	69SB121-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1
Inorganics (mg/kg)											
Antimony	2.7 U	2.1 U	2.6 U	2.6 U	2.8 U	2.2 U	2.3 U	2.4 U	2.3 U	2.5 U	2.4 U
Arsenic	0.88	5.8	0.88	1.2	3	4.4	1.2	4	3.4	0.99	4.3
Barium	69	18	110	110	13	17	97	41	39	84	27
Beryllium	0.31	0.056 J	0.32	0.31	0.14 U	0.066 J	0.27	0.13	0.091 J	0.3	0.072 J
Cadmium	0.082 J	0.15	0.064 J	0.095 J	0.32	0.064 J	0.12	0.55	0.084 J	0.069 J	0.72
Chromium	16	26	18	14	36	31	19	22	24	16	27
Cobalt	14	6.1	16	16	6.7	7.5	15	12	9.3	13	7.9
Copper	100 J	18 J	96 J	97 J	20	15	67	82	28	82	24
Lead	3 J	9.1 J	2.6 J	2.6 J	5.4 J	2.1 J	5.6 J	11 J	3.4 J	2.1 J	12 J
Mercury	0.037	0.009 J	0.034	0.023 J	0.03 J	0.021 UJ	0.035 J	0.025 J	0.022 UJ	0.098 J	0.029 J
Nickel	9.3	7.4	11	9.3	7.8	8.5	8.6	9.1	7.7	8.5	8.9
Selenium	1.3 U	1 U	1.3 U	1.3 U	1.4 U	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Silver	0.27 U	0.21 U	0.76	0.96	0.28 U	0.22 U	0.21 J	0.24 U	0.23 U	0.25 U	0.24 U
Thallium	0.14 J	0.42 U	0.087 J	0.091 J	0.57 U	0.44 U	0.11 J	0.077 J	0.47 U	0.15 J	0.12 J
Tin	27 U	21 U	26 U	26 U	28 U	22 U	23 U	24 U	23 U	25 U	24 U
Vanadium	190 J	71 J	170 J	180 J	77	78	170	100	90	190	73
Zinc	85	9.2	86	83	13 J	15 J	56 J	29 J	20 J	67 J	25 J

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SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB121	69SB121	69SB122	69SB122	69SB122	69SB123	69SB123	69SB123	69SB124	69SB124	69SB124
Sample ID	69SB121-01	69SB121-02	69SB122-00	69SB122-01	69SB122-02	69SB123-00	69SB123-01	69SB123-02	69SB124-00	69SB124-01	69SB124-02
Date	8/4/2010	8/4/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Antimony	2.4 U	2.4 U	2.5 U	2.8 U	2.6 U	2.3 U	2.3 U	2.5 U	3.2 U	2.7 U	2.6 U
Arsenic	1.4	1.4	3.6	2.6	2.3	2.3	2.5	0.87	2.7	0.38 J	0.42 J
Barium	59	30	32	40	53	28	40	63	80	250	92
Beryllium	0.42	0.33	0.09 J	0.18	0.16	0.067 J	0.11 J	0.34	0.25	0.39	0.3
Cadmium	0.063 J	0.067 J	4.4	0.26	0.13 U	0.79	0.069 J	0.047 J	1.7	0.13	0.043 J
Chromium	21	18	33	46	36	68	27	14	27	19	16
Cobalt	23	10	8.3	3	3.2	16	9.2	15	13	22	10
Copper	93	80	43	120	130	37	40	100	87	120	120
Lead	2.8 J	2.4 J	71 J	9.7 J	5.4 J	7.3 J	0.76 J	2.6 J	16 J	3.5 J	3.4 J
Mercury	0.11 J	0.11 J	0.034 J	0.09 J	0.073 J	0.032 J	0.022 UJ	0.03 J	0.053 J	0.064 J	0.12 J
Nickel	10	8.8	10	4.9	4.5	19	9.9	9.8	13	11	8.9
Selenium	1.2 U	1.2 U	1.3 U	1.3 J	1.1 J	1.1 U	1.2 U	1.3 U	1.6 U	1.3 U	1.3 U
Silver	0.24 U	0.24 U	0.25 U	0.28 U	0.26 U	0.23 U	0.23 U	0.24 J	0.18 J	0.27 U	0.26 U
Thallium	0.17 J	0.13 J	0.51 U	0.55 U	0.53 U	0.46 U	0.06 J	0.093 J	0.14 J	0.23 J	0.16 J
Tin	24 U	24 U	25 U	28 U	26 U	23 U	23 U	25 U	32 U	27 U	26 U
Vanadium	230	200	100	480	430	110	85	180	100	120	120
Zinc	80 J	71 J	77 J	17 J	15 J	26 J	28 J	80 J	110 J	100 J	76 J

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SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB125	69SB125	69SB125	69SB126	69SB126	69SB126	69SB127	69SB127	69SB127	69SB128	69SB128
Sample ID	69SB125-00	69SB125-01	69SB125-02	69SB126-00	69SB126-01	69SB126-02	69SB127-00	69SB127-01	69SB127-02	69SB128-00	69SB128-01
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Depth Range	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0
Inorganics (mg/kg)											
Antimony	2.7 UJ	2.3 UJ	2.5 UJ	2.8 UJ	2.1 UJ	2.4 UJ	2.8 UJ	2.5 UJ	2.9 UJ	2.9 UJ	2.8 UJ
Arsenic	2.8	4	2.4	3	3.5	1.2	2.2	1.7	0.84	1.4	1.5
Barium	59 J	18 J	54 J	470 J	130 J	77 J	50 J	25 J	27 J	16 J	21 J
Beryllium	0.23	0.11 U	0.21	0.25	0.074 J	0.3	0.2	0.13	0.11 J	0.15	0.14
Cadmium	0.28	0.072 J	0.25	0.47	0.18	0.11 J	1.3	0.065 J	0.031 J	0.059 J	0.057 J
Chromium	18 J	29 J	15 J	27 J	26 J	17 J	22 J	19 J	10 R	27 J	18 J
Cobalt	64	7.7	34	45	17	24	10	2.5	1.5 J	4.5	4.1
Copper	67	19	67	89	36	92	70	85	85 J	120	110
Lead	7.1	1.3	6	8.2	2.7	3	19	4.4	2.8 J	3.8	2.9
Mercury	0.18	0.021	0.15	0.17	0.03	0.048	0.15	0.026	0.087	0.12	0.066
Nickel	7.3	8	8	5.7	8.7	9.7	7.6	2.7	1.5	3.3	2.8
Selenium	2	1.1 U	1.7	2.1	1 U	1.2 U	0.83 J	1.6	0.91 J	1 J	1.1 J
Silver	0.27	0.23 U	0.17 J	0.2 J	0.21 U	0.24 U	0.28 U	0.25 U	0.29 U	0.29 U	0.28 U
Thallium	0.26 J	0.46 U	0.11 J	0.32 J	0.08 J	0.13 J	0.57 U	0.5 U	0.58 U	0.58 U	0.55 U
Tin	27 U	23 U	25 U	28 U	21 U	24 U	28 U	25 U	29 U	29 U	28 U
Vanadium	270	77	240	310	100	210	240	580	400 R	410	390
Zinc	60	10	58	52	19	74	44	11	6.7	12	9.9

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SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB128	69SB129	69SB129	69SB129	69SB130	69SB130	69SB130	69SB131	69SB131	69SB131	69SB132
Sample ID	69SB128-02	69SB129-00	69SB129-01	69SB129-02	69SB130-00	69SB130-01	69SB130-02	69SB131-00	69SB131-01	69SB131-02	69SB132-00
Date	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/4/2010
Depth Range	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1
Inorganics (mg/kg)											
Antimony	2.5 UJ	3 UJ	2.7 UJ	2.4 UJ	2.5 UJ	2.5 UJ	2.7 UJ	3 UJ	2.2 UJ	2.5 UJ	2.6 UJ
Arsenic	0.33 J	1.6	0.79	2.4	1.7	1.4	2.8	1.8	0.68	0.99	2
Barium	28 J	26 J	18 J	17 J	20 J	22 J	19 J	50 J	49 J	31 J	10 J
Beryllium	0.068 J	0.12 J	0.075 J	0.12	0.13	0.11 J	0.2	0.19	0.15	0.17	0.11 J
Cadmium	0.034 J	0.26	0.14 U	0.12 U	0.22	0.035 J	0.045 J	1.5 J	0.11 U	0.12 U	0.044 J
Chromium	5.7 J	19 J	15 J	19 J	36 J	29 J	53 J	22 J	11	14	17
Cobalt	1.5	3.8	1.2	1.4	2.3	2	2.7	11	9.6 J	11 J	2 J
Copper	40	84	55	100	55	75	140	68 J	46	66	95
Lead	0.88	3.6	1.7	4.4	4.6	1.4	4.5	32 J	2	2.1	2.2
Mercury	0.081	0.093	0.042	0.083	0.18	0.071	0.15	0.047	0.046	0.069	0.11
Nickel	1.4	3.7	2.8	2.1	3.6	2.5	3.5	5.6	4.2	4.2	2.6
Selenium	1.2 U	0.91 J	1.4 U	2.2	0.71 J	0.79 J	1.9	1.5 U	1.1 U	1.2 U	0.67 J
Silver	0.25 U	0.3 U	0.27 U	0.24 U	0.25 U	0.25 U	0.27 U	0.3 U	0.22 U	0.25 U	0.26 U
Thallium	0.49 U	0.6 U	0.54 U	0.47 U	0.49 U	0.08 J	0.54 U	0.11 J	0.085 J	0.11 J	0.51 U
Tin	25 U	30 U	27 U	24 U	25 U	25 U	27 U	30 U	22 U	25 U	26 U
Vanadium	150	330	250	560	240	290	580	160 J	130	210	550
Zinc	5.8	24	7.3	10	12	10	14	51	34	38	11

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SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB132	69SB132	69SB133	69SB133	69SB133	69SB134	69SB134	69SB134	69SB135	69SB135	69SB135
Sample ID	69SB132-01	69SB132-02	69SB133-00	69SB133-01	69SB133-02	69SB134-00	69SB134-01	69SB134-02	69SB135-00	69SB135-01	69SB135-02
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Antimony	2.3 UJ	2.7 UJ	2.6 UJ	2.4 UJ	2.6 UJ	2.5 UJ	2.4 UJ	2.4 UJ	2.5 UJ	2.6 UJ	2.4 UJ
Arsenic	1.1	0.77	2.6	1	1.2	2.4	1.3	1	2	1	0.59 J
Barium	12 J	8.2 J	29 J	14 J	14 J	54 J	270 J	42 J	63 J	78 J	41 J
Beryllium	0.098 J	0.11 J	0.13	0.095 J	0.098 J	0.13	0.37	0.28	0.16	0.25	0.19
Cadmium	0.12 U	0.13 U	0.34	0.045 J	0.13 U	0.75	0.27	0.065 J	1.5	0.15	0.066 J
Chromium	11	9.4	19	12	9.1	18	13	11	16	12	11
Cobalt	1.2 J	1 J	6.4 J	3.4 J	1.2 J	11 J	33 J	14 J	13 J	18 J	11 J
Copper	67	74	86	85	65	48	89	73	64	81	62
Lead	2.2	1.8	8.6	3.3	2.1	13	3	2.6	35	5.3	3
Mercury	0.044	0.034	0.066	0.07	0.058	0.028	0.069	0.04	0.04	0.035	0.047
Nickel	1.5	1.4	4.5	3.5	1.7	6.9	7.9	7.6	7.4	7.6	6.1
Selenium	1.2 U	1.3 U	1 J	0.92 J	0.79 J	1.3 U	1.2 U	1.2 U	1.3 U	1.3 U	1.2 U
Silver	0.23 U	0.27 U	0.26 U	0.24 U	0.26 U	0.25 U	0.24 U	0.24 U	0.25 U	0.26 U	0.24 U
Thallium	0.47 U	0.54 U	0.53 U	0.49 U	0.51 U	0.073 J	0.18 J	0.1 J	0.07 J	0.083 J	0.072 J
Tin	23 U	27 U	26 U	24 U	26 U	25 U	24 U	24 U	25 U	26 U	24 U
Vanadium	400	350	370	380	220	100	210	180	120	200	130
Zinc	6.1	7.7	21	12	7.8	43	72	65	70	68	55

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB136	69SB136	69SB136	69SB137	69SB137	69SB137	69SB138	69SB138	69SB138	69SB139	69SB139
Sample ID	69SB136-00	69SB136-01	69SB136-02	69SB137-00	69SB137-01	69SB137-02	69SB138-00	69SB138-01	69SB138-02	69SB139-00	69SB139-01
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010
Depth Range	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0
Inorganics (mg/kg)											
Antimony	2.5 UJ	2.5 UJ	2.4 UJ	2.5 UJ	2.5 U	2.7 U	2.4 U	2.6 U	2.4 U	2.6 U	2.3 U
Arsenic	1	1.3	1.2	0.93	1.4	1.1	1.3	1.3	2.5	5.1	5.9
Barium	68 J	51 J	30 J	40 J	26	30	86	55	22	15	48
Beryllium	0.29	0.19	0.17	0.23	0.19	0.15	0.25	0.24	0.17	0.13 U	0.12
Cadmium	0.092 J	0.07 J	0.092 J	0.097 J	0.05 J	0.045 J	0.49	0.089 J	0.049 J	0.095 J	0.031 J
Chromium	12	11	11	12	15 J	13 J	20 J	18 J	28 J	7.8 J	15 J
Cobalt	17 J	19 J	16 J	11 J	6.9	6.9	19	19	9.4	2.1	8.3
Copper	73	73	71	74	80 J	70 J	88 J	78 J	130 J	7.4 J	57 J
Lead	3.4	3.5	3.4	4.1	2.6 J	2 J	15 J	3.3 J	3.7 J	2.6 J	1.7 J
Mercury	0.073	0.085	0.11	0.14	0.13 J	0.085 J	0.042 J	0.051 J	0.028 J	0.024 UJ	0.036 J
Nickel	7.3	5.7	4.6	6.4	5.8	4.5	6.6	8	5.6	2.5	4
Selenium	1.2 U	1.2 U	1.2 U	1.2 U	0.74 J	0.68 J	1.2 U	1.3 U	1.1 J	1.3 U	1.1 U
Silver	0.25 U	0.25 U	0.24 U	0.25 U	0.25 U	0.27 U	0.24 U	0.26 U	0.24 U	0.26 U	0.23 U
Thallium	0.099 J	0.12 J	0.13 J	0.067 J	0.11 J	0.077 J	0.15 J	0.094 J	0.099 J	0.51 U	0.099 J
Tin	25 U	25 U	24 U	25 U	25 U	27 U	24 U	26 U	24 U	26 U	23 U
Vanadium	160	170	160	190	240 J	230 J	210 J	200 J	280 J	18 J	140 J
Zinc	71	57	42	49	33	32	110	58	28	13	18

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB139	69SB140	69SB140	69SB140	69SB141	69SB141	69SB141	69SB142	69SB142	69SB142	69SB143
Sample ID	69SB139-02	69SB140-00	69SB140-01	69SB140-02	69SB141-00	69SB141-01	69SB141-02	69SB142-00	69SB142-01	69SB142-02	69SB143-00
Date	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/4/2010	8/3/2010
Depth Range	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1
Inorganics (mg/kg)											
Antimony	2.4 U	2.7 U	2.6 U	2.5 U	2.6 U	2.3 U	2.6 U	3.2 U	2.4 U	2.4 U	2.3 U
Arsenic	1.9	1.2	1.8	1.2	4.7	1.1	1	2.6	2.2	2.5	1.8
Barium	24	29	27	16	15	54	46	22	26	110	12
Beryllium	0.13	0.17	0.17	0.19	0.13 U	0.18	0.13	0.15 J	0.18	0.2	0.079 J
Cadmium	0.12 U	0.36	0.066 J	0.061 J	0.43	0.064 J	0.052 J	0.14 J	0.044 J	0.053 J	0.16
Chromium	14 J	17 J	52 J	20 J	35 J	28 J	12 J	60 J	30 J	22 J	19 J
Cobalt	3.9	8	6.9	7.8	13 J	11	15	12	18	14	4.5
Copper	87 J	90 J	67 J	90 J	44 J	91 J	81 J	79 J	120 J	130 J	55 J
Lead	2.1 J	8.5 J	5.9 J	4 J	5.6 J	3.2 J	2.5 J	4.8 J	3.6 J	2.3 J	2 J
Mercury	0.15 J	0.08 J	0.068 J	0.071 J	0.022 J	0.11 J	0.053 J	0.034 UJ	0.066 J	0.073 J	0.08 J
Nickel	3.4	5.1	3.3	4	14 J	5.7	4.6	10	6.9	4.8	4.7
Selenium	1 J	1.4 U	0.64 J	1.3 U	1.3 U	1.1 U	1.3 U	1.6 U	0.96 J	0.88 J	1.1 U
Silver	0.24 U	0.27 U	0.26 U	0.25 U	0.26 U	0.23 U	0.26 U	0.32 U	0.24 U	0.24 U	0.23 U
Thallium	0.065 J	0.54 U	0.51 U	0.51 U	0.53 U	0.099 J	0.088 J	0.083 J	0.17 J	0.15 J	0.063 J
Tin	24 U	27 U	26 U	25 U	26 U	23 U	26 U	32 U	24 U	24 U	23 U
Vanadium	270 J	210 J	530 J	370 J	94 J	260 J	280 J	210 J	270 J	320 J	180 J
Zinc	16	35	20	20	21 J	37	16	24	33	23	12

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB143	69SB143	69SB144	69SB144	69SB144	69SB145	69SB145	69SB145	69SB146	69SB146	69SB146
Sample ID	69SB143-01	69SB143-02	69SB144-00	69SB144-01	69SB144-02	69SB145-00	69SB145-01	69SB145-02	69SB146-00	69SB146-01	69SB146-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0
Inorganics (mg/kg)											
Antimony	2.4 U	2.8 U	2.2 U	2.6 U	2.7 U	2.3 U	2.8 U	2.4 U	2.3 U	2.5 U	2.8 U
Arsenic	1	0.75	2.1	0.92	0.51 J	1.8	1.3	0.9	0.89	0.31 J	0.4 J
Barium	9.1	10	62	18	25	12	26	22	21	18	8
Beryllium	0.069 J	0.14 U	0.2	0.13	0.075 J	0.11 U	0.071 J	0.12	0.073 J	0.13 U	0.092 J
Cadmium	0.12 U	0.14 U	0.18	0.13 U	0.14 U	0.14	0.14 U	0.12 U	0.055 J	0.13 U	0.14 U
Chromium	6.2	5	14	14	9.4	68	13	13	7.6	4.4	3.1
Cobalt	1.8	1.8	14	2	2.7	14	1.8	2.3	3.2	0.53	1
Copper	76 J	54 J	57 J	100 J	77 J	33 J	77 J	170 J	65 J	34 J	67 J
Lead	1.2	0.82	7.4	1.4	0.94	1.4	2	1.5	2.6	1.5	1.5
Mercury	0.068 R	0.048 R	0.099 R	0.024 R	0.019 R	0.025 R	0.064 R	0.077 R	0.023 R	0.027 R	0.028 R
Nickel	1.9	1.8	6	2	2.1	19	2	1.5	1.9	1.3 U	1.4 U
Selenium	0.73 J	1.4 U	0.58 J	0.9 J	1.4 U	1.1 U	0.95 J	0.63 J	0.65 J	1.3 U	1.4 U
Silver	0.24 U	0.28 U	0.22 U	0.26 U	0.27 U	0.23 U	0.28 U	0.24 U	0.23 U	0.25 U	0.28 U
Thallium	0.078 J	0.07 J	0.13 J	0.11 J	0.14 J	0.46 U	0.55 U	0.49 U	0.057 J	0.5 U	0.56 U
Tin	24 U	28 U	22 U	26 U	27 U	23 U	28 U	24 U	23 U	25 U	28 U
Vanadium	200	190	150	380 J	130	120	240	280	150	87	120
Zinc	11	6.4	42	16	12	18	5.6	12	10	5 U	5.6 U

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB147	69SB147	69SB147	69SB148	69SB148	69SB148	69SB149	69SB149	69SB149	69SB150	69SB150
Sample ID	69SB147-00	69SB147-01	69SB147-02	69SB148-00	69SB148-01	69SB148-02	69SB149-00	69SB149-01	69SB149-02	69SB150-00	69SB150-01
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0
Inorganics (mg/kg)											
Antimony	2.5 U	2.6 U	2.5 U	2.4 U	2.6 U	2.5 U	2.4 U	2.3 UJ	2.4 UJ	2.4 UJ	2.4 UJ
Arsenic	0.96	0.85	0.73	1.3	1.2	1	0.65	1.2	1	0.86	0.61
Barium	16	15	14	22	18	16	22	20	31	47	60
Beryllium	0.13 U	0.13 U	0.072 J	0.12	0.26	0.17	0.12 U	0.15	0.11 J	0.19	0.21
Cadmium	0.13 U	0.13 U	0.12 U	0.089 J	0.13 U	0.12 U	0.12 U	0.12 U	0.12 U	0.079 J	0.12 U
Chromium	9.7	10	8.5 J	14	17	13	4.2	15	6	16	6.9
Cobalt	0.61	0.88	2 R	3.7	2.9	2.7	1	22	2.3	15	7.4
Copper	37 J	63 J	74 J	88 J	170 J	160 J	55 J	110	110	96	150
Lead	1.8	1.8	1.4 J	2.8	1.3	0.98	1.3	2.9	4.4	3.6	1.2
Mercury	0.025 R	0.026 R	0.13 R	0.079 R	0.025 R	0.025 R	0.071 R	0.022 J	0.052	0.077	0.017 J
Nickel	1.2 J	1.3	1.5	4.2	2.9	3.9	1.3	1.6	0.99 J	7.2	3.4
Selenium	0.98 J	0.75 J	1.2 U	0.78 J	1.1 J	0.94 J	1.2 U	0.72 J	1.2 U	1.2 U	1.2 U
Silver	0.25 U	0.26 U	0.25 U	0.24 U	0.26 U	0.25 U	0.24 U	0.23 U	0.24 U	0.24 U	0.24 U
Thallium	0.5 U	0.51 U	0.084 J	0.079 J	0.52 U	0.49 U	0.48 U	0.068 J	0.073 J	0.083 J	0.091 J
Tin	25 U	26 U	25 U	24 U	26 U	25 U	24 U	23 U	24 U	24 U	24 U
Vanadium	310	250	260 R	160	270	180	70	170 J	130 J	160 J	210 J
Zinc	5.1	5.9	7.4	13	11	7.5	4.9	7.7	4.9 U	49	17

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 TOTAL SOIL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SB150	69SB151	69SB151	69SB151	69SB152	69SB152	69SB152
Sample ID	69SB150-02	69SB151-00	69SB151-01	69SB151-02	69SB152-00	69SB152-01	69SB152-02
Date	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010	8/3/2010
Depth Range	2.0-3.0	0-1	1.0-2.0	2.0-3.0	0-1	1.0-2.0	2.0-3.0
Inorganics (mg/kg)							
Antimony	2.5 UJ	2.4 UJ	2.4 UJ	2.4 UJ	2.2 UJ	2.3 UJ	2.4 UJ
Arsenic	0.6 J	1.5	0.89	1.1	1.4	0.79	0.97
Barium	44	50	15	7.2	82	13	27
Beryllium	0.45	0.19	0.19	0.15	0.24	0.14	0.3
Cadmium	0.12 U	0.31	0.054 J	0.12 U	0.19	0.12 U	0.034 J
Chromium	5.7	13	14	15	13	11	13
Cobalt	12	13	8	5.5	17	5.5	6.2
Copper	280	68	120	150	59	120	200
Lead	0.44 J	7	4.6	2.1	5.3	1.2	3.2
Mercury	0.013 J	0.053	0.066	0.14	0.024	0.068	0.065
Nickel	3.9	11	5.6	3.4	7.3	4.5	6.4
Selenium	1.2 U	1.2 U	1.2 U	1.2 U	1.1 U	1.2 U	1.2 U
Silver	0.25 U	0.24 U	0.24 U	0.24 U	0.22 U	0.23 U	0.24 U
Thallium	0.13 J	0.062 J	0.15 J	0.1 J	0.11 J	0.47 U	0.48 U
Tin	25 U	24 U	24 U	24 U	22 U	23 U	24 U
Vanadium	260 J	120 J	170 J	220 J	140 J	200 J	310 J
Zinc	21	51	20	15	58	8.9	12

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 SEDIMENT
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SD01	69SD02	69SD03	69SD04	69SD05	69SD06	69SD07	69SD08	69SD09	69SD10	69SD11
Sample ID	69SD01	69SD02	69SD03	69SD04	69SD05	69SD06	69SD07	69SD08	69SD09	69SD10	69SD11
Sample Date	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)											
Antimony	4 UJ	4.6 UJ	4.3 UJ	3.3 U	3.3 U	4.1 UJ	5.3 UJ	4.6 UJ	4.1 UJ	6.2 UJ	3.6 U
Arsenic	1.6 J	1.8 J	2.8 J	1.9	3.4	3.8 J	4.6 J	3 J	4.8 J	2.4 J	2.1
Barium	38 J	38 J	48 J	24 J	26 J	110 J	130 J	140 J	77 J	100 J	52 J
Beryllium	0.13 J	0.15 J	0.14 J	0.16 J	0.2	0.29 J	0.33 J	0.2 J	0.25 J	0.22 J	0.18
Cadmium	1.1 J	0.77 J	4.6 J	0.38	0.44	16 J	24 J	12 J	2.9 J	4.1 J	1.5
Chromium	26 J	21 J	25 J	20	30	99 J	72 J	40 J	32 J	23 J	20
Cobalt	6.4 J	7.2 J	8.5 J	5.8 J	5.6 J	18 J	18 J	14 J	20 J	16 J	12 J
Copper	83 J	96 J	85 J	96 J	130 J	140 J	160 J	110 J	130 J	110 J	70 J
Lead	51 J	8.3 J	48 J	6.4	8.6	440 J	680 J	250 J	30 J	26 J	24
Mercury	0.081 J	0.077 J	0.073 J	0.067	0.062	0.085 J	0.076 J	0.067 J	0.07 J	0.14 J	0.063
Nickel	6.9 J	6.8 J	10 J	5.3	5.3	34 J	27 J	15 J	11 J	10 J	8.3
Selenium	1.1 J	1.2 J	2.1 UJ	0.85 J	1.3 J	2.1 UJ	2.7 UJ	2.3 UJ	1.3 J	3.1 UJ	1.8 U
Silver	0.4 UJ	0.46 UJ	0.43 UJ	0.33 U	0.33 U	0.7 J	0.47 J	0.25 J	0.41 UJ	0.62 UJ	0.36 U
Thallium	0.4 UJ	0.11 J	0.43 UJ	0.33 U	0.33 U	0.41 UJ	0.53 UJ	0.46 UJ	0.41 UJ	0.62 UJ	0.36 U
Tin	40 UJ	46 UJ	43 UJ	33 U	33 U	41 UJ	53 UJ	46 UJ	41 UJ	62 UJ	36 U
Vanadium	180 J	220 J	170 J	190 J	350 J	110 J	140 J	150 J	370 J	230 J	150 J
Zinc	49 J	44 J	100 J	40	55	450 J	490 J	220 J	89 J	110 J	71

APPENDIX G

SUMMARY OF ANALYTICAL RESULTS - 2010 SEDIMENT
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	69SD12	69SD13	69SD14
Sample ID	69SD12	69SD13	69SD14
Sample Date	11/5/2010	11/5/2010	11/5/2010
Inorganics (mg/kg)			
Antimony	3.7 U	3.9 U	3.2 U
Arsenic	1	2.1	4
Barium	33 J	65 J	99 J
Beryllium	0.098 J	0.21	0.28
Cadmium	1.4	1	0.92
Chromium	10	23	61
Cobalt	7.7 J	15 J	16 J
Copper	38 J	72 J	98 J
Lead	15	21	15
Mercury	0.048	0.045	0.05
Nickel	5.2	7.5	8.1
Selenium	1.8 U	1.9 U	1 J
Silver	0.37 U	0.39 U	0.32 U
Thallium	0.37 U	0.39 U	0.32 U
Tin	37 U	39 U	32 U
Vanadium	67 J	170 J	350 J
Zinc	44	63	70

APPENDIX H
HHRA–STATISTICAL SUMMARY(ProUCL Computational Output)

2008 CORRECTIVE MEASURES STUDY INVESTIGATION HHRA

Appendix H

2008 Surface Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Data	25	Number of Detected Data	14
Number of Distinct Detected Data	12	Number of Non-Detect Data	11
		Percent Non-Detects	44.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.8	Minimum Detected	1.569
Maximum Detected	460	Maximum Detected	6.131
Mean of Detected	83.76	Mean of Detected	3.357
SD of Detected	126.1	SD of Detected	1.568
Minimum Non-Detect	1.9	Minimum Non-Detect	0.642
Maximum Non-Detect	2.7	Maximum Non-Detect	0.993

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	11
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	14
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	44.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.679	Shapiro Wilk Test Statistic	0.864
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	47.39	Mean	1.921
SD	101.8	SD	2.017
95% DL/2 (t) UCL	82.23	95% H-Stat (DL/2) UCL	271.6
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	1.589
		SD in Log Scale	2.381
		Mean in Original Scale	47.18
		SD in Original Scale	101.9
		95% t UCL	82.05
		95% Percentile Bootstrap UCL	82.18
		95% BCA Bootstrap UCL	103.1

Appendix H General UCL Statistics for Data Sets with Non-Detects

2008 Surface Soil

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.503
Theta Star	166.5
nu star	14.09
A-D Test Statistic	1.004
5% A-D Critical Value	0.786
K-S Test Statistic	0.786
5% K-S Critical Value	0.24

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	460
Mean	62.96
Median	30.13
SD	97.96
k star	0.228
Theta star	276.5
Nu star	11.38
AppChi2	4.823
95% Gamma Approximate UCL	148.6
95% Adjusted Gamma UCL	158

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	49.02
SD	99.01
SE of Mean	20.55
95% KM (t) UCL	84.17
95% KM (z) UCL	82.82
95% KM (jackknife) UCL	83.34
95% KM (bootstrap t) UCL	124.2
95% KM (BCA) UCL	90.33
95% KM (Percentile Bootstrap) UCL	85.87
95% KM (Chebyshev) UCL	138.6
97.5% KM (Chebyshev) UCL	177.4
99% KM (Chebyshev) UCL	253.5
Potential UCLs to Use	
99% KM (Chebyshev) UCL	253.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (BaP)

General Statistics

Number of Valid Data	25	Number of Detected Data	17
Number of Distinct Detected Data	15	Number of Non-Detect Data	8
		Percent Non-Detects	32.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2.8	Minimum Detected	1.03
Maximum Detected	530	Maximum Detected	6.273
Mean of Detected	100.4	Mean of Detected	3.67
SD of Detected	146.7	SD of Detected	1.466
Minimum Non-Detect	0.73	Minimum Non-Detect	-0.315
Maximum Non-Detect	3.3	Maximum Non-Detect	1.194

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	16
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	36.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.686	Shapiro Wilk Test Statistic	0.972
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	68.45	Mean	2.296
SD	128.9	SD	2.384
95% DL/2 (t) UCL	112.6	95% H-Stat (DL/2) UCL	1602
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	22.33	Mean in Log Scale	2.565
SD	172	SD in Log Scale	2.034
95% MLE (t) UCL	81.19	Mean in Original Scale	68.65
95% MLE (Tiku) UCL	86.32	SD in Original Scale	128.8
		95% t UCL	112.7
		95% Percentile Bootstrap UCL	113.8
		95% BCA Bootstrap UCL	124.6

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.575
Theta Star	174.6
nu star	19.54
A-D Test Statistic	0.651
5% A-D Critical Value	0.785
K-S Test Statistic	0.785
5% K-S Critical Value	0.219
Data appear Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	530
Mean	68.25
Median	17
SD	129
k star	0.0962
Theta star	709.4
Nu star	4.811
AppChi2	1.066
95% Gamma Approximate UCL	308.1
95% Adjusted Gamma UCL	344.5

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	69.15
SD	125.9
SE of Mean	25.96
95% KM (t) UCL	113.6
95% KM (z) UCL	111.8
95% KM (jackknife) UCL	112.7
95% KM (bootstrap t) UCL	143.3
95% KM (BCA) UCL	115.7
95% KM (Percentile Bootstrap) UCL	114.2
95% KM (Chebyshev) UCL	182.3
97.5% KM (Chebyshev) UCL	231.2
99% KM (Chebyshev) UCL	327.4
Potential UCLs to Use	
95% KM (BCA) UCL	115.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	25	Number of Detected Data	18
Number of Distinct Detected Data	16	Number of Non-Detect Data	7
		Percent Non-Detects	28.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.6	Minimum Detected	1.723
Maximum Detected	1300	Maximum Detected	7.17
Mean of Detected	223.3	Mean of Detected	4.329
SD of Detected	357.8	SD of Detected	1.538
Minimum Non-Detect	0.84	Minimum Non-Detect	-0.174
Maximum Non-Detect	5.5	Maximum Non-Detect	1.705

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	7
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	18
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	28.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.648	Shapiro Wilk Test Statistic	0.963
5% Shapiro Wilk Critical Value	0.897	5% Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	161	Mean	3
SD	317.9	SD	2.553
95% DL/2 (t) UCL	269.8	95% H-Stat (DL/2) UCL	6685
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	82.76	Mean in Log Scale	3.324
SD	389.3	SD in Log Scale	2.092
95% MLE (t) UCL	216	Mean in Original Scale	161.4
95% MLE (Tiku) UCL	219.6	SD in Original Scale	317.8
		95% t UCL	270.1
		95% Percentile Bootstrap UCL	274.9
		95% BCA Bootstrap UCL	310.2

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.517
Theta Star	432.1
nu star	18.6
A-D Test Statistic	0.882
5% A-D Critical Value	0.793
K-S Test Statistic	0.793
5% K-S Critical Value	0.214

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	1300
Mean	160.8
Median	29
SD	318.1
k star	0.102
Theta star	1580
Nu star	5.089
AppChi2	1.193
95% Gamma Approximate UCL	685.5
95% Adjusted Gamma UCL	763.3

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	162.3
SD	310.8
SE of Mean	63.97
95% KM (t) UCL	271.8
95% KM (z) UCL	267.6
95% KM (jackknife) UCL	270.4
95% KM (bootstrap t) UCL	371.4
95% KM (BCA) UCL	280.4
95% KM (Percentile Bootstrap) UCL	277.8
95% KM (Chebyshev) UCL	441.2
97.5% KM (Chebyshev) UCL	561.8
99% KM (Chebyshev) UCL	798.8

Potential UCLs to Use

99% KM (Chebyshev) UCL	798.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Number of Valid Data	25	Number of Detected Data	19
Number of Distinct Detected Data	18	Number of Non-Detect Data	6
		Percent Non-Detects	24.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3.9	Minimum Detected	1.361
Maximum Detected	1000	Maximum Detected	6.908
Mean of Detected	142	Mean of Detected	3.83
SD of Detected	246	SD of Detected	1.548
Minimum Non-Detect	0.68	Minimum Non-Detect	-0.386
Maximum Non-Detect	4.2	Maximum Non-Detect	1.435

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	7
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	18
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	28.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.603	Shapiro Wilk Test Statistic	0.964
5% Shapiro Wilk Critical Value	0.901	5% Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	108.1	Mean	2.74
SD	221.8	SD	2.414
95% DL/2 (t) UCL	184	95% H-Stat (DL/2) UCL	2829
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	53.11	Mean in Log Scale	2.973
SD	271	SD in Log Scale	2.06
95% MLE (t) UCL	145.8	Mean in Original Scale	108.2
95% MLE (Tiku) UCL	148.3	SD in Original Scale	221.7
		95% t UCL	184.1
		95% Percentile Bootstrap UCL	177
		95% BCA Bootstrap UCL	215.3

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.503
Theta Star	282.4
nu star	19.11
A-D Test Statistic	0.888
5% A-D Critical Value	0.797
K-S Test Statistic	0.797
5% K-S Critical Value	0.209

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	1000
Mean	107.9
Median	21
SD	221.9
k star	0.112
Theta star	963.1
Nu star	5.603
AppChi2	1.44
95% Gamma Approximate UCL	419.8
95% Adjusted Gamma UCL	464.2

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	108.9
SD	216.9
SE of Mean	44.57
95% KM (t) UCL	185.1
95% KM (z) UCL	182.2
95% KM (jackknife) UCL	184.2
95% KM (bootstrap t) UCL	293.4
95% KM (BCA) UCL	179.7
95% KM (Percentile Bootstrap) UCL	190.4
95% KM (Chebyshev) UCL	303.1
97.5% KM (Chebyshev) UCL	387.2
99% KM (Chebyshev) UCL	552.3

Potential UCLs to Use

95% KM (Chebyshev) UCL	303.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Number of Valid Data	25	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	11
		Percent Non-Detects	44.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3	Minimum Detected	1.099
Maximum Detected	220	Maximum Detected	5.394
Mean of Detected	37.66	Mean of Detected	2.873
SD of Detected	57.19	SD of Detected	1.247
Minimum Non-Detect	0.65	Minimum Non-Detect	-0.431
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	12
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	52.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.62	Shapiro Wilk Test Statistic	0.959
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	21.44	Mean	1.358
SD	46.06	SD	2.032
95% DL/2 (t) UCL	37.2	95% H-Stat (DL/2) UCL	162.8
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	1.476
		SD in Log Scale	1.861
		Mean in Original Scale	21.43
		SD in Original Scale	46.06
		95% t UCL	37.19
		95% Percentile Bootstrap UCL	37.88
		95% BCA Bootstrap UCL	46.64

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.666
Theta Star	56.57
nu star	18.64
A-D Test Statistic	0.587
5% A-D Critical Value	0.769
K-S Test Statistic	0.769
5% K-S Critical Value	0.237
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	220
Mean	28.98
Median	15.2
SD	43.68
k star	0.37
Theta star	78.28
Nu star	18.51
AppChi2	9.759
95% Gamma Approximate UCL	54.95
95% Adjusted Gamma UCL	57.5

Note: DL/2 is not a recommended method.

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	22.41
SD	44.69
SE of Mean	9.275
95% KM (t) UCL	38.28
95% KM (z) UCL	37.67
95% KM (jackknife) UCL	37.88
95% KM (bootstrap t) UCL	60.25
95% KM (BCA) UCL	40.1
95% KM (Percentile Bootstrap) UCL	38.32
95% KM (Chebyshev) UCL	62.84
97.5% KM (Chebyshev) UCL	80.34
99% KM (Chebyshev) UCL	114.7
Potential UCLs to Use	
95% KM (BCA) UCL	40.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	25	Number of Detected Data	16
Number of Distinct Detected Data	15	Number of Non-Detect Data	9
		Percent Non-Detects	36.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	8.6	Minimum Detected	2.152
Maximum Detected	1400	Maximum Detected	7.244
Mean of Detected	136.7	Mean of Detected	3.702
SD of Detected	341.6	SD of Detected	1.345
Minimum Non-Detect	1.3	Minimum Non-Detect	0.262
Maximum Non-Detect	4.2	Maximum Non-Detect	1.435

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	16
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	36.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.396	Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	87.79	Mean	2.305
SD	278.1	SD	2.188
95% DL/2 (t) UCL	183	95% H-Stat (DL/2) UCL	743.8
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	2.528
		SD in Log Scale	1.939
		Mean in Original Scale	88.08
		SD in Original Scale	278
		95% t UCL	183.2
		95% Percentile Bootstrap UCL	197.1
		95% BCA Bootstrap UCL	274.6

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.464
Theta Star	294.8
nu star	14.84
A-D Test Statistic	1.77
5% A-D Critical Value	0.795
K-S Test Statistic	0.795
5% K-S Critical Value	0.227

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	1400
Mean	88.42
Median	17
SD	278
k star	0.0947
Theta star	933.5
Nu star	4.736
AppChi2	1.032
95% Gamma Approximate UCL	405.7
95% Adjusted Gamma UCL	454.2

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	90.56
SD	271.6
SE of Mean	56.11
95% KM (t) UCL	186.6
95% KM (z) UCL	182.9
95% KM (jackknife) UCL	184.7
95% KM (bootstrap t) UCL	588.8
95% KM (BCA) UCL	191.3
95% KM (Percentile Bootstrap) UCL	199
95% KM (Chebyshev) UCL	335.1
97.5% KM (Chebyshev) UCL	441
99% KM (Chebyshev) UCL	648.9

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	441

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	19

Raw Statistics

Minimum	1.4
Maximum	5.4
Mean	3.376
Median	3.7
SD	1.175
Coefficient of Variation	0.348
Skewness	-0.268

Log-transformed Statistics

Minimum of Log Data	0.336
Maximum of Log Data	1.686
Mean of log Data	1.146
SD of log Data	0.405

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.949
Shapiro Wilk Critical Value	0.918

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.897
Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.778

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.749
95% Modified-t UCL (Johnson-1978)	3.776

Assuming Lognormal Distribution

95% H-UCL	3.99
95% Chebyshev (MVUE) UCL	4.637
97.5% Chebyshev (MVUE) UCL	5.172
99% Chebyshev (MVUE) UCL	6.221

Gamma Distribution Test

k star (bias corrected)	6.39
Theta Star	0.528
MLE of Mean	3.376
MLE of Standard Deviation	1.336
nu star	319.5
Approximate Chi Square Value (.05)	279.1
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	276.5
Anderson-Darling Test Statistic	0.756
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.166
Kolmogorov-Smirnov 5% Critical Value	0.175

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.865
95% Adjusted Gamma UCL	3.901

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	3.763
95% Jackknife UCL	3.778
95% Standard Bootstrap UCL	3.752
95% Bootstrap-t UCL	3.769
95% Hall's Bootstrap UCL	3.757
95% Percentile Bootstrap UCL	3.74
95% BCA Bootstrap UCL	3.752
95% Chebyshev(Mean, Sd) UCL	4.401
97.5% Chebyshev(Mean, Sd) UCL	4.844
99% Chebyshev(Mean, Sd) UCL	5.715

Potential UCL to Use

Use 95% Student's-t UCL 3.778

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Number of Valid Data	25	Number of Detected Data	24
Number of Distinct Detected Data	22	Number of Non-Detect Data	1
		Percent Non-Detects	4.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.051	Minimum Detected	-2.976
Maximum Detected	36	Maximum Detected	3.584
Mean of Detected	3.372	Mean of Detected	-0.0432
SD of Detected	7.839	SD of Detected	1.522
Minimum Non-Detect	0.039	Minimum Non-Detect	-3.244
Maximum Non-Detect	0.039	Maximum Non-Detect	-3.244

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.435	Shapiro Wilk Test Statistic	0.967
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.238	Mean	-0.199
SD	7.703	SD	1.681
95% DL/2 (t) UCL	5.874	95% H-Stat (DL/2) UCL	11.09
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	3.03	Mean in Log Scale	-0.193
SD	7.748	SD in Log Scale	1.669
95% MLE (t) UCL	5.681	Mean in Original Scale	3.238
95% MLE (Tiku) UCL	5.416	SD in Original Scale	7.703
		95% t UCL	5.874
		95% Percentile Bootstrap UCL	5.98
		95% BCA Bootstrap UCL	7.396

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.469
Theta Star	7.194
nu star	22.5
A-D Test Statistic	1.694
5% A-D Critical Value	0.806
K-S Test Statistic	0.806
5% K-S Critical Value	0.188

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	36
Mean	3.237
Median	0.8
SD	7.703
k star	0.288
Theta star	11.22
Nu star	14.42
AppChi2	6.861
95% Gamma Approximate UCL	6.805
95% Adjusted Gamma UCL	7.175

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	3.239
SD	7.547
SE of Mean	1.542
95% KM (t) UCL	5.877
95% KM (z) UCL	5.775
95% KM (jackknife) UCL	5.874
95% KM (bootstrap t) UCL	16.58
95% KM (BCA) UCL	5.678
95% KM (Percentile Bootstrap) UCL	6.078
95% KM (Chebyshev) UCL	9.96
97.5% KM (Chebyshev) UCL	12.87
99% KM (Chebyshev) UCL	18.58
Potential UCLs to Use	
99% KM (Chebyshev) UCL	18.58

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	5.7	Minimum of Log Data	1.74
Maximum	18	Maximum of Log Data	2.89
Mean	10.34	Mean of log Data	2.275
Median	9.6	SD of log Data	0.356
SD	3.711		
Coefficient of Variation	0.359		
Skewness	0.603		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.92	Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.918	Shapiro Wilk Critical Value	0.918
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	11.61	95% H-UCL	11.85
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.61
95% Adjusted-CLT UCL (Chen-1995)	11.65	97.5% Chebyshev (MVUE) UCL	15.02
95% Modified-t UCL (Johnson-1978)	11.62	99% Chebyshev (MVUE) UCL	17.81

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	7.402	Data appear Normal at 5% Significance Level
Theta Star	1.396	
MLE of Mean	10.34	
MLE of Standard Deviation	3.799	
nu star	370.1	
Approximate Chi Square Value (.05)	326.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0395	95% CLT UCL 11.56
Adjusted Chi Square Value	323.7	95% Jackknife UCL 11.61
		95% Standard Bootstrap UCL 11.48
Anderson-Darling Test Statistic	0.455	95% Bootstrap-t UCL 11.7
Anderson-Darling 5% Critical Value	0.746	95% Hall's Bootstrap UCL 11.72
Kolmogorov-Smirnov Test Statistic	0.116	95% Percentile Bootstrap UCL 11.59
Kolmogorov-Smirnov 5% Critical Value	0.175	95% BCA Bootstrap UCL 11.66
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 13.57
		97.5% Chebyshev(Mean, Sd) UCL 14.97
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 17.72
95% Approximate Gamma UCL	11.72	
95% Adjusted Gamma UCL	11.82	

Potential UCL to Use		Use 95% Student's-t UCL	11.61

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2008 Surface Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Data	25	Number of Detected Data	24
Number of Distinct Detected Data	24	Number of Non-Detect Data	1
		Percent Non-Detects	4.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.93	Minimum Detected	-0.0726
Maximum Detected	520	Maximum Detected	6.254
Mean of Detected	59.87	Mean of Detected	2.919
SD of Detected	116.7	SD of Detected	1.54
Minimum Non-Detect	0.71	Minimum Non-Detect	-0.342
Maximum Non-Detect	0.71	Maximum Non-Detect	-0.342

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.529	Shapiro Wilk Test Statistic	0.979
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	57.49	Mean	2.76
SD	114.9	SD	1.703
95% DL/2 (t) UCL	96.8	95% H-Stat (DL/2) UCL	227.8
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	54.49	Mean in Log Scale	2.765
SD	115.6	SD in Log Scale	1.693
95% MLE (t) UCL	94.06	Mean in Original Scale	57.49
95% MLE (Tiku) UCL	90.34	SD in Original Scale	114.9
		95% t UCL	96.8
		95% Percentile Bootstrap UCL	98.84
		95% BCA Bootstrap UCL	115.8

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.496
Theta Star	120.6
nu star	23.83
A-D Test Statistic	1.188
5% A-D Critical Value	0.803
K-S Test Statistic	0.803
5% K-S Critical Value	0.188

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	520
Mean	57.47
Median	15
SD	114.9
k star	0.285
Theta star	201.5
Nu star	14.26
AppChi2	6.751
95% Gamma Approximate UCL	121.4
95% Adjusted Gamma UCL	128.1

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	57.51
SD	112.5
SE of Mean	22.99
95% KM (t) UCL	96.85
95% KM (z) UCL	95.33
95% KM (jackknife) UCL	96.75
95% KM (bootstrap t) UCL	144.4
95% KM (BCA) UCL	94.79
95% KM (Percentile Bootstrap) UCL	94.37
95% KM (Chebyshev) UCL	157.7
97.5% KM (Chebyshev) UCL	201.1
99% KM (Chebyshev) UCL	286.3
Potential UCLs to Use	
95% KM (Chebyshev) UCL	157.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Observations	25	Number of Distinct Observations	20

Raw Statistics

Minimum	46
Maximum	280
Mean	116.4
Median	100
SD	56.71
Coefficient of Variation	0.487
Skewness	1.398

Log-transformed Statistics

Minimum of Log Data	3.829
Maximum of Log Data	5.635
Mean of log Data	4.657
SD of log Data	0.449

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.878
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	135.8

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	138.4
95% Modified-t UCL (Johnson-1978)	136.3

Assuming Lognormal Distribution

95% H-UCL	138.9
95% Chebyshev (MVUE) UCL	162.9
97.5% Chebyshev (MVUE) UCL	183.2
99% Chebyshev (MVUE) UCL	223.1

Gamma Distribution Test

k star (bias corrected)	4.567
Theta Star	25.48
MLE of Mean	116.4
MLE of Standard Deviation	54.45
nu star	228.3
Approximate Chi Square Value (.05)	194.4
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	192.2
Anderson-Darling Test Statistic	0.361
Anderson-Darling 5% Critical Value	0.747
Kolmogorov-Smirnov Test Statistic	0.131
Kolmogorov-Smirnov 5% Critical Value	0.175

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	136.7
95% Adjusted Gamma UCL	138.2

Nonparametric Statistics

95% CLT UCL	135
95% Jackknife UCL	135.8
95% Standard Bootstrap UCL	134.5
95% Bootstrap-t UCL	140.7
95% Hall's Bootstrap UCL	144.1
95% Percentile Bootstrap UCL	136
95% BCA Bootstrap UCL	138.7
95% Chebyshev(Mean, Sd) UCL	165.8
97.5% Chebyshev(Mean, Sd) UCL	187.2
99% Chebyshev(Mean, Sd) UCL	229.2

Potential UCL to Use

Use 95% Approximate Gamma UCL 136.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Data	35	Number of Detected Data	14
Number of Distinct Detected Data	12	Number of Non-Detect Data	21
		Percent Non-Detects	60.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.8	Minimum Detected	1.569
Maximum Detected	460	Maximum Detected	6.131
Mean of Detected	83.76	Mean of Detected	3.357
SD of Detected	126.1	SD of Detected	1.568
Minimum Non-Detect	1.9	Minimum Non-Detect	0.642
Maximum Non-Detect	2.7	Maximum Non-Detect	0.993

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	21
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	14
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	60.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.679	Shapiro Wilk Test Statistic	0.864
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	34.16	Mean	1.397
SD	88.13	SD	1.892
95% DL/2 (t) UCL	59.35	95% H-Stat (DL/2) UCL	80.89
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	0.531
		SD in Log Scale	2.726
		Mean in Original Scale	33.8
		SD in Original Scale	88.27
		95% t UCL	59.03
		95% Percentile Bootstrap UCL	58.96
		95% BCA Bootstrap UCL	73.89

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.503
Theta Star	166.5
nu star	14.09
A-D Test Statistic	1.004
5% A-D Critical Value	0.786
K-S Test Statistic	0.786
5% K-S Critical Value	0.24

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	4.8
Maximum	460
Mean	85.25
Median	83.75
SD	78.55
k star	1.201
Theta star	71
Nu star	84.05
AppChi2	63.92
95% Gamma Approximate UCL	112.1
95% Adjusted Gamma UCL	113.6

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	36.38
SD	86.03
SE of Mean	15.09
95% KM (t) UCL	61.9
95% KM (z) UCL	61.21
95% KM (jackknife) UCL	60.97
95% KM (bootstrap t) UCL	86.75
95% KM (BCA) UCL	62.84
95% KM (Percentile Bootstrap) UCL	62.19
95% KM (Chebyshev) UCL	102.2
97.5% KM (Chebyshev) UCL	130.6
99% KM (Chebyshev) UCL	186.5
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	130.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (BaP)

General Statistics

Number of Valid Data	35	Number of Detected Data	17
Number of Distinct Detected Data	15	Number of Non-Detect Data	18
		Percent Non-Detects	51.43%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2.8	Minimum Detected	1.03
Maximum Detected	530	Maximum Detected	6.273
Mean of Detected	100.4	Mean of Detected	3.67
SD of Detected	146.7	SD of Detected	1.466
Minimum Non-Detect	0.73	Minimum Non-Detect	-0.315
Maximum Non-Detect	3.3	Maximum Non-Detect	1.194

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	19
Number treated as Detected	16
Single DL Non-Detect Percentage	54.29%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.686	Shapiro Wilk Test Statistic	0.972
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	49.01	Mean	1.395
SD	112.7	SD	2.47
95% DL/2 (t) UCL	81.22	95% H-Stat (DL/2) UCL	608.6
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	1.632
		SD in Log Scale	2.293
		Mean in Original Scale	49.21
		SD in Original Scale	112.6
		95% t UCL	81.39
		95% Percentile Bootstrap UCL	83.04
		95% BCA Bootstrap UCL	94

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.575
Theta Star	174.6
nu star	19.54
A-D Test Statistic	0.651
5% A-D Critical Value	0.785
K-S Test Statistic	0.785
5% K-S Critical Value	0.219

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	2.8
Maximum	530
Mean	100.4
Median	100.7
SD	100.7
k star	1.149
Theta star	87.37
Nu star	80.41
AppChi2	60.75
95% Gamma Approximate UCL	132.8
95% Adjusted Gamma UCL	134.6

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	50.19
SD	110.6
SE of Mean	19.26
95% KM (t) UCL	82.76
95% KM (z) UCL	81.87
95% KM (jackknife) UCL	81.52
95% KM (bootstrap t) UCL	118
95% KM (BCA) UCL	87.97
95% KM (Percentile Bootstrap) UCL	86.57
95% KM (Chebyshev) UCL	134.2
97.5% KM (Chebyshev) UCL	170.5
99% KM (Chebyshev) UCL	241.8

Potential UCLs to Use

95% KM (t) UCL	82.76

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	35	Number of Detected Data	18
Number of Distinct Detected Data	16	Number of Non-Detect Data	17
		Percent Non-Detects	48.57%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.6	Minimum Detected	1.723
Maximum Detected	1300	Maximum Detected	7.17
Mean of Detected	223.3	Mean of Detected	4.329
SD of Detected	357.8	SD of Detected	1.538
Minimum Non-Detect	0.84	Minimum Non-Detect	-0.174
Maximum Non-Detect	5.5	Maximum Non-Detect	1.705

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	17
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	18
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	48.57%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.648	Shapiro Wilk Test Statistic	0.963
5% Shapiro Wilk Critical Value	0.897	5% Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	115.2	Mean	1.939
SD	277.1	SD	2.738
95% DL/2 (t) UCL	194.3	95% H-Stat (DL/2) UCL	3198
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	2.342
		SD in Log Scale	2.396
		Mean in Original Scale	115.6
		SD in Original Scale	276.9
		95% t UCL	194.7
		95% Percentile Bootstrap UCL	196
		95% BCA Bootstrap UCL	224.2

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.517
Theta Star	432.1
nu star	18.6
A-D Test Statistic	0.882
5% A-D Critical Value	0.793
K-S Test Statistic	0.793
5% K-S Critical Value	0.214

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	1300
Mean	205.3
Median	166.4
SD	269.5
k star	0.401
Theta star	512.5
Nu star	28.04
AppChi2	16.96
95% Gamma Approximate UCL	339.4
95% Adjusted Gamma UCL	347.8

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	117.6
SD	272.1
SE of Mean	47.32
95% KM (t) UCL	197.6
95% KM (z) UCL	195.4
95% KM (jackknife) UCL	195.5
95% KM (bootstrap t) UCL	275.7
95% KM (BCA) UCL	199.1
95% KM (Percentile Bootstrap) UCL	203
95% KM (Chebyshev) UCL	323.8
97.5% KM (Chebyshev) UCL	413.1
99% KM (Chebyshev) UCL	588.4
Potential UCLs to Use	
99% KM (Chebyshev) UCL	588.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Number of Valid Data	35	Number of Detected Data	19
Number of Distinct Detected Data	18	Number of Non-Detect Data	16
		Percent Non-Detects	45.71%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3.9	Minimum Detected	1.361
Maximum Detected	1000	Maximum Detected	6.908
Mean of Detected	142	Mean of Detected	3.83
SD of Detected	246	SD of Detected	1.548
Minimum Non-Detect	0.68	Minimum Non-Detect	-0.386
Maximum Non-Detect	4.2	Maximum Non-Detect	1.435

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	17
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	18
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	48.57%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.603	Shapiro Wilk Test Statistic	0.964
5% Shapiro Wilk Critical Value	0.901	5% Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	77.31	Mean	1.69
SD	192.8	SD	2.637
95% DL/2 (t) UCL	132.4	95% H-Stat (DL/2) UCL	1613
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	1.987
		SD in Log Scale	2.374
		Mean in Original Scale	77.54
		SD in Original Scale	192.7
		95% t UCL	132.6
		95% Percentile Bootstrap UCL	134.4
		95% BCA Bootstrap UCL	167.3

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.503
Theta Star	282.4
nu star	19.11
A-D Test Statistic	0.888
5% A-D Critical Value	0.797
K-S Test Statistic	0.797
5% K-S Critical Value	0.209

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	1000
Mean	110.7
Median	53.33
SD	188.2
k star	0.215
Theta star	514.6
Nu star	15.06
AppChi2	7.303
95% Gamma Approximate UCL	228.3
95% Adjusted Gamma UCL	236.6

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	78.87
SD	189.4
SE of Mean	32.88
95% KM (t) UCL	134.5
95% KM (z) UCL	133
95% KM (jackknife) UCL	132.9
95% KM (bootstrap t) UCL	214.9
95% KM (BCA) UCL	150.2
95% KM (Percentile Bootstrap) UCL	138.8
95% KM (Chebyshev) UCL	222.2
97.5% KM (Chebyshev) UCL	284.2
99% KM (Chebyshev) UCL	406.1

Potential UCLs to Use

95% KM (BCA) UCL	150.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Number of Valid Data	35	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	21
		Percent Non-Detects	60.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3	Minimum Detected	1.099
Maximum Detected	220	Maximum Detected	5.394
Mean of Detected	37.66	Mean of Detected	2.873
SD of Detected	57.19	SD of Detected	1.247
Minimum Non-Detect	0.65	Minimum Non-Detect	-0.431
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	23
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	12
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	65.71%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.62	Shapiro Wilk Test Statistic	0.959
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	15.42	Mean	0.693
SD	39.88	SD	2.013
95% DL/2 (t) UCL	26.82	95% H-Stat (DL/2) UCL	58.54
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	0.638
		SD in Log Scale	2.068
		Mean in Original Scale	15.37
		SD in Original Scale	39.9
		95% t UCL	26.78
		95% Percentile Bootstrap UCL	27
		95% BCA Bootstrap UCL	35.25

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.666
Theta Star	56.57
nu star	18.64
A-D Test Statistic	0.587
5% A-D Critical Value	0.769
K-S Test Statistic	0.769
5% K-S Critical Value	0.237
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	3
Maximum	220
Mean	37.68
Median	36.86
SD	35.87
k star	1.607
Theta star	23.45
Nu star	112.5
AppChi2	89
95% Gamma Approximate UCL	47.62
95% Adjusted Gamma UCL	48.15

Note: DL/2 is not a recommended method.

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	16.87
SD	38.77
SE of Mean	6.801
95% KM (t) UCL	28.37
95% KM (z) UCL	28.05
95% KM (jackknife) UCL	27.9
95% KM (bootstrap t) UCL	47.41
95% KM (BCA) UCL	29.95
95% KM (Percentile Bootstrap) UCL	28.86
95% KM (Chebyshev) UCL	46.51
97.5% KM (Chebyshev) UCL	59.34
99% KM (Chebyshev) UCL	84.54
Potential UCLs to Use	
95% KM (t) UCL	28.37

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	35	Number of Detected Data	16
Number of Distinct Detected Data	15	Number of Non-Detect Data	19
		Percent Non-Detects	54.29%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	8.6	Minimum Detected	2.152
Maximum Detected	1400	Maximum Detected	7.244
Mean of Detected	136.7	Mean of Detected	3.702
SD of Detected	341.6	SD of Detected	1.345
Minimum Non-Detect	1.3	Minimum Non-Detect	0.262
Maximum Non-Detect	4.2	Maximum Non-Detect	1.435

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	16
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	54.29%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.396	Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	62.93	Mean	1.573
SD	237.1	SD	2.182
95% DL/2 (t) UCL	130.7	95% H-Stat (DL/2) UCL	248.3
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	1.628
		SD in Log Scale	2.246
		Mean in Original Scale	63.19
		SD in Original Scale	237
		95% t UCL	130.9
		95% Percentile Bootstrap UCL	140.1
		95% BCA Bootstrap UCL	184.9

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.464
Theta Star	294.8
nu star	14.84
A-D Test Statistic	1.77
5% A-D Critical Value	0.795
K-S Test Statistic	0.795
5% K-S Critical Value	0.227

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	8.6
Maximum	1400
Mean	136.3
Median	104.8
SD	229.4
k star	0.903
Theta star	150.9
Nu star	63.21
AppChi2	45.92
95% Gamma Approximate UCL	187.6
95% Adjusted Gamma UCL	190.5

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	67.14
SD	232.5
SE of Mean	40.6
95% KM (t) UCL	135.8
95% KM (z) UCL	133.9
95% KM (jackknife) UCL	133.4
95% KM (bootstrap t) UCL	454.1
95% KM (BCA) UCL	156.2
95% KM (Percentile Bootstrap) UCL	144.3
95% KM (Chebyshev) UCL	244.1
97.5% KM (Chebyshev) UCL	320.7
99% KM (Chebyshev) UCL	471.1

Potential UCLs to Use

95% KM (BCA) UCL	156.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	35	Number of Distinct Observations	27

Raw Statistics		Log-transformed Statistics	
Minimum	0.83	Minimum of Log Data	-0.186
Maximum	5.4	Maximum of Log Data	1.686
Mean	2.779	Mean of log Data	0.873
Median	2.7	SD of log Data	0.584
SD	1.399		
Coefficient of Variation	0.503		
Skewness	0.148		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Test Statistic	0.911
Shapiro Wilk Critical Value	0.934	Shapiro Wilk Critical Value	0.934
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3.178	95% H-UCL	3.474
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.114
95% Adjusted-CLT UCL (Chen-1995)	3.174	97.5% Chebyshev (MVUE) UCL	4.672
95% Modified-t UCL (Johnson-1978)	3.179	99% Chebyshev (MVUE) UCL	5.769

Gamma Distribution Test		Data Distribution
k star (bias corrected)	3.236	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	0.859	
MLE of Mean	2.779	
MLE of Standard Deviation	1.545	
nu star	226.5	
Approximate Chi Square Value (.05)	192.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0425	95% CLT UCL 3.167
Adjusted Chi Square Value	191.2	95% Jackknife UCL 3.178
		95% Standard Bootstrap UCL 3.16
Anderson-Darling Test Statistic	0.826	95% Bootstrap-t UCL 3.175
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL 3.163
Kolmogorov-Smirnov Test Statistic	0.141	95% Percentile Bootstrap UCL 3.165
Kolmogorov-Smirnov 5% Critical Value	0.15	95% BCA Bootstrap UCL 3.172
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 3.809
		97.5% Chebyshev(Mean, Sd) UCL 4.255
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 5.131
95% Approximate Gamma UCL	3.267	
95% Adjusted Gamma UCL	3.292	

Potential UCL to Use	Use 95% Approximate Gamma UCL 3.267

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Number of Valid Data	35	Number of Detected Data	27
Number of Distinct Detected Data	23	Number of Non-Detect Data	8
		Percent Non-Detects	22.86%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.046	Minimum Detected	-3.079
Maximum Detected	36	Maximum Detected	3.584
Mean of Detected	3.009	Mean of Detected	-0.322
SD of Detected	7.447	SD of Detected	1.658
Minimum Non-Detect	0.034	Minimum Non-Detect	-3.381
Maximum Non-Detect	0.041	Maximum Non-Detect	-3.194

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	27
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	22.86%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.416	Shapiro Wilk Test Statistic	0.964
5% Shapiro Wilk Critical Value	0.923	5% Shapiro Wilk Critical Value	0.923
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.325	Mean	-1.16
SD	6.636	SD	2.13
95% DL/2 (t) UCL	4.222	95% H-Stat (DL/2) UCL	13.54
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.002	Mean in Log Scale	-1.175
SD	7.704	SD in Log Scale	2.158
95% MLE (t) UCL	3.204	Mean in Original Scale	2.325
95% MLE (Tiku) UCL	3.183	SD in Original Scale	6.636
		95% t UCL	4.222
		95% Percentile Bootstrap UCL	4.41
		95% BCA Bootstrap UCL	5.282

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.427
Theta Star	7.038
nu star	23.08
A-D Test Statistic	1.657
5% A-D Critical Value	0.818
K-S Test Statistic	0.818
5% K-S Critical Value	0.179

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	36
Mean	2.321
Median	0.61
SD	6.637
k star	0.118
Theta star	19.63
Nu star	8.278
AppChi2	2.897
95% Gamma Approximate UCL	6.632
95% Adjusted Gamma UCL	6.992

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.331
SD	6.538
SE of Mean	1.126
95% KM (t) UCL	4.236
95% KM (z) UCL	4.184
95% KM (jackknife) UCL	4.226
95% KM (bootstrap t) UCL	11.49
95% KM (BCA) UCL	4.353
95% KM (Percentile Bootstrap) UCL	4.251
95% KM (Chebyshev) UCL	7.24
97.5% KM (Chebyshev) UCL	9.364
99% KM (Chebyshev) UCL	13.54

Potential UCLs to Use

99% KM (Chebyshev) UCL	13.54

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Observations	35	Number of Distinct Observations	26

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.4	Minimum of Log Data	0.875
Maximum	27	Maximum of Log Data	3.296
Mean	10.6	Mean of log Data	2.25
Median	9.6	SD of log Data	0.498
SD	4.995		
Coefficient of Variation	0.471		
Skewness	1.031		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.937	Shapiro Wilk Test Statistic	0.972
Shapiro Wilk Critical Value	0.934	Shapiro Wilk Critical Value	0.934
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.03	95% H-UCL	12.67
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	14.8
95% Adjusted-CLT UCL (Chen-1995)	12.15	97.5% Chebyshev (MVUE) UCL	16.57
95% Modified-t UCL (Johnson-1978)	12.06	99% Chebyshev (MVUE) UCL	20.06

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	4.268	Data appear Normal at 5% Significance Level
Theta Star	2.485	
MLE of Mean	10.6	
MLE of Standard Deviation	5.133	
nu star	298.7	
Approximate Chi Square Value (.05)	259.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0425	95% CLT UCL 11.99
Adjusted Chi Square Value	258	95% Jackknife UCL 12.03
		95% Standard Bootstrap UCL 11.96
Anderson-Darling Test Statistic	0.246	95% Bootstrap-t UCL 12.22
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL 12.3
Kolmogorov-Smirnov Test Statistic	0.0936	95% Percentile Bootstrap UCL 11.99
Kolmogorov-Smirnov 5% Critical Value	0.149	95% BCA Bootstrap UCL 12.19
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 14.28
		97.5% Chebyshev(Mean, Sd) UCL 15.88
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 19
95% Approximate Gamma UCL	12.2	
95% Adjusted Gamma UCL	12.28	

Potential UCL to Use	Use 95% Student's-t UCL 12.03

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Data	25	Number of Detected Data	24
Number of Distinct Detected Data	24	Number of Non-Detect Data	1
		Percent Non-Detects	4.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.93	Minimum Detected	-0.0726
Maximum Detected	520	Maximum Detected	6.254
Mean of Detected	59.87	Mean of Detected	2.919
SD of Detected	116.7	SD of Detected	1.54
Minimum Non-Detect	0.71	Minimum Non-Detect	-0.342
Maximum Non-Detect	0.71	Maximum Non-Detect	-0.342

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.529	Shapiro Wilk Test Statistic	0.979
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	57.49	Mean	2.76
SD	114.9	SD	1.703
95% DL/2 (t) UCL	96.8	95% H-Stat (DL/2) UCL	227.8
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	54.49	Mean in Log Scale	2.765
SD	115.6	SD in Log Scale	1.693
95% MLE (t) UCL	94.06	Mean in Original Scale	57.49
95% MLE (Tiku) UCL	90.34	SD in Original Scale	114.9
		95% t UCL	96.8
		95% Percentile Bootstrap UCL	98.53
		95% BCA Bootstrap UCL	116

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.496
Theta Star	120.6
nu star	23.83
A-D Test Statistic	1.188
5% A-D Critical Value	0.803
K-S Test Statistic	0.803
5% K-S Critical Value	0.188

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-12
Maximum	520
Mean	57.47
Median	15
SD	114.9
k star	0.285
Theta star	201.5
Nu star	14.26
AppChi2	6.751
95% Gamma Approximate UCL	121.4
95% Adjusted Gamma UCL	128.1

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	57.51
SD	112.5
SE of Mean	22.99
95% KM (t) UCL	96.85
95% KM (z) UCL	95.33
95% KM (jackknife) UCL	96.75
95% KM (bootstrap t) UCL	138.9
95% KM (BCA) UCL	99.61
95% KM (Percentile Bootstrap) UCL	98.2
95% KM (Chebyshev) UCL	157.7
97.5% KM (Chebyshev) UCL	201.1
99% KM (Chebyshev) UCL	286.3

Potential UCLs to Use

95% KM (Chebyshev) UCL	157.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2008 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Observations	35	Number of Distinct Observations	27

Raw Statistics

Minimum	46
Maximum	460
Mean	167.7
Median	140
SD	110
Coefficient of Variation	0.656
Skewness	1.296

Log-transformed Statistics

Minimum of Log Data	3.829
Maximum of Log Data	6.131
Mean of log Data	4.935
SD of log Data	0.614

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.849
Shapiro Wilk Critical Value	0.934

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.934

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	199.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	202.6
95% Modified-t UCL (Johnson-1978)	199.8

Assuming Lognormal Distribution

95% H-UCL	208.1
95% Chebyshev (MVUE) UCL	247.4
97.5% Chebyshev (MVUE) UCL	282.3
99% Chebyshev (MVUE) UCL	350.8

Gamma Distribution Test

k star (bias corrected)	2.605
Theta Star	64.38
MLE of Mean	167.7
MLE of Standard Deviation	103.9
nu star	182.3
Approximate Chi Square Value (.05)	152.1
Adjusted Level of Significance	0.0425
Adjusted Chi Square Value	150.8
Anderson-Darling Test Statistic	0.626
Anderson-Darling 5% Critical Value	0.755
Kolmogorov-Smirnov Test Statistic	0.137
Kolmogorov-Smirnov 5% Critical Value	0.15

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	201
95% Adjusted Gamma UCL	202.8

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	198.3
95% Jackknife UCL	199.1
95% Standard Bootstrap UCL	197.4
95% Bootstrap-t UCL	205.2
95% Hall's Bootstrap UCL	202.2
95% Percentile Bootstrap UCL	199.9
95% BCA Bootstrap UCL	203.7
95% Chebyshev(Mean, Sd) UCL	248.8
97.5% Chebyshev(Mean, Sd) UCL	283.8
99% Chebyshev(Mean, Sd) UCL	352.8

Potential UCL to Use

Use 95% Approximate Gamma UCL 201

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Full Data Sets

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	52	Number of Distinct Observations	35

Raw Statistics

Minimum	0.65
Maximum	6.2
Mean	2.729
Median	2.6
SD	1.344
Coefficient of Variation	0.493
Skewness	0.49

Log-transformed Statistics

Minimum of Log Data	-0.431
Maximum of Log Data	1.825
Mean of log Data	0.869
SD of log Data	0.549

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.0867
Lilliefors Critical Value	0.123

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.106
Lilliefors Critical Value	0.123

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.041

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.049
95% Modified-t UCL (Johnson-1978)	3.043

Assuming Lognormal Distribution

95% H-UCL	3.212
95% Chebyshev (MVUE) UCL	3.736
97.5% Chebyshev (MVUE) UCL	4.157
99% Chebyshev (MVUE) UCL	4.984

Gamma Distribution Test

k star (bias corrected)	3.665
Theta Star	0.744
MLE of Mean	2.729
MLE of Standard Deviation	1.425
nu star	381.2
Approximate Chi Square Value (.05)	336.9
Adjusted Level of Significance	0.0454
Adjusted Chi Square Value	335.8
Anderson-Darling Test Statistic	0.457
Anderson-Darling 5% Critical Value	0.754
Kolmogorov-Smirnov Test Statistic	0.0973
Kolmogorov-Smirnov 5% Critical Value	0.124

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.087
95% Adjusted Gamma UCL	3.098

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	3.035
95% Jackknife UCL	3.041
95% Standard Bootstrap UCL	3.03
95% Bootstrap-t UCL	3.056
95% Hall's Bootstrap UCL	3.052
95% Percentile Bootstrap UCL	3.05
95% BCA Bootstrap UCL	3.044
95% Chebyshev(Mean, Sd) UCL	3.541
97.5% Chebyshev(Mean, Sd) UCL	3.893
99% Chebyshev(Mean, Sd) UCL	4.583

Potential UCL to Use

Use 95% Student's-t UCL 3.041

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2010 Surface Soil

General UCL Statistics for Full Data Sets

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Observations	52	Number of Distinct Observations	40

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.61	Minimum of Log Data	-0.494
Maximum	64	Maximum of Log Data	4.159
Mean	10.03	Mean of log Data	1.974
Median	7.75	SD of log Data	0.844
SD	10.26		
Coefficient of Variation	1.023		
Skewness	3.695		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.215	Lilliefors Test Statistic	0.0966
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.41	95% H-UCL	13.26
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	16.07
95% Adjusted-CLT UCL (Chen-1995)	13.15	97.5% Chebyshev (MVUE) UCL	18.62
95% Modified-t UCL (Johnson-1978)	12.53	99% Chebyshev (MVUE) UCL	23.62

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.573	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	6.374	
MLE of Mean	10.03	
MLE of Standard Deviation	7.995	
nu star	163.6	
Approximate Chi Square Value (.05)	135.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0454	95% CLT UCL 12.37
Adjusted Chi Square Value	134.3	95% Jackknife UCL 12.41
		95% Standard Bootstrap UCL 12.28
Anderson-Darling Test Statistic	0.817	95% Bootstrap-t UCL 14.65
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL 25.42
Kolmogorov-Smirnov Test Statistic	0.105	95% Percentile Bootstrap UCL 12.46
Kolmogorov-Smirnov 5% Critical Value	0.125	95% BCA Bootstrap UCL 13.19
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 16.23
		97.5% Chebyshev(Mean, Sd) UCL 18.92
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 24.19
95% Approximate Gamma UCL	12.15	
95% Adjusted Gamma UCL	12.22	

Potential UCL to Use	Use 95% Approximate Gamma UCL 12.15

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2010 Surface Soil

General UCL Statistics for Full Data Sets

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Number of Valid Observations	52	Number of Distinct Observations	37

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.054	Minimum of Log Data	-2.919
Maximum	0.6	Maximum of Log Data	-0.511
Mean	0.326	Mean of log Data	-1.419
Median	0.43	SD of log Data	0.877
SD	0.199		
Coefficient of Variation	0.609		
Skewness	-0.302		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.24	Lilliefors Test Statistic	0.303
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.372	95% H-UCL	0.465
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.565
95% Adjusted-CLT UCL (Chen-1995)	0.37	97.5% Chebyshev (MVUE) UCL	0.657
95% Modified-t UCL (Johnson-1978)	0.372	99% Chebyshev (MVUE) UCL	0.838

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.731	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.188	
MLE of Mean	0.326	
MLE of Standard Deviation	0.248	
nu star	180	
Approximate Chi Square Value (.05)	149.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0454	95% CLT UCL 0.371
Adjusted Chi Square Value	149.2	95% Jackknife UCL 0.372
		95% Standard Bootstrap UCL 0.371
Anderson-Darling Test Statistic	4.721	95% Bootstrap-t UCL 0.374
Anderson-Darling 5% Critical Value	0.765	95% Hall's Bootstrap UCL 0.369
Kolmogorov-Smirnov Test Statistic	0.291	95% Percentile Bootstrap UCL 0.371
Kolmogorov-Smirnov 5% Critical Value	0.125	95% BCA Bootstrap UCL 0.368
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.446
		97.5% Chebyshev(Mean, Sd) UCL 0.498
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.6
95% Approximate Gamma UCL	0.391	
95% Adjusted Gamma UCL	0.393	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	0.446

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2010 Surface Soil

General UCL Statistics for Full Data Sets

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Observations	52	Number of Distinct Observations	32

Raw Statistics		**Log-transformed Statistics**	
Minimum	9	Minimum of Log Data	2.197
Maximum	550	Maximum of Log Data	6.31
Mean	145.7	Mean of log Data	4.74
Median	105	SD of log Data	0.739
SD	106.6		
Coefficient of Variation	0.731		
Skewness	1.714		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.192	Lilliefors Test Statistic	0.107
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	170.5	95% H-UCL	186.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	223.2
95% Adjusted-CLT UCL (Chen-1995)	173.8	97.5% Chebyshev (MVUE) UCL	255.1
95% Modified-t UCL (Johnson-1978)	171.1	99% Chebyshev (MVUE) UCL	317.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.107	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	69.16	
MLE of Mean	145.7	
MLE of Standard Deviation	100.4	
nu star	219.1	
Approximate Chi Square Value (.05)	185.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0454	95% CLT UCL 170
Adjusted Chi Square Value	185	95% Jackknife UCL 170.5
		95% Standard Bootstrap UCL 169.8
Anderson-Darling Test Statistic	0.788	95% Bootstrap-t UCL 174.3
Anderson-Darling 5% Critical Value	0.762	95% Hall's Bootstrap UCL 175.5
Kolmogorov-Smirnov Test Statistic	0.117	95% Percentile Bootstrap UCL 170.8
Kolmogorov-Smirnov 5% Critical Value	0.125	95% BCA Bootstrap UCL 173.3
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 210.1
		97.5% Chebyshev(Mean, Sd) UCL 238
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 292.7
95% Approximate Gamma UCL	171.8	
95% Adjusted Gamma UCL	172.6	

Potential UCL to Use	Use 95% Approximate Gamma UCL 171.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix H

2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	161	Number of Distinct Observations	71

Raw Statistics		Log-transformed Statistics	
Minimum	0.27	Minimum of Log Data	-1.309
Maximum	6.2	Maximum of Log Data	1.825
Mean	1.892	Mean of log Data	0.406
Median	1.3	SD of log Data	0.689
SD	1.333		
Coefficient of Variation	0.704		
Skewness	1.179		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.2	Lilliefors Test Statistic	0.0992
Lilliefors Critical Value	0.0698	Lilliefors Critical Value	0.0698
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.066	95% H-UCL	2.112
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.395
95% Adjusted-CLT UCL (Chen-1995)	2.075	97.5% Chebyshev (MVUE) UCL	2.61
95% Modified-t UCL (Johnson-1978)	2.067	99% Chebyshev (MVUE) UCL	3.032

Gamma Distribution Test		Data Distribution
k star (bias corrected)	2.269	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.834	
MLE of Mean	1.892	
MLE of Standard Deviation	1.256	
nu star	730.6	
Approximate Chi Square Value (.05)	668.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0485	95% CLT UCL 2.065
Adjusted Chi Square Value	668.3	95% Jackknife UCL 2.066
		95% Standard Bootstrap UCL 2.066
Anderson-Darling Test Statistic	3.069	95% Bootstrap-t UCL 2.075
Anderson-Darling 5% Critical Value	0.764	95% Hall's Bootstrap UCL 2.067
Kolmogorov-Smirnov Test Statistic	0.136	95% Percentile Bootstrap UCL 2.075
Kolmogorov-Smirnov 5% Critical Value	0.0745	95% BCA Bootstrap UCL 2.07
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.35
		97.5% Chebyshev(Mean, Sd) UCL 2.548
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.937
95% Approximate Gamma UCL	2.067	
95% Adjusted Gamma UCL	2.068	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2.35

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix H

2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Data	160	Number of Detected Data	160
Number of Distinct Detected Data	86	Number of Non-Detect Data	
Number of Missing Values	1	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.38	Minimum Detected	-0.968
Maximum Detected	64	Maximum Detected	4.159
Mean of Detected	9.295	Mean of Detected	1.807
SD of Detected	8.638	SD of Detected	1.01
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.151	Lilliefors Test Statistic	0.077
5% Lilliefors Critical Value	0.07	5% Lilliefors Critical Value	0.07
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	9.295	Mean	1.807
SD	8.638	SD	1.01
95% DL/2 (t) UCL	10.43	95% H-Stat (DL/2) UCL	12.12
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

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2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.305
Theta Star	7.124
nu star	417.6
A-D Test Statistic	0.336
5% A-D Critical Value	0.775
K-S Test Statistic	0.775
5% K-S Critical Value	0.0756

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.38
Maximum	64
Mean	9.295
Median	6.9
SD	8.638
k star	1.305
Theta star	7.124
Nu star	417.6
AppChi2	371.2
95% Gamma Approximate UCL	10.46
95% Adjusted Gamma UCL	10.47

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	9.295
SD	8.611
SE of Mean	0.683
95% KM (t) UCL	10.43
95% KM (z) UCL	10.42
95% KM (jackknife) UCL	10.43
95% KM (bootstrap t) UCL	10.68
95% KM (BCA) UCL	10.52
95% KM (Percentile Bootstrap) UCL	10.41
95% KM (Chebyshev) UCL	12.27
97.5% KM (Chebyshev) UCL	13.56
99% KM (Chebyshev) UCL	16.09

Potential UCLs to Use

95% KM (Chebyshev) UCL	12.27

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Number of Valid Data	161	Number of Detected Data	83
Number of Distinct Detected Data	40	Number of Non-Detect Data	78
		Percent Non-Detects	48.45%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.054	Minimum Detected	-2.919
Maximum Detected	0.32	Maximum Detected	-1.139
Mean of Detected	0.107	Mean of Detected	-2.298
SD of Detected	0.0443	SD of Detected	0.348
Minimum Non-Detect	0.13	Minimum Non-Detect	-2.04
Maximum Non-Detect	0.64	Maximum Non-Detect	-0.446

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	161
Number treated as Detected	
Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.174	Lilliefors Test Statistic	0.096
5% Lilliefors Critical Value	0.0973	5% Lilliefors Critical Value	0.0973
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.17	Mean	-1.9
SD	0.08	SD	0.53
95% DL/2 (t) UCL	0.181	95% H-Stat (DL/2) UCL	0.186
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.304
		SD in Log Scale	0.292
		Mean in Original Scale	0.104
		SD in Original Scale	0.0354
		95% t UCL	0.109
		95% Percentile Bootstrap UCL	0.109
		95% BCA Bootstrap UCL	0.11

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2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	7.532
Theta Star	0.0142
nu star	1250
A-D Test Statistic	1.238
5% A-D Critical Value	0.753
K-S Test Statistic	0.753
5% K-S Critical Value	0.0981

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.054
Maximum	0.32
Mean	0.11
Median	0.11
SD	0.0349
k star	11.58
Theta star	0.0095
Nu star	3727
AppChi2	3587
95% Gamma Approximate UCL	0.114
95% Adjusted Gamma UCL	0.114

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.106
SD	0.0432
SE of Mean	0.00467
95% KM (t) UCL	0.114
95% KM (z) UCL	0.114
95% KM (jackknife) UCL	0.114
95% KM (bootstrap t) UCL	0.116
95% KM (BCA) UCL	0.115
95% KM (Percentile Bootstrap) UCL	0.114
95% KM (Chebyshev) UCL	0.127
97.5% KM (Chebyshev) UCL	0.136
99% KM (Chebyshev) UCL	0.153

Potential UCLs to Use

95% KM (t) UCL	0.114
95% KM (% Bootstrap) UCL	0.114

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Data	159	Number of Detected Data	159
Number of Distinct Detected Data	62	Number of Non-Detect Data	
Number of Missing Values	2	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	9	Minimum Detected	2.197
Maximum Detected	580	Maximum Detected	6.363
Mean of Detected	199.5	Mean of Detected	5.112
SD of Detected	117.4	SD of Detected	0.654
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.107	Lilliefors Test Statistic	0.0933
5% Lilliefors Critical Value	0.0703	5% Lilliefors Critical Value	0.0703
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	199.5	Mean	5.112
SD	117.4	SD	0.654
95% DL/2 (t) UCL	214.9	95% H-Stat (DL/2) UCL	227.2
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

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2010 Total Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.822
Theta Star	70.68
nu star	897.5
A-D Test Statistic	0.402
5% A-D Critical Value	0.76
K-S Test Statistic	0.76
5% K-S Critical Value	0.0748

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	9
Maximum	580
Mean	199.5
Median	180
SD	117.4
k star	2.822
Theta star	70.68
Nu star	897.5
AppChi2	829
95% Gamma Approximate UCL	216
95% Adjusted Gamma UCL	216.1

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	199.5
SD	117
SE of Mean	9.312
95% KM (t) UCL	214.9
95% KM (z) UCL	214.8
95% KM (jackknife) UCL	214.9
95% KM (bootstrap t) UCL	216.3
95% KM (BCA) UCL	215.5
95% KM (Percentile Bootstrap) UCL	214.8
95% KM (Chebyshev) UCL	240.1
97.5% KM (Chebyshev) UCL	257.6
99% KM (Chebyshev) UCL	292.1

Potential UCLs to Use

95% KM (BCA) UCL	215.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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2010 Sediment

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	13

Raw Statistics

Minimum	1
Maximum	4.8
Mean	2.807
Median	2.6
SD	1.167
Coefficient of Variation	0.416
Skewness	0.359

Log-transformed Statistics

Minimum of Log Data	
Maximum of Log Data	1.569
Mean of log Data	0.945
SD of log Data	0.448

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.954
Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.36

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.352
95% Modified-t UCL (Johnson-1978)	3.365

Assuming Lognormal Distribution

95% H-UCL	3.647
95% Chebyshev (MVUE) UCL	4.328
97.5% Chebyshev (MVUE) UCL	4.979
99% Chebyshev (MVUE) UCL	6.259

Gamma Distribution Test

k star (bias corrected)	4.67
Theta Star	0.601
MLE of Mean	2.807
MLE of Standard Deviation	1.299
nu star	130.8
Approximate Chi Square Value (.05)	105.4
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	102.3
Anderson-Darling Test Statistic	0.208
Anderson-Darling 5% Critical Value	0.737
Kolmogorov-Smirnov Test Statistic	0.131
Kolmogorov-Smirnov 5% Critical Value	0.229

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.484
95% Adjusted Gamma UCL	3.587

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	3.32
95% Jackknife UCL	3.36
95% Standard Bootstrap UCL	3.305
95% Bootstrap-t UCL	3.39
95% Hall's Bootstrap UCL	3.336
95% Percentile Bootstrap UCL	3.307
95% BCA Bootstrap UCL	3.307
95% Chebyshev(Mean, Sd) UCL	4.167
97.5% Chebyshev(Mean, Sd) UCL	4.755
99% Chebyshev(Mean, Sd) UCL	5.911

Potential UCL to Use

Use 95% Student's-t UCL 3.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

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2010 Sediment

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	0.38	Minimum of Log Data	-0.968
Maximum	24	Maximum of Log Data	3.178
Mean	5.079	Mean of log Data	0.796
Median	1.45	SD of log Data	1.316
SD	7.176		
Coefficient of Variation	1.413		
Skewness	1.898		

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.691
Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	8.476

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	9.273
95% Modified-t UCL (Johnson-1978)	8.638

Assuming Lognormal Distribution

95% H-UCL	17.88
95% Chebyshev (MVUE) UCL	12.92
97.5% Chebyshev (MVUE) UCL	16.45
99% Chebyshev (MVUE) UCL	23.39

Gamma Distribution Test

k star (bias corrected)	0.617
Theta Star	8.227
MLE of Mean	5.079
MLE of Standard Deviation	6.464
nu star	17.29
Approximate Chi Square Value (.05)	8.877
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	8.088
Anderson-Darling Test Statistic	0.814
Anderson-Darling 5% Critical Value	0.773
Kolmogorov-Smirnov Test Statistic	0.244
Kolmogorov-Smirnov 5% Critical Value	0.238

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	9.891
95% Adjusted Gamma UCL	10.86

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	8.234
95% Jackknife UCL	8.476
95% Standard Bootstrap UCL	8.108
95% Bootstrap-t UCL	11.52
95% Hall's Bootstrap UCL	8.969
95% Percentile Bootstrap UCL	8.386
95% BCA Bootstrap UCL	8.879
95% Chebyshev(Mean, Sd) UCL	13.44
97.5% Chebyshev(Mean, Sd) UCL	17.06
99% Chebyshev(Mean, Sd) UCL	24.16

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 13.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix H

2010 Sediment

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	12

Raw Statistics		Log-transformed Statistics	
Minimum	5.6	Minimum of Log Data	1.723
Maximum	20	Maximum of Log Data	2.996
Mean	12.16	Mean of log Data	2.403
Median	13	SD of log Data	0.465
SD	5.153		
Coefficient of Variation	0.424		
Skewness	0.0231		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.897	Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	14.6	95% H-UCL	15.97
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	19.01
95% Adjusted-CLT UCL (Chen-1995)	14.43	97.5% Chebyshev (MVUE) UCL	21.95
95% Modified-t UCL (Johnson-1978)	14.6	99% Chebyshev (MVUE) UCL	27.72

Gamma Distribution Test		Data Distribution
k star (bias corrected)	4.326	Data appear Normal at 5% Significance Level
Theta Star	2.811	
MLE of Mean	12.16	
MLE of Standard Deviation	5.845	
nu star	121.1	
Approximate Chi Square Value (.05)	96.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0312	95% CLT UCL 14.42
Adjusted Chi Square Value	93.81	95% Jackknife UCL 14.6
		95% Standard Bootstrap UCL 14.32
Anderson-Darling Test Statistic	0.682	95% Bootstrap-t UCL 14.52
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL 14.29
Kolmogorov-Smirnov Test Statistic	0.184	95% Percentile Bootstrap UCL 14.39
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL 14.36
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 18.16
		97.5% Chebyshev(Mean, Sd) UCL 20.76
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 25.86
95% Approximate Gamma UCL	15.23	
95% Adjusted Gamma UCL	15.7	

Potential UCL to Use	Use 95% Student's-t UCL 14.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix H

2010 Sediment

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	13

Raw Statistics		**Log-transformed Statistics**	
Minimum	6.4	Minimum of Log Data	1.856
Maximum	680	Maximum of Log Data	6.522
Mean	116	Mean of log Data	3.597
Median	25	SD of log Data	1.472
SD	203.5		
Coefficient of Variation	1.755		
Skewness	2.198		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.598	Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	212.3	95% H-UCL	476
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	275.8
95% Adjusted-CLT UCL (Chen-1995)	239.6	97.5% Chebyshev (MVUE) UCL	354.4
95% Modified-t UCL (Johnson-1978)	217.6	99% Chebyshev (MVUE) UCL	508.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.474	Data appear Lognormal at 5% Significance Level
Theta Star	244.7	
MLE of Mean	116	
MLE of Standard Deviation	168.4	
nu star	13.27	
Approximate Chi Square Value (.05)	6.073	**Nonparametric Statistics**
Adjusted Level of Significance	0.0312	95% CLT UCL 205.4
Adjusted Chi Square Value	5.44	95% Jackknife UCL 212.3
		95% Standard Bootstrap UCL 200.9
Anderson-Darling Test Statistic	1.387	95% Bootstrap-t UCL 374.1
Anderson-Darling 5% Critical Value	0.789	95% Hall's Bootstrap UCL 260.4
Kolmogorov-Smirnov Test Statistic	0.309	95% Percentile Bootstrap UCL 212.8
Kolmogorov-Smirnov 5% Critical Value	0.241	95% BCA Bootstrap UCL 244.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 353
		97.5% Chebyshev(Mean, Sd) UCL 455.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 657.1
95% Approximate Gamma UCL	253.3	
95% Adjusted Gamma UCL	282.8	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	353

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix H

2010 Sediment

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	11

Raw Statistics

Minimum	67
Maximum	370
Mean	203.4
Median	175
SD	92.71
Coefficient of Variation	0.456
Skewness	0.784

Log-transformed Statistics

Minimum of Log Data	4.205
Maximum of Log Data	5.914
Mean of log Data	5.217
SD of log Data	0.469

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.889
Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.943
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	247.2

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	249.7
95% Modified-t UCL (Johnson-1978)	248.1

Assuming Lognormal Distribution

95% H-UCL	267.2
95% Chebyshev (MVUE) UCL	318.2
97.5% Chebyshev (MVUE) UCL	367.6
99% Chebyshev (MVUE) UCL	464.7

Gamma Distribution Test

k star (bias corrected)	4.192
Theta Star	48.51
MLE of Mean	203.4
MLE of Standard Deviation	99.32
nu star	117.4
Approximate Chi Square Value (.05)	93.37
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	90.53
Anderson-Darling Test Statistic	0.431
Anderson-Darling 5% Critical Value	0.738
Kolmogorov-Smirnov Test Statistic	0.149
Kolmogorov-Smirnov 5% Critical Value	0.229

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	255.7
95% Adjusted Gamma UCL	263.7

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	244.1
95% Jackknife UCL	247.2
95% Standard Bootstrap UCL	242.2
95% Bootstrap-t UCL	254.1
95% Hall's Bootstrap UCL	247
95% Percentile Bootstrap UCL	241.7
95% BCA Bootstrap UCL	247.1
95% Chebyshev(Mean, Sd) UCL	311.4
97.5% Chebyshev(Mean, Sd) UCL	358.1
99% Chebyshev(Mean, Sd) UCL	449.9

Potential UCL to Use

Use 95% Student's-t UCL 247.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX I
CHEMICAL INTAKE EQUATIONS

Surface Soil/Subsurface Soil

Incidental Ingestion of Soil

The following equation is used in the calculation of a CDI (mg/kg/day) for a human receptor who incidentally ingests soil at the site:

$$CDI = \frac{Cs \ x \ IR \ x \ FI \ x \ CF \ x \ EF \ x \ ED}{BW \ x \ AT_c \ or \ AT_{nc}}$$

Where:

Cs	=	chemical concentration in soil (mg/kg)
IR	=	ingestion rate (mg/day)
FI	=	fraction of soil ingested from the source (unitless)
CF	=	conversion factor (10^{-06} kg/mg)
EF	=	exposure frequency (days/yr)
ED	=	exposure duration (yrs)
BW	=	adult body weight (kg)
AT_c	=	averaging time carcinogens (days)
AT_{nc}	=	averaging time, noncarcinogens (days)

Dermal Contact with Soil

The absorbed dose associated with the potential dermal contact of COPCs in soil was calculated using the following equation (USEPA, 1989):

$$DAD = \frac{Cs \ x \ SA \ x \ AF \ x \ ABS \ x \ EF \ x \ ED \ x \ CF}{BW \ x \ AT}$$

Where:

DAD	=	Dermally Absorbed Dose, mg/kg-day
Cs	=	Chemical concentration in the soil, mg/kg
AF	=	Adherence Factor, milligram per square centimeter day (mg/cm^2-d)
ABS	=	Absorbed fraction, unitless
CF	=	Conversion Factor, 10^{-06} mg/kg
SA	=	Surface Area of exposed skin, cm^2
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

Inhalation of Fugitive Dust/Volatiles from Soil

The daily intake resulting from the inhalation of COPCs adsorbed onto fugitive dust particulate and/or volatiles was estimated using the following equation (USEPA, 1989):

$$CDI = \frac{Ca \ x \ RR \ x \ ET \ x \ EF \ x \ ED}{BW \ x \ AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Ca	=	Chemical concentration in air as fugitive dust, milligrams per cubic meter (mg/m^3)
RR	=	Respiration Rate, m^3/hour
ET	=	Exposure Time, hours/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

The air concentration (Ca) of a chemical in fugitive dust emissions was estimated from the following equation, adapted from Cowherd (1985).

$$Ca = Cs \times (1/PEF + 1/VF)$$

Where:

Ca	=	Chemical concentration in air as fugitive dust, mg/m^3
Cs	=	Concentration of chemical in the soil, mg/kg
PEF	=	Particulate Emission Factor, m^3/kg
VF	=	Volatilization Factor, m^3/kg

Volatilization factors used in this HHRA were obtained from the USEPA Region IX PRG tables (USEPA, 2004) or if not available there, were calculated (USEPA, 2001).

<u>Groundwater</u>

Ingestion of Groundwater

The daily intake associated with the direct potential ingestion of the COPCs in groundwater under a drinking water scenario were calculated using the following equation (USEPA, 1989):

$$CDI = \frac{Cw \times IR \times EF \times ED}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Cw	=	Chemical concentration in water, mg/L
IR	=	Ingestion Rate, L/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

Dermal Contact with Groundwater

The absorbed dose associated with potential dermal contact with COPCs in groundwater was calculated using the following equation (USEPA, 1989 and 2004):

$$CDI = \frac{DA_{event} * EF * ED * CF * SA}{BW \ x \ AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
DA_{event}	=	Absorbed dose per event (mg/cm^2-event) (assume 1 event/day)
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
CF	=	Conversion Factor, 1 L/1000 cm^3
SA	=	Surface Area of exposed skin, cm^2
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

The following equations are used to calculate DA_{event} for organic compounds:

If $t_{event} \leq t^*$, then

$$DA_{event} = 2FA * K_p * C_w * \sqrt{\frac{6\tau_{event} * t_{event}}{\pi}}$$

If $t_{event} > t^*$, then

$$DA_{event} = FA * K_p * C_w \left[\frac{t_{event}}{1+B} + 2\tau_{event} \left(\frac{1+3B+3B^2}{(1+B)^2} \right) \right]$$

Where:

DA_{event}	=	Absorbed dose per event (mg/cm^2-event)
FA	=	Fraction absorbed (dimensionless)
K_p	=	Dermal permeability coefficient of compound in water (cm/hour)
Cw	=	Chemical concentration in water (mg/cm^3)
τ_{event}	=	Lag time per event (hour /event)
t_{event}	=	Event duration (hour /event) (assume 1 event/day)
t*	=	Time to reach steady-state (hour) = $2.4\tau_{event}$
B	=	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (dimensionless).

The following equation is used to calculate DA_{event} for inorganic and highly ionized organic chemicals:

$$DA_{event} = K_p * C_w * t_{event}$$

Where:

DA_{event}	=	Absorbed dose per event (mg/cm^2-event)
K_p	=	Dermal permeability coefficient of compound in water (cm/ hour)
C_w	=	Chemical concentration in water (mg/cm^3)
t_{event}	=	Event duration (hours/event) (assume 1 event/day)

APPENDIX J
RISK CALCULATION SPREADSHEETS

2008 CORRECTIVE MEASURES STUDY INVESTIGATION HHRA

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Youth	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
IR-S	mg/day	Ingestion rate of soil	100	100	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	4,015	

				Adult						Youth					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	NA	4.1E-09	--	--	1.2E-08	--	--	2.9E-09	--	--	1.9E-08	--	--
Benzo(a)anthracene	0.254	7.3E-01	NA	1.8E-08	1.3E-08	2.3%	5.2E-08	--	--	1.3E-08	9.2E-09	2.3%	8.0E-08	--	--
Benzo(a)pyrene (BaP)	0.116	7.3E+00	NA	8.1E-09	5.9E-08	10.7%	2.4E-08	--	--	5.8E-09	4.2E-08	10.7%	3.7E-08	--	--
Benzo(b)fluoranthene	0.799	7.3E-01	NA	5.6E-08	4.1E-08	7.4%	1.6E-07	--	--	4.0E-08	2.9E-08	7.4%	2.5E-07	--	--
Benzo(k)fluoranthene	0.140	7.3E-02	NA	9.8E-09	7.1E-10	0.1%	2.8E-08	--	--	7.0E-09	5.1E-10	0.1%	4.4E-08	--	--
Chrysene	0.303	7.3E-03	NA	2.1E-08	1.5E-10	0.0%	6.2E-08	--	--	1.5E-08	1.1E-10	0.0%	9.6E-08	--	--
Dibenz(a,h)anthracene	0.0401	7.3E+00	NA	2.8E-09	2.0E-08	3.7%	8.2E-09	--	--	2.0E-09	1.5E-08	3.7%	1.3E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	1.8E-09	--	--	5.3E-09	--	--	1.3E-09	--	--	8.2E-09	--	--
Indeno(1,2,3-cd)pyrene	0.441	7.3E-01	NA	3.1E-08	2.2E-08	4.1%	9.0E-08	--	--	2.2E-08	1.6E-08	4.1%	1.4E-07	--	--
Arsenic	3.78	1.5E+00	3.0E-04	2.6E-07	4.0E-07	71.7%	7.7E-07	2.6E-03	0.4%	1.9E-07	2.8E-07	71.7%	1.2E-06	4.0E-03	0.4%
Cadmium	18.6	NA	1.0E-03	1.3E-06	--	--	3.8E-06	3.8E-03	0.6%	9.3E-07	--	--	5.9E-06	5.9E-03	0.6%
Cobalt	12.0	NA	3.0E-04	8.4E-07	--	--	2.4E-06	8.1E-03	1.4%	6.0E-07	--	--	3.8E-06	1.3E-02	1.4%
Lead	158	NA	NA	1.1E-05	--	--	3.2E-05	--	--	7.9E-06	--	--	5.0E-05	--	--
Vanadium	201	NA	7.0E-05	1.4E-05	--	--	4.1E-05	5.8E-01	97.6%	1.0E-05	--	--	6.4E-05	9.1E-01	97.6%
				Total ILCR:	5.5E-07	100.0%	Total HI:	6.0E-01	100.0%	Total ILCR:	3.9E-07	100.0%	Total HI:	9.3E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	Youth	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.07	0.2	
ABS	NA	Absorption fraction	CS	CS	
SA	cm2/day	Skin surface area available for contact	5,700	3,200	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	4,015	

					Adult						Youth					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	1.0E-01	NA	NA	1.6E-09	--	--	4.8E-09	--	--	1.9E-09	--	--	1.2E-08	--	--
Benzo(a)anthracene	0.254	1.3E-01	7.3E-01	NA	9.2E-09	6.7E-09	5.2%	2.7E-08	--	--	1.1E-08	7.7E-09	5.2%	6.7E-08	--	--
Benzo(a)pyrene (BaP)	0.116	1.3E-01	7.3E+00	NA	4.2E-09	3.1E-08	23.8%	1.2E-08	--	--	4.8E-09	3.5E-08	23.8%	3.1E-08	--	--
Benzo(b)fluoranthene	0.799	1.3E-01	7.3E-01	NA	2.9E-08	2.1E-08	16.4%	8.4E-08	--	--	3.3E-08	2.4E-08	16.4%	2.1E-07	--	--
Benzo(k)fluoranthene	0.140	1.3E-01	7.3E-02	NA	5.1E-09	3.7E-10	0.3%	1.5E-08	--	--	5.8E-09	4.2E-10	0.3%	3.7E-08	--	--
Chrysene	0.303	1.3E-01	7.3E-03	NA	1.1E-08	8.0E-11	0.1%	3.2E-08	--	--	1.3E-08	9.2E-11	0.1%	8.0E-08	--	--
Dibenz(a,h)anthracene	0.0401	1.3E-01	7.3E+00	NA	1.5E-09	1.1E-08	8.2%	4.2E-09	--	--	1.7E-09	1.2E-08	8.2%	1.1E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	NA	7.2E-09	--	--	2.1E-08	--	--	8.3E-09	--	--	5.3E-08	--	--
Indeno(1,2,3-cd)pyrene	0.441	1.3E-01	7.3E-01	NA	1.6E-08	1.2E-08	9.1%	4.7E-08	--	--	1.8E-08	1.3E-08	9.1%	1.2E-07	--	--
Arsenic	3.78	3.0E-02	1.5E+00	3.0E-04	3.2E-08	4.7E-08	36.8%	9.2E-08	3.1E-04	0.0%	3.6E-08	5.4E-08	36.8%	2.3E-07	7.7E-04	0.0%
Cadmium	18.6	1.0E-03	NA	3.0E-05	5.2E-09	--	--	1.5E-08	5.0E-04	0.1%	5.9E-09	--	--	3.8E-08	1.3E-03	0.1%
Cobalt	12.0	1.0E-02	NA	3.0E-04	3.3E-08	--	--	9.7E-08	3.2E-04	0.0%	3.8E-08	--	--	2.4E-07	8.1E-04	0.0%
Lead	158	1.0E-02	NA	NA	4.4E-07	--	--	1.3E-06	--	--	5.0E-07	--	--	3.2E-06	--	--
Vanadium	201	1.0E-02	NA	1.8E-06	5.6E-07	--	--	1.6E-06	9.0E-01	99.9%	6.4E-07	--	--	4.1E-06	2.2E+00	99.9%
					Total ILCR:	1.3E-07	100.0%	Total HI:	9.0E-01	100.0%	Total ILCR:	1.5E-07	100.0%	Total HI:	2.2E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	Youth	
EC	mg/m3	Exposure Concentration	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfC	mg/kg/d	Inhalation Reference Concentration	CS	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
VF	m3/kg	Volatilization Factor	CS	CS	
PEF	m3/kg	Particulate emission factor	1.36E+09	1.36E+09	
ET	hours/day	Exposure time	2.0	2.0	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
AT-C	hours	Averaging time, carcinogens	613,200	613,200	
AT-N	hours	Averaging time, noncarcinogens	210,240	96,360	

						Adult						Youth					
						Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	4.24E-11	4.2E-03	NA	1.7E-13	7.3E-13	0.1%	5.0E-13	--	--	7.9E-14	3.3E-13	0.1%	5.0E-13	--	--
Benzo(a)anthracene	0.254	1.8E+07	1.42E-08	1.1E-04	NA	5.8E-11	6.4E-12	1.2%	1.7E-10	--	--	2.6E-11	2.9E-12	1.2%	1.7E-10	--	--
Benzo(a)pyrene (BaP)	0.116	3.5E+07	3.38E-09	1.1E-03	NA	1.4E-11	1.5E-11	2.9%	4.0E-11	--	--	6.3E-12	6.9E-12	2.9%	4.0E-11	--	--
Benzo(b)fluoranthene	0.799	2.1E+07	3.83E-08	1.1E-04	NA	1.6E-10	1.7E-11	3.3%	4.6E-10	--	--	7.2E-11	7.9E-12	3.3%	4.6E-10	--	--
Benzo(k)fluoranthene	0.140	4.5E+07	3.20E-09	1.1E-04	NA	1.3E-11	1.4E-12	0.3%	3.8E-11	--	--	6.0E-12	6.6E-13	0.3%	3.8E-11	--	--
Chrysene	0.303	2.7E+06	1.11E-07	1.1E-05	NA	4.5E-10	5.0E-12	1.0%	1.3E-09	--	--	2.1E-10	2.3E-12	1.0%	1.3E-09	--	--
Dibenz(a,h)anthracene	0.0401	8.7E+07	4.92E-10	1.2E-03	NA	2.0E-12	2.4E-12	0.5%	5.8E-12	--	--	9.2E-13	1.1E-12	0.5%	5.8E-12	--	--
Di-n-octyl Phthalate	0.0260	1.6E+07	1.69E-09	NA	NA	6.9E-12	--	--	2.0E-11	--	--	3.2E-12	--	--	2.0E-11	--	--
Indeno(1,2,3-cd)pyrene	0.441	8.2E+07	5.70E-09	1.1E-04	NA	2.3E-11	2.6E-12	0.5%	6.8E-11	--	--	1.1E-11	1.2E-12	0.5%	6.8E-11	--	--
Arsenic	3.78	NA	2.72E-09	4.3E-03	1.5E-05	1.1E-11	4.8E-11	9.3%	3.2E-11	2.2E-06	4.1%	5.1E-12	2.2E-11	9.3%	3.2E-11	2.2E-06	4.1%
Cadmium	18.6	NA	1.34E-08	1.8E-03	1.0E-05	5.4E-11	9.8E-11	19.1%	1.6E-10	1.6E-05	30.4%	2.5E-11	4.5E-11	19.1%	1.6E-10	1.6E-05	30.4%
Cobalt	12.0	NA	8.63E-09	9.0E-03	6.0E-06	3.5E-11	3.2E-10	61.7%	1.0E-10	1.7E-05	32.7%	1.6E-11	1.4E-10	61.7%	1.0E-10	1.7E-05	32.7%
Lead	158	NA	1.14E-07	NA	NA	4.6E-10	--	--	1.3E-09	--	--	2.1E-10	--	--	1.3E-09	--	--
Vanadium	201	NA	1.45E-07	NA	1.0E-04	5.9E-10	--	--	1.7E-09	1.7E-05	32.8%	2.7E-10	--	--	1.7E-09	1.7E-05	32.8%
						Total ILCR:	5.1E-10	100.0%	Total HI:	5.2E-05	100.0%	Total ILCR:	2.3E-10	100.0%	Total HI:	5.2E-05	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	NA	2.1E-08	--	--	5.8E-08	--	--
Benzo(a)anthracene	0.254	7.3E-01	NA	8.9E-08	6.5E-08	2.3%	2.5E-07	--	--
Benzo(a)pyrene (BaP)	0.116	7.3E+00	NA	4.1E-08	3.0E-07	10.7%	1.1E-07	--	--
Benzo(b)fluoranthene	0.799	7.3E-01	NA	2.8E-07	2.0E-07	7.4%	7.8E-07	--	--
Benzo(k)fluoranthene	0.140	7.3E-02	NA	4.9E-08	3.6E-09	0.1%	1.4E-07	--	--
Chrysene	0.303	7.3E-03	NA	1.1E-07	7.7E-10	0.0%	3.0E-07	--	--
Dibenz(a,h)anthracene	0.0401	7.3E+00	NA	1.4E-08	1.0E-07	3.7%	3.9E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	9.1E-09	--	--	2.5E-08	--	--
Indeno(1,2,3-cd)pyrene	0.441	7.3E-01	NA	1.5E-07	1.1E-07	4.1%	4.3E-07	--	--
Arsenic	3.78	1.5E+00	3.0E-04	1.3E-06	2.0E-06	71.7%	3.7E-06	1.2E-02	0.4%
Cadmium	18.6	NA	1.0E-03	6.5E-06	--	--	1.8E-05	1.8E-02	0.6%
Cobalt	12.0	NA	3.0E-04	4.2E-06	--	--	1.2E-05	3.9E-02	1.4%
Lead	158	NA	NA	5.5E-05	--	--	1.5E-04	--	--
Vanadium	201	NA	7.0E-05	7.0E-05	--	--	2.0E-04	2.8E+00	97.6%
				Total ILCR:	2.8E-06	100.0%	Total HI:	2.9E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.2	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	1.0E-01	NA	NA	1.4E-08	--	--	3.8E-08	--	--
Benzo(a)anthracene	0.254	1.3E-01	7.3E-01	NA	7.6E-08	5.6E-08	5.2%	2.1E-07	--	--
Benzo(a)pyrene (BaP)	0.116	1.3E-01	7.3E+00	NA	3.5E-08	2.5E-07	23.8%	9.7E-08	--	--
Benzo(b)fluoranthene	0.799	1.3E-01	7.3E-01	NA	2.4E-07	1.7E-07	16.4%	6.7E-07	--	--
Benzo(k)fluoranthene	0.140	1.3E-01	7.3E-02	NA	4.2E-08	3.1E-09	0.3%	1.2E-07	--	--
Chrysene	0.303	1.3E-01	7.3E-03	NA	9.1E-08	6.6E-10	0.1%	2.5E-07	--	--
Dibenz(a,h)anthracene	0.0401	1.3E-01	7.3E+00	NA	1.2E-08	8.8E-08	8.2%	3.4E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	NA	6.0E-08	--	--	1.7E-07	--	--
Indeno(1,2,3-cd)pyrene	0.441	1.3E-01	7.3E-01	NA	1.3E-07	9.7E-08	9.1%	3.7E-07	--	--
Arsenic	3.78	3.0E-02	1.5E+00	3.0E-04	2.6E-07	3.9E-07	36.8%	7.3E-07	2.4E-03	0.0%
Cadmium	18.6	1.0E-03	NA	3.0E-05	4.3E-08	--	--	1.2E-07	4.0E-03	0.1%
Cobalt	12.0	1.0E-02	NA	3.0E-04	2.8E-07	--	--	7.7E-07	2.6E-03	0.0%
Lead	158	1.0E-02	NA	NA	3.6E-06	--	--	1.0E-05	--	--
Vanadium	201	1.0E-02	NA	1.8E-06	4.6E-06	--	--	1.3E-05	7.1E+00	99.9%
					Total ILCR:	1.1E-06	100.0%	Total HI:	7.1E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	
EC	mg/m3	Exposure Concentration	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	
HQ	NA	Hazard quotient	CS	
RfC	mg/m3	Inhalation Reference Concentration	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
VF	m3/kg	Volatilization Factor	CS	
PEF	m3/kg	Particulate emission factor	1.36E+09	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
AT-C	hours	Averaging time, carcinogens	613,200	
AT-N	hours	Averaging time, noncarcinogens	219,000	

						Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	4.24E-11	4.2E-03	NA	3.5E-12	1.5E-11	0.1%	9.7E-12	--	--
Benzo(a)anthracene	0.254	1.8E+07	1.42E-08	1.1E-04	NA	1.2E-09	1.3E-10	1.2%	3.2E-09	--	--
Benzo(a)pyrene (BaP)	0.116	3.5E+07	3.38E-09	1.1E-03	NA	2.8E-10	3.0E-10	2.9%	7.7E-10	--	--
Benzo(b)fluoranthene	0.799	2.1E+07	3.83E-08	1.1E-04	NA	3.1E-09	3.4E-10	3.3%	8.8E-09	--	--
Benzo(k)fluoranthene	0.140	4.5E+07	3.20E-09	1.1E-04	NA	2.6E-10	2.9E-11	0.3%	7.3E-10	--	--
Chrysene	0.303	2.7E+06	1.11E-07	1.1E-05	NA	9.1E-09	1.0E-10	1.0%	2.5E-08	--	--
Dibenz(a,h)anthracene	0.0401	8.7E+07	4.92E-10	1.2E-03	NA	4.0E-11	4.8E-11	0.5%	1.1E-10	--	--
Di-n-octyl Phthalate	0.0260	1.6E+07	1.69E-09	NA	NA	1.4E-10	--	--	3.9E-10	--	--
Indeno(1,2,3-cd)pyrene	0.441	8.2E+07	5.70E-09	1.1E-04	NA	4.6E-10	5.1E-11	0.5%	1.3E-09	--	--
Arsenic	3.78	NA	2.72E-09	4.3E-03	1.5E-05	2.2E-10	9.5E-10	9.3%	6.2E-10	4.1E-05	4.1%
Cadmium	18.6	NA	1.34E-08	1.8E-03	1.0E-05	1.1E-09	2.0E-09	19.1%	3.1E-09	3.1E-04	30.4%
Cobalt	12.0	NA	8.63E-09	9.0E-03	6.0E-06	7.0E-10	6.3E-09	61.7%	2.0E-09	3.3E-04	32.7%
Lead	158	NA	1.14E-07	NA	NA	9.3E-09	--	--	2.6E-08	--	--
Vanadium	201	NA	1.45E-07	NA	1.0E-04	1.2E-08	--	--	3.3E-08	3.3E-04	32.8%
						Total ILCR:	1.0E-08	100.0%	Total HI:	1.0E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIC
ACCIDENTAL INGESTION OF SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
CDI	mg/kg/d	Chronic daily intake	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDo	mg/kg/d	Oral reference dose	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
IR-S	mg/day	Ingestion rate of soil	100	200
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06
FI	NA	Fraction of soil ingested from site	1	1
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

		Age Adjusted CDIs			
		Ages 16-24	Ages 6-15	Ages 2-5	Ages 0-1
Parameter	C (mg/kg)	CDI (mg/kg/d)	CDI (mg/kg/d)	CDI (mg/kg/d)	CDI (mg/kg/d)
Benzo(a)anthracene	0.254	1.2E-07	3.6E-07	8.4E-07	2.8E-06
Benzo(a)pyrene (BaP)	0.116	5.4E-08	1.6E-07	3.8E-07	1.3E-06
Benzo(b)fluoranthene	0.799	3.8E-07	1.1E-06	2.6E-06	8.8E-06
Benzo(k)fluoranthene	0.140	6.6E-08	2.0E-07	4.6E-07	1.5E-06
Chrysene	0.303	1.4E-07	4.3E-07	1.0E-06	3.3E-06
Dibenz(a,h)anthracene	0.0401	1.9E-08	5.7E-08	1.3E-07	4.4E-07
Indeno(1,2,3-cd)pyrene	0.441	2.1E-07	6.2E-07	1.4E-06	4.8E-06

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	NA	2.8E-08	--	--	8.1E-08	--	--	6.5E-08	--	--	7.5E-07	--	--
Benzo(a)anthracene	0.254	7.3E-01	NA	4.1E-06	3.0E-06	7.7%	3.5E-07	--	--	3.6E-06	2.6E-06	6.9%	3.2E-06	--	--
Benzo(a)pyrene (BaP)	0.116	7.3E+00	NA	1.9E-06	1.4E-05	35.2%	1.6E-07	--	--	1.7E-06	1.2E-05	31.6%	1.5E-06	--	--
Benzo(b)fluoranthene	0.799	7.3E-01	NA	1.3E-05	9.4E-06	24.2%	1.1E-06	--	--	1.1E-05	8.3E-06	21.8%	1.0E-05	--	--
Benzo(k)fluoranthene	0.140	7.3E-02	NA	2.3E-06	1.6E-07	0.4%	1.9E-07	--	--	2.0E-06	1.5E-07	0.4%	1.8E-06	--	--
Chrysene	0.303	7.3E-03	NA	4.9E-06	3.6E-08	0.1%	4.2E-07	--	--	4.3E-06	3.2E-08	0.1%	3.9E-06	--	--
Dibenz(a,h)anthracene	0.0401	7.3E+00	NA	6.5E-07	4.7E-06	12.2%	5.5E-08	--	--	5.7E-07	4.2E-06	10.9%	5.1E-07	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	1.2E-08	--	--	3.6E-08	--	--	2.8E-08	--	--	3.3E-07	--	--
Indeno(1,2,3-cd)pyrene	0.441	7.3E-01	NA	7.1E-06	5.2E-06	13.4%	6.0E-07	--	--	6.3E-06	4.6E-06	12.0%	5.6E-06	--	--
Arsenic	3.78	1.5E+00	3.0E-04	1.8E-06	2.7E-06	6.9%	5.2E-06	1.7E-02	0.4%	4.1E-06	6.2E-06	16.3%	4.8E-05	1.6E-01	0.4%
Cadmium	18.6	NA	1.0E-03	8.7E-06	--	--	2.5E-05	2.5E-02	0.6%	2.0E-05	--	--	2.4E-04	2.4E-01	0.6%
Cobalt	12.0	NA	3.0E-04	5.6E-06	--	--	1.6E-05	5.5E-02	1.4%	1.3E-05	--	--	1.5E-04	5.1E-01	1.4%
Lead	158	NA	NA	7.4E-05	--	--	2.2E-04	--	--	1.7E-04	--	--	2.0E-03	--	--
Vanadium	201	NA	7.0E-05	9.4E-05	--	--	2.8E-04	3.9E+00	97.6%	2.2E-04	--	--	2.6E-03	3.7E+01	97.6%
				Total ILCR:	3.9E-05	100.0%	Total HI:	4.0E+00	100.0%	Total ILCR:	3.8E-05	100.0%	Total HI:	3.8E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
DAD	mg/kg/d	Dermally absorbed dose	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDd	mg/kg/d	Dermal reference dose	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06
AF	mg/cm2	Soil to skin adherence factor	0.07	0.2
ABS	NA	Absorption fraction	CS	CS
SA	cm2/day	Skin surface area available for contact	5,700	2,800
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

			Age Adjusted DADs			
			Ages 16-24	Ages 6-15	Ages 2-5	Ages 0-1
Parameter	C (mg/kg)	ABS	DAD (mg/kg/d)	DAD (mg/kg/d)	DAD (mg/kg/d)	DAD (mg/kg/d)
Benzo(a)anthracene	0.254	1.3E-01	6.2E-08	1.9E-07	3.0E-07	1.0E-06
Benzo(a)pyrene (BaP)	0.116	1.3E-01	2.8E-08	8.5E-08	1.4E-07	4.6E-07
Benzo(b)fluoranthene	0.799	1.3E-01	1.9E-07	5.8E-07	9.6E-07	3.2E-06
Benzo(k)fluoranthene	0.140	1.3E-01	3.4E-08	1.0E-07	1.7E-07	5.6E-07
Chrysene	0.303	1.3E-01	7.4E-08	2.2E-07	3.6E-07	1.2E-06
Dibenz(a,h)anthracene	0.0401	1.3E-01	9.8E-09	2.9E-08	4.8E-08	1.6E-07
Indeno(1,2,3-cd)pyrene	0.441	1.3E-01	1.1E-07	3.2E-07	5.3E-07	1.8E-06

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	1.0E-01	NA	NA	1.1E-08	--	--	3.2E-08	--	--	1.8E-08	--	--	2.1E-07	--	--
Benzo(a)anthracene	0.254	1.3E-01	7.3E-01	NA	1.6E-06	1.1E-06	8.1%	1.8E-07	--	--	1.3E-06	9.6E-07	7.9%	1.2E-06	--	--
Benzo(a)pyrene (BaP)	0.116	1.3E-01	7.3E+00	NA	7.1E-07	5.2E-06	36.9%	8.2E-08	--	--	6.0E-07	4.4E-06	36.1%	5.4E-07	--	--
Benzo(b)fluoranthene	0.799	1.3E-01	7.3E-01	NA	4.9E-06	3.6E-06	25.4%	5.7E-07	--	--	4.1E-06	3.0E-06	24.9%	3.7E-06	--	--
Benzo(k)fluoranthene	0.140	1.3E-01	7.3E-02	NA	8.6E-07	6.3E-08	0.4%	9.9E-08	--	--	7.3E-07	5.3E-08	0.4%	6.5E-07	--	--
Chrysene	0.303	1.3E-01	7.3E-03	NA	1.9E-06	1.4E-08	0.1%	2.2E-07	--	--	1.6E-06	1.1E-08	0.1%	1.4E-06	--	--
Dibenz(a,h)anthracene	0.0401	1.3E-01	7.3E+00	NA	2.5E-07	1.8E-06	12.8%	2.8E-08	--	--	2.1E-07	1.5E-06	12.5%	1.9E-07	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	NA	4.9E-08	--	--	1.4E-07	--	--	8.0E-08	--	--	9.3E-07	--	--
Indeno(1,2,3-cd)pyrene	0.441	1.3E-01	7.3E-01	NA	2.7E-06	2.0E-06	14.0%	3.1E-07	--	--	2.3E-06	1.7E-06	13.7%	2.1E-06	--	--
Arsenic	3.78	3.0E-02	1.5E+00	3.0E-04	2.1E-07	3.2E-07	2.3%	6.2E-07	2.1E-03	0.0%	3.5E-07	5.2E-07	4.3%	4.1E-06	1.4E-02	0.0%
Cadmium	18.6	1.0E-03	NA	3.0E-05	3.5E-08	--	--	1.0E-07	3.4E-03	0.1%	5.7E-08	--	--	6.7E-07	2.2E-02	0.1%
Cobalt	12.0	1.0E-02	NA	3.0E-04	2.2E-07	--	--	6.6E-07	2.2E-03	0.0%	3.7E-07	--	--	4.3E-06	1.4E-02	0.0%
Lead	158	1.0E-02	NA	NA	3.0E-06	--	--	8.6E-06	--	--	4.8E-06	--	--	5.7E-05	--	--
Vanadium	201	1.0E-02	NA	1.8E-06	3.8E-06	--	--	1.1E-05	6.0E+00	99.9%	6.2E-06	--	--	7.2E-05	4.0E+01	99.9%
					Total ILCR:	1.4E-05	100.0%	Total HI:	6.0E+00	100.0%	Total ILCR:	1.2E-05	100.0%	Total HI:	4.0E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT ILCR = EC*IUR*1000 ug/mg
Where: Ca = C/VF + C/PEF HQ = EC/RfC CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
EC	mg/m3	Exposure Concentration	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfC	mg/m3	Inhalation Reference Concentration	CS	CS
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
VF	m3/kg	Volatilization Factor	CS	CS
PEF	m3/kg	Particulate emission factor	1.36E+09	1.36E+09
ET	hours/day	Exposure time	24	24
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
AT-C	hours	Averaging time, carcinogens	613,200	613,200
AT-N	hours	Averaging time, noncarcinogens	210,240	52,560

		Age Adjusted ECs			
		Ages 16-24	Ages 6-15	Ages 2-5	Ages 0-1
Parameter	Ca (mg/m3)	EC (mg/m3)	EC (mg/m3)	EC (mg/m3)	EC (mg/m3)
Benzo(a)anthracene	1.4E-08	4.7E-09	1.4E-08	3.5E-09	1.2E-08
Benzo(a)pyrene (BaP)	3.4E-09	1.1E-09	3.3E-09	8.3E-10	2.8E-09
Benzo(b)fluoranthene	3.8E-08	1.3E-08	3.8E-08	9.5E-09	3.2E-08
Benzo(k)fluoranthene	3.2E-09	1.1E-09	3.2E-09	7.9E-10	2.6E-09
Chrysene	1.1E-07	3.7E-08	1.1E-07	2.7E-08	9.2E-08
Dibenz(a,h)anthracene	4.9E-10	1.6E-10	4.9E-10	1.2E-10	4.0E-10
Indeno(1,2,3-cd)pyrene	5.7E-09	1.9E-09	5.6E-09	1.4E-09	4.7E-09

						Adult						Young Child					
						Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC mg/m3	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans	0.0590	NA	4.24E-11	4.2E-03	NA	1.4E-11	5.9E-11	0.1%	4.1E-11	--	--	3.5E-12	1.5E-11	0.1%	4.1E-11	--	--
Benzo(a)anthracene	0.254	1.8E+07	1.42E-08	1.1E-04	NA	3.4E-08	3.7E-09	5.6%	1.4E-08	--	--	1.5E-08	1.7E-09	7.4%	1.4E-08	--	--
Benzo(a)pyrene (BaP)	0.116	3.5E+07	3.38E-09	1.1E-03	NA	8.0E-09	8.9E-09	13.3%	3.2E-09	--	--	3.6E-09	4.0E-09	17.7%	3.2E-09	--	--
Benzo(b)fluoranthene	0.799	2.1E+07	3.83E-08	1.1E-04	NA	9.1E-08	1.0E-08	15.1%	3.7E-08	--	--	4.1E-08	4.5E-09	20.1%	3.7E-08	--	--
Benzo(k)fluoranthene	0.140	4.5E+07	3.20E-09	1.1E-04	NA	7.6E-09	8.4E-10	1.3%	3.1E-09	--	--	3.4E-09	3.8E-10	1.7%	3.1E-09	--	--
Chrysene	0.303	2.7E+06	1.11E-07	1.1E-05	NA	2.7E-07	2.9E-09	4.4%	1.1E-07	--	--	1.2E-07	1.3E-09	5.8%	1.1E-07	--	--
Dibenz(a,h)anthracene	0.0401	8.7E+07	4.92E-10	1.2E-03	NA	1.2E-09	1.4E-09	2.1%	4.7E-10	--	--	5.3E-10	6.3E-10	2.8%	4.7E-10	--	--
Di-n-octyl Phthalate	0.0260	1.6E+07	1.69E-09	NA	NA	5.6E-10	--	--	1.6E-09	--	--	1.4E-10	--	--	1.6E-09	--	--
Indeno(1,2,3-cd)pyrene	0.441	8.2E+07	5.70E-09	1.1E-04	NA	1.4E-08	1.5E-09	2.2%	5.5E-09	--	--	6.1E-09	6.7E-10	3.0%	5.5E-09	--	--
Arsenic	3.78	NA	2.72E-09	4.3E-03	1.5E-05	8.9E-10	3.8E-09	5.8%	2.6E-09	1.7E-04	4.1%	2.2E-10	9.6E-10	4.3%	2.6E-09	1.7E-04	4.1%
Cadmium	18.6	NA	1.34E-08	1.8E-03	1.0E-05	4.4E-09	7.9E-09	11.9%	1.3E-08	1.3E-03	30.4%	1.1E-09	2.0E-09	8.8%	1.3E-08	1.3E-03	30.4%
Cobalt	12.0	NA	8.63E-09	9.0E-03	6.0E-06	2.8E-09	2.6E-08	38.3%	8.3E-09	1.4E-03	32.7%	7.1E-10	6.4E-09	28.4%	8.3E-09	1.4E-03	32.7%
Lead	158	NA	1.14E-07	NA	NA	3.7E-08	--	--	1.1E-07	--	--	9.3E-09	--	--	1.1E-07	--	--
Vanadium	201	NA	1.45E-07	NA	1.0E-04	4.8E-08	--	--	1.4E-07	1.4E-03	32.8%	1.2E-08	--	--	1.4E-07	1.4E-03	32.8%
						Total ILCR:	6.7E-08	100.0%	Total HI:	4.2E-03	100.0%	Total ILCR:	2.2E-08	100.0%	Total HI:	4.2E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INGESTION OF GROUNDWATER (2008) AS DRINKING WATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
CDI	mg/kg/d	Chronic daily intake	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDo	mg/kg/d	Oral reference dose	CS	CS
C	mg/L	Concentration of chemical in water	CS	CS
IR-W	L/day	Ingestion rate of water	2	1
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.5E+00	3.0E-04	5.3E-06	7.9E-06	100.0%	1.5E-05	5.1E-02	1.4%	3.1E-06	4.6E-06	100.0%	3.6E-05	1.2E-01	1.4%
Cobalt	0.0110	NA	3.0E-04	1.0E-04	--	--	3.0E-04	1.0E+00	26.7%	6.0E-05	--	--	7.0E-04	2.3E+00	26.7%
Vanadium	0.00690	NA	7.0E-05	6.5E-05	--	--	1.9E-04	2.7E+00	71.9%	3.8E-05	--	--	4.4E-04	6.3E+00	71.9%
				Total ILCR:	7.9E-06	100.0%	Total HI:	3.8E+00	100.0%	Total ILCR:	4.6E-06	100.0%	Total HI:	8.8E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*Kp*SA*EF*ED*ET)/(BW*AT) — Inorganics — ILCR = CDI*CSFo Adj — CSF Adj = CSF/AD
DAD (mg/kg/d) = (C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT) — ET ≤ t* (Organics) — HQ = CDI/RfDo Adj — RfD Adj = RfD*AD
DAD (mg/kg/d) = (C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B+B^2)/$(1+B)^2$))*SA*EF*ED)/(BW*AT) — ET > t* (Benzene & Vinyl Chloride)

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
SA	cm2	Skin surface area available for contact	18,000	6,600	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	24	6	
ET	hours/day	Exposure time	0.58	1.00	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	2,190	
C	mg/L	Concentration of chemical in water	CS	CS	
CF	L/cm3	Conversion factor	1.00E-03	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	CS	
AD	NA	Adjustment for absorbed dose	CS	CS	

								Adult						Young Child					
								Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	tau (hours)	t* (hours)	B	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.00E-03	NA	NA	NA	1.5E+00	3.0E-04	2.7E-08	4.1E-08	100.0%	8.0E-08	2.7E-04	0.0%	2.0E-08	3.0E-08	100.0%	2.4E-07	7.9E-04	0.0%
Cobalt	0.0110	4.00E-04	NA	NA	NA	NA	3.0E-04	2.2E-07	--	--	6.3E-07	2.1E-03	0.4%	1.6E-07	--	--	1.9E-06	6.2E-03	0.4%
Vanadium	0.00690	1.00E-03	NA	NA	NA	NA	1.8E-06	3.4E-07	--	--	9.9E-07	5.4E-01	99.6%	2.5E-07	--	--	2.9E-06	1.6E+00	99.6%
								Total ILCR:	4.1E-08	100.0%	Total HI:	5.4E-01	100.0%	Total ILCR:	3.0E-08	100.0%	Total HI:	1.6E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

Kp, tau, t*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	NA	2.1E-08	--	--	5.8E-08	--	--
Benzo(a)anthracene	0.254	7.3E-01	NA	8.9E-08	6.5E-08	2.3%	2.5E-07	--	--
Benzo(a)pyrene (BaP)	0.116	7.3E+00	NA	4.1E-08	3.0E-07	10.7%	1.1E-07	--	--
Benzo(b)fluoranthene	0.799	7.3E-01	NA	2.8E-07	2.0E-07	7.4%	7.8E-07	--	--
Benzo(k)fluoranthene	0.140	7.3E-02	NA	4.9E-08	3.6E-09	0.1%	1.4E-07	--	--
Chrysene	0.303	7.3E-03	NA	1.1E-07	7.7E-10	0.0%	3.0E-07	--	--
Dibenz(a,h)anthracene	0.0401	7.3E+00	NA	1.4E-08	1.0E-07	3.7%	3.9E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	9.1E-09	--	--	2.5E-08	--	--
Indeno(1,2,3-cd)pyrene	0.441	7.3E-01	NA	1.5E-07	1.1E-07	4.1%	4.3E-07	--	--
Arsenic	3.78	1.5E+00	3.0E-04	1.3E-06	2.0E-06	71.7%	3.7E-06	1.2E-02	0.4%
Cadmium	18.6	NA	1.0E-03	6.5E-06	--	--	1.8E-05	1.8E-02	0.6%
Cobalt	12.0	NA	3.0E-04	4.2E-06	--	--	1.2E-05	3.9E-02	1.4%
Lead	158	NA	NA	5.5E-05	--	--	1.5E-04	--	--
Vanadium	201	NA	7.0E-05	7.0E-05	--	--	2.0E-04	2.8E+00	97.6%
				Total ILCR:	2.8E-06	100.0%	Total HI:	2.9E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.2	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	1.0E-01	NA	NA	1.4E-08	--	--	3.8E-08	--	--
Benzo(a)anthracene	0.254	1.3E-01	7.3E-01	NA	7.6E-08	5.6E-08	5.2%	2.1E-07	--	--
Benzo(a)pyrene (BaP)	0.116	1.3E-01	7.3E+00	NA	3.5E-08	2.5E-07	23.8%	9.7E-08	--	--
Benzo(b)fluoranthene	0.799	1.3E-01	7.3E-01	NA	2.4E-07	1.7E-07	16.4%	6.7E-07	--	--
Benzo(k)fluoranthene	0.140	1.3E-01	7.3E-02	NA	4.2E-08	3.1E-09	0.3%	1.2E-07	--	--
Chrysene	0.303	1.3E-01	7.3E-03	NA	9.1E-08	6.6E-10	0.1%	2.5E-07	--	--
Dibenz(a,h)anthracene	0.0401	1.3E-01	7.3E+00	NA	1.2E-08	8.8E-08	8.2%	3.4E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	NA	6.0E-08	--	--	1.7E-07	--	--
Indeno(1,2,3-cd)pyrene	0.441	1.3E-01	7.3E-01	NA	1.3E-07	9.7E-08	9.1%	3.7E-07	--	--
Arsenic	3.78	3.0E-02	1.5E+00	3.0E-04	2.6E-07	3.9E-07	36.8%	7.3E-07	2.4E-03	0.0%
Cadmium	18.6	1.0E-03	NA	3.0E-05	4.3E-08	--	--	1.2E-07	4.0E-03	0.1%
Cobalt	12.0	1.0E-02	NA	3.0E-04	2.8E-07	--	--	7.7E-07	2.6E-03	0.0%
Lead	158	1.0E-02	NA	NA	3.6E-06	--	--	1.0E-05	--	--
Vanadium	201	1.0E-02	NA	1.8E-06	4.6E-06	--	--	1.3E-05	7.1E+00	99.9%
					Total ILCR:	1.1E-06	100.0%	Total HI:	7.1E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	
EC	mg/m3	Exposure Concentration	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	
HQ	NA	Hazard quotient	CS	
RfC	mg/m3	Inhalation Reference Concentration	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
VF	m3/kg	Volatilization Factor	CS	
PEF	m3/kg	Particulate emission factor	1.36E+09	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
AT-C	hours	Averaging time, carcinogens	613,200	
AT-N	hours	Averaging time, noncarcinogens	219,000	

						Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	4.24E-11	4.2E-03	NA	3.5E-12	1.5E-11	0.1%	9.7E-12	--	--
Benzo(a)anthracene	0.254	1.8E+07	1.42E-08	1.1E-04	NA	1.2E-09	1.3E-10	1.2%	3.2E-09	--	--
Benzo(a)pyrene (BaP)	0.116	3.5E+07	3.38E-09	1.1E-03	NA	2.8E-10	3.0E-10	2.9%	7.7E-10	--	--
Benzo(b)fluoranthene	0.799	2.1E+07	3.83E-08	1.1E-04	NA	3.1E-09	3.4E-10	3.3%	8.8E-09	--	--
Benzo(k)fluoranthene	0.140	4.5E+07	3.20E-09	1.1E-04	NA	2.6E-10	2.9E-11	0.3%	7.3E-10	--	--
Chrysene	0.303	2.7E+06	1.11E-07	1.1E-05	NA	9.1E-09	1.0E-10	1.0%	2.5E-08	--	--
Dibenz(a,h)anthracene	0.0401	8.7E+07	4.92E-10	1.2E-03	NA	4.0E-11	4.8E-11	0.5%	1.1E-10	--	--
Di-n-octyl Phthalate	0.0260	1.6E+07	1.69E-09	NA	NA	1.4E-10	--	--	3.9E-10	--	--
Indeno(1,2,3-cd)pyrene	0.441	8.2E+07	5.70E-09	1.1E-04	NA	4.6E-10	5.1E-11	0.5%	1.3E-09	--	--
Arsenic	3.78	NA	2.72E-09	4.3E-03	1.5E-05	2.2E-10	9.5E-10	9.3%	6.2E-10	4.1E-05	4.1%
Cadmium	18.6	NA	1.34E-08	1.8E-03	1.0E-05	1.1E-09	2.0E-09	19.1%	3.1E-09	3.1E-04	30.4%
Cobalt	12.0	NA	8.63E-09	9.0E-03	6.0E-06	7.0E-10	6.3E-09	61.7%	2.0E-09	3.3E-04	32.7%
Lead	158	NA	1.14E-07	NA	NA	9.3E-09	--	--	2.6E-08	--	--
Vanadium	201	NA	1.45E-07	NA	1.0E-04	1.2E-08	--	--	3.3E-08	3.3E-04	32.8%
						Total ILCR:	1.0E-08	100.0%	Total HI:	1.0E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	330	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	NA	2.7E-09	--	--	1.9E-07	--	--
Benzo(a)anthracene	0.254	7.3E-01	NA	1.2E-08	8.6E-09	2.3%	8.2E-07	--	--
Benzo(a)pyrene (BaP)	0.116	7.3E+00	NA	5.4E-09	3.9E-08	10.7%	3.7E-07	--	--
Benzo(b)fluoranthene	0.799	7.3E-01	NA	3.7E-08	2.7E-08	7.4%	2.6E-06	--	--
Benzo(k)fluoranthene	0.140	7.3E-02	NA	6.5E-09	4.7E-10	0.1%	4.5E-07	--	--
Chrysene	0.303	7.3E-03	NA	1.4E-08	1.0E-10	0.0%	9.8E-07	--	--
Dibenz(a,h)anthracene	0.0401	7.3E+00	NA	1.8E-09	1.4E-08	3.7%	1.3E-07	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	1.2E-09	--	--	8.4E-08	--	--
Indeno(1,2,3-cd)pyrene	0.441	7.3E-01	NA	2.0E-08	1.5E-08	4.1%	1.4E-06	--	--
Arsenic	3.78	1.5E+00	3.0E-04	1.7E-07	2.6E-07	71.7%	1.2E-05	4.1E-02	0.4%
Cadmium	18.6	NA	1.0E-03	8.6E-07	--	--	6.0E-05	6.0E-02	0.6%
Cobalt	12.0	NA	3.0E-04	5.5E-07	--	--	3.9E-05	1.3E-01	1.4%
Lead	158	NA	NA	7.3E-06	--	--	5.1E-04	--	--
Vanadium	201	NA	7.0E-05	9.3E-06	--	--	6.5E-04	9.3E+00	97.6%
				Total ILCR:	3.6E-07	100.0%	Total HI:	9.5E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.3	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	1.0E-01	NA	NA	8.2E-10	--	--	5.7E-08	--	--
Benzo(a)anthracene	0.254	1.3E-01	7.3E-01	NA	4.6E-09	3.3E-09	5.2%	3.2E-07	--	--
Benzo(a)pyrene (BaP)	0.116	1.3E-01	7.3E+00	NA	2.1E-09	1.5E-08	23.8%	1.5E-07	--	--
Benzo(b)fluoranthene	0.799	1.3E-01	7.3E-01	NA	1.4E-08	1.0E-08	16.4%	1.0E-06	--	--
Benzo(k)fluoranthene	0.140	1.3E-01	7.3E-02	NA	2.5E-09	1.8E-10	0.3%	1.8E-07	--	--
Chrysene	0.303	1.3E-01	7.3E-03	NA	5.5E-09	4.0E-11	0.1%	3.8E-07	--	--
Dibenz(a,h)anthracene	0.0401	1.3E-01	7.3E+00	NA	7.2E-10	5.3E-09	8.2%	5.0E-08	--	--
Di-n-octyl Phthalate	0.0260	NA	NA	NA	3.6E-09	--	--	2.5E-07	--	--
Indeno(1,2,3-cd)pyrene	0.441	1.3E-01	7.3E-01	NA	7.9E-09	5.8E-09	9.1%	5.6E-07	--	--
Arsenic	3.78	3.0E-02	1.5E+00	3.0E-04	1.6E-08	2.4E-08	36.8%	1.1E-06	3.7E-03	0.0%
Cadmium	18.6	1.0E-03	NA	3.0E-05	2.6E-09	--	--	1.8E-07	6.0E-03	0.1%
Cobalt	12.0	1.0E-02	NA	3.0E-04	1.7E-08	--	--	1.2E-06	3.9E-03	0.0%
Lead	158	1.0E-02	NA	NA	2.2E-07	--	--	1.5E-05	--	--
Vanadium	201	1.0E-02	NA	1.8E-06	2.8E-07	--	--	1.9E-05	1.1E+01	99.9%
					Total ILCR:	6.4E-08	100.0%	Total HI:	1.1E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	
EC	mg/m3	Exposure Concentration	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	
HQ	NA	Hazard quotient	CS	
RfC	mg/m3	Inhalation Reference Concentration	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
VF	m3/kg	Volatilization Factor	CS	
PEF	m3/kg	Particulate emission factor	2.99E+06	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
AT-C	hours	Averaging time, carcinogens	613,200	
AT-N	hours	Averaging time, noncarcinogens	8,760	

						Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
1,4-Dichloro-2-butene (trans)	0.0590	NA	1.97E-08	4.2E-03	NA	6.4E-11	2.7E-10	0.2%	4.5E-09	--	--
Benzo(a)anthracene	0.254	1.8E+07	9.89E-08	1.1E-04	NA	3.2E-10	3.5E-11	0.0%	2.3E-08	--	--
Benzo(a)pyrene (BaP)	0.116	3.5E+07	4.20E-08	1.1E-03	NA	1.4E-10	1.5E-10	0.1%	9.6E-09	--	--
Benzo(b)fluoranthene	0.799	2.1E+07	3.05E-07	1.1E-04	NA	9.9E-10	1.1E-10	0.1%	7.0E-08	--	--
Benzo(k)fluoranthene	0.140	4.5E+07	4.99E-08	1.1E-04	NA	1.6E-10	1.8E-11	0.0%	1.1E-08	--	--
Chrysene	0.303	2.7E+06	2.12E-07	1.1E-05	NA	6.9E-10	7.6E-12	0.0%	4.8E-08	--	--
Dibenz(a,h)anthracene	0.0401	8.7E+07	1.39E-08	1.2E-03	NA	4.5E-11	5.4E-11	0.0%	3.2E-09	--	--
Di-n-octyl Phthalate	0.0260	1.6E+07	1.04E-08	NA	NA	3.4E-11	--	--	2.4E-09	--	--
Indeno(1,2,3-cd)pyrene	0.441	8.2E+07	1.53E-07	1.1E-04	NA	5.0E-10	5.5E-11	0.0%	3.5E-08	--	--
Arsenic	3.78	NA	1.26E-06	4.3E-03	1.5E-05	4.1E-09	1.8E-08	10.3%	2.9E-07	1.9E-02	4.1%
Cadmium	18.6	NA	6.21E-06	1.8E-03	1.0E-05	2.0E-08	3.6E-08	21.1%	1.4E-06	1.4E-01	30.4%
Cobalt	12.0	NA	4.01E-06	9.0E-03	6.0E-06	1.3E-08	1.2E-07	68.2%	9.2E-07	1.5E-01	32.7%
Lead	158	NA	5.28E-05	NA	NA	1.7E-07	--	--	1.2E-05	--	--
Vanadium	201	NA	6.72E-05	NA	1.0E-04	2.2E-07	--	--	1.5E-05	1.5E-01	32.8%
						Total ILCR:	1.7E-07	100.0%	Total HI:	4.7E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

PARTICULATE EMISSION FACTOR - CONSTRUCTION WORKERS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

$$PEF = Q/C_{sr} \times 1/F_D \times \left[\frac{T \times A_R}{556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)} \right]$$

$$Q/C_{sr} = A \times \exp\left((\ln A_S - B)^2/C\right)$$

Symbol	Definition (units)	Default	Reference
Q/C_{sr}	Inverse of a 1-h avg. air concentration along a straight road bisecting a 7 acre square site (g/m2 -s/kg/m3)	15.8	USEPA 2002
A	Constant (unitless)	12.9351	USEPA 2002
A_S	Arial extent of site surface soil contamination (acres)	7	Site-specific
B	Constant (unitless)	5.7383	USEPA 2002
C	Constant (unitless)	71.7711	USEPA 2002
F_D	Dispersion correction factor	0.185	USEPA 2002
T	Total time over which construction occurs (s)	7.20E+06	USEPA 2002
A_R	Surface area of contaminated road segment (m^2)	2,565	Site-specific
W	Mean vehicle weight (tons)	11	USEPA 2002
p	Number of days with at least 0.01 inches of precipitation (days/year)	120	USEPA 2002
Sum(VKT)	Sum of fleet vehicle kilometers traveled during the exposure duration (km)	840	USEPA 2002
PEF	Particulate Emission Factor (m^3/kg)	2.99E+06	Site-specific

Q/C_{sr} Calculation

$\ln A_S$	1.946	
$(\ln A_S - B)^2$	14.4	
$(\ln A_S - B)^2/C$	0.200	
$e^{(\ln AS - B)2/C}$	1.22	
$A \times e^{(\ln AS - B)2/C}$	15.8	Q/C_{sr}

PEF Calculation

$Q/C_{sr} \times 1/F_D$	85	
$T \times A_R$	18,468,162,855	
$(W/3)^{0.4}$	1.68	
(365-p)/365	0.671	
$556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)$	527,152	
$T \times A_R/556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)$	35,034	
PEF	2,993,052	
7 acres / 0.000247 acres / m2 =	28,340	m^2
sqrt (28340) / 1000 =	0.168	km

Assumptions

W assumptions: 10 - 2-ton cars and 10 - 20-ton trucks = 20 vehicles

Sum(VKT) assumptions:

Assume that the site is 7 acres configured as a square with the unpaved road segment dividing the square evenly. The road length equals the square root of the 7 acres (0.168 km). Assume that each vehicle travels the length of the road 1 time per day, 5 days per week, for a total of 12 months (1 year) = 20 vehicles x 0.168 km/day x 50 weeks/yr x 5 days/week = 840 km

A_R assumptions:

Based on VKT, the road length is 168 m and assume the road width is 50 ft. (15.24).

Reference

USEPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INGESTION OF GROUNDWATER (2008) AS DRINKING WATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/L	Concentration of chemical in water	CS	
IR-W	L/day	Ingestion rate of water	0.02	
EF	days/year	Exposure frequency	50	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.5E+00	3.0E-04	3.1E-10	4.7E-10	100.0%	2.2E-08	7.3E-05	1.4%
Cobalt	0.0110	NA	3.0E-04	6.2E-09	--	--	4.3E-07	1.4E-03	26.7%
Vanadium	0.00690	NA	7.0E-05	3.9E-09	--	--	2.7E-07	3.9E-03	71.9%
				Total ILCR:	4.7E-10	100.0%	Total HI:	5.4E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER (2008) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*Kp*SA*EF*ED*ET)/(BW*AT) Inorganics ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
DAD (mg/kg/d) = (C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT) ET ≤ t* (Organics) HQ = CDI/RfDo Adj RfD Adj = RfD*AD
DAD (mg/kg/d) = (C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B+B^2)/(1+B)^2))*SA*EF*ED)/(BW*AT ET > t* (Benzene & Vinyl Chloride)

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
SA	cm2	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	50	
ED	years	Exposure duration	1	
ET	hours/day	Exposure time	2.00	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	
C	mg/L	Concentration of chemical in water	CS	
CF	L/cm3	Conversion factor	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	
AD	NA	Adjustment for absorbed dose	CS	

								Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	tau (hours)	t* (hours)	B	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.00E-03	NA	NA	NA	1.5E+00	3.0E-04	1.0E-10	1.5E-10	100.0%	7.2E-09	2.4E-05	0.0%
Cobalt	0.0110	4.00E-04	NA	NA	NA	NA	3.0E-04	8.1E-10	--	--	5.7E-08	1.9E-04	0.4%
Vanadium	0.00690	1.00E-03	NA	NA	NA	NA	1.8E-06	1.3E-09	--	--	8.9E-08	4.9E-02	99.6%
								Total ILCR:	1.5E-10	100.0%	Total HI:	4.9E-02	100.0%

NOTES:
-- - Not applicable. Kp, tau, t*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted
NA - Toxicity criterion not available.

2010 DISTURBED SOIL SAMPLING INVESTIGATION HHRA

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Youth	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
IR-S	mg/day	Ingestion rate of soil	100	100	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	4,015	

				Adult						Youth					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	1.5E+00	3.0E-04	2.1E-07	3.2E-07	100.0%	6.2E-07	2.1E-03	8.0%	1.5E-07	2.3E-07	100.0%	9.6E-07	3.2E-03	8.0%
Cobalt	12.3	NA	3.0E-04	8.6E-07	--	--	2.5E-06	8.3E-03	32.5%	6.1E-07	--	--	3.9E-06	1.3E-02	32.5%
Thallium	0.320	NA	1.0E-05	2.2E-08	--	--	6.5E-08	6.5E-03	25.3%	1.6E-08	--	--	1.0E-07	1.0E-02	25.3%
Vanadium	216	NA	5.0E-03	1.5E-05	--	--	4.4E-05	8.8E-03	34.2%	1.1E-05	--	--	6.8E-05	1.4E-02	34.2%
				Total ILCR:	3.2E-07	100.0%	Total HI:	2.6E-02	100.0%	Total ILCR:	2.3E-07	100.0%	Total HI:	4.0E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	Youth	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.07	0.2	
ABS	NA	Absorption fraction	CS	CS	
SA	cm2/day	Skin surface area available for contact	5,700	3,200	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	4,015	

					Adult						Youth					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	3.0E-02	1.5E+00	3.0E-04	2.5E-08	3.8E-08	100.0%	7.4E-08	2.5E-04	20.7%	2.9E-08	4.4E-08	100.0%	1.8E-07	6.2E-04	20.7%
Cobalt	12.3	1.0E-02	NA	3.0E-04	3.4E-08	--	--	1.0E-07	3.3E-04	28.0%	3.9E-08	--	--	2.5E-07	8.3E-04	28.0%
Thallium	0.320	1.0E-02	NA	1.0E-05	8.9E-10	--	--	2.6E-09	2.6E-04	21.8%	1.0E-09	--	--	6.5E-09	6.5E-04	21.8%
Vanadium	216	1.0E-02	NA	5.0E-03	6.0E-07	--	--	1.8E-06	3.5E-04	29.5%	6.9E-07	--	--	4.4E-06	8.8E-04	29.5%
					Total ILCR:	3.8E-08	100.0%	Total HI:	1.2E-03	100.0%	Total ILCR:	4.4E-08	100.0%	Total HI:	3.0E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	Youth	
EC	mg/m3	Exposure Concentration	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfC	mg/kg/d	Inhalation Reference Concentration	CS	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
VF	m3/kg	Volatilization Factor	CS	CS	
PEF	m3/kg	Particulate emission factor	1.36E+09	1.36E+09	
ET	hours/day	Exposure time	2.0	2.0	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
AT-C	hours	Averaging time, carcinogens	613,200	613,200	
AT-N	hours	Averaging time, noncarcinogens	210,240	96,360	

						Adult						Youth					
						Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
Arsenic	3.04	NA	2.24E-09	4.3E-03	1.5E-05	9.1E-12	3.9E-11	10.6%	2.7E-11	1.8E-06	9.0%	4.2E-12	1.8E-11	10.6%	2.7E-11	1.8E-06	9.0%
Cobalt	12.3	NA	9.04E-09	9.0E-03	6.0E-06	3.7E-11	3.3E-10	89.4%	1.1E-10	1.8E-05	91.0%	1.7E-11	1.5E-10	89.4%	1.1E-10	1.8E-05	91.0%
Thallium	0.320	NA	2.35E-10	NA	NA	9.6E-13	--	--	2.8E-12	--	--	4.4E-13	--	--	2.8E-12	--	--
Vanadium	216	NA	1.59E-07	NA	NA	6.5E-10	--	--	1.9E-09	--	--	3.0E-10	--	--	1.9E-09	--	--
						Total ILCR:	3.7E-10	100.0%	Total HI:	2.0E-05	100.0%	Total ILCR:	1.7E-10	100.0%	Total HI:	2.0E-05	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SEDIMENT (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	Youth	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
IR-S	mg/day	Ingestion rate of sediment	100	100	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	4,015	

				Adult						Youth					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.36	1.5E+00	3.0E-04	2.3E-07	3.5E-07	100.0%	6.8E-07	2.3E-03	8.4%	1.7E-07	2.5E-07	100.0%	1.1E-06	3.5E-03	8.4%
Cadmium	13.4	NA	1.0E-03	9.4E-07	--	--	2.7E-06	2.7E-03	10.0%	6.7E-07	--	--	4.2E-06	4.2E-03	10.0%
Cobalt	14.6	NA	3.0E-04	1.0E-06	--	--	3.0E-06	9.9E-03	36.4%	7.3E-07	--	--	4.6E-06	1.5E-02	36.4%
Lead	353	NA	NA	2.5E-05	--	--	7.2E-05	--	--	1.8E-05	--	--	1.1E-04	--	--
Thallium	0.110	NA	1.0E-05	7.7E-09	--	--	2.2E-08	2.2E-03	8.2%	5.5E-09	--	--	3.5E-08	3.5E-03	8.2%
Vanadium	247	NA	5.0E-03	1.7E-05	--	--	5.0E-05	1.0E-02	37.0%	1.2E-05	--	--	7.8E-05	1.6E-02	37.0%
				Total ILCR:	3.5E-07	100.0%	Total HI:	2.7E-02	100.0%	Total ILCR:	2.5E-07	100.0%	Total HI:	4.2E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SEDIMENT (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	Youth	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.3	0.3	
ABS	NA	Absorption fraction	CS	CS	
SA	cm2/day	Skin surface area available for contact	5,700	3,200	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
BW	kg	Body weight	70	45	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	4,015	

					Adult						Youth					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.36	3.0E-02	1.5E+00	3.0E-04	1.2E-07	1.8E-07	100.0%	3.5E-07	1.2E-03	17.9%	4.8E-08	7.2E-08	100.0%	3.1E-07	1.0E-03	17.9%
Cadmium	13.4	1.0E-03	NA	3.0E-05	1.6E-08	--	--	4.7E-08	1.6E-03	23.8%	6.4E-09	--	--	4.1E-08	1.4E-03	23.8%
Cobalt	14.6	1.0E-02	NA	3.0E-04	1.7E-07	--	--	5.1E-07	1.7E-03	26.0%	7.0E-08	--	--	4.4E-07	1.5E-03	26.0%
Lead	353	1.0E-02	NA	NA	4.2E-06	--	--	1.2E-05	--	--	1.7E-06	--	--	1.1E-05	--	--
Thallium	0.110	1.0E-02	NA	1.0E-05	1.3E-09	--	--	3.8E-09	3.8E-04	5.9%	5.3E-10	--	--	3.3E-09	3.3E-04	5.9%
Vanadium	247	1.0E-02	NA	5.0E-03	2.9E-06	--	--	8.6E-06	1.7E-03	26.4%	1.2E-06	--	--	7.5E-06	1.5E-03	26.4%
					Total ILCR:	1.8E-07	100.0%	Total HI:	6.5E-03	100.0%	Total ILCR:	7.2E-08	100.0%	Total HI:	5.7E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	1.5E+00	3.0E-04	1.1E-06	1.6E-06	100.0%	3.0E-06	9.9E-03	8.0%
Cobalt	12.3	NA	3.0E-04	4.3E-06	--	--	1.2E-05	4.0E-02	32.5%
Thallium	0.320	NA	1.0E-05	1.1E-07	--	--	3.1E-07	3.1E-02	25.3%
Vanadium	216	NA	5.0E-03	7.5E-05	--	--	2.1E-04	4.2E-02	34.2%
				Total ILCR:	1.6E-06	100.0%	Total HI:	1.2E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.2	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	3.0E-02	1.5E+00	3.0E-04	2.1E-07	3.2E-07	100.0%	5.9E-07	2.0E-03	20.7%
Cobalt	12.3	1.0E-02	NA	3.0E-04	2.8E-07	--	--	7.9E-07	2.6E-03	28.0%
Thallium	0.320	1.0E-02	NA	1.0E-05	7.4E-09	--	--	2.1E-08	2.1E-03	21.8%
Vanadium	216	1.0E-02	NA	5.0E-03	5.0E-06	--	--	1.4E-05	2.8E-03	29.5%
					Total ILCR:	3.2E-07	100.0%	Total HI:	9.5E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	
EC	mg/m3	Exposure Concentration	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	
HQ	NA	Hazard quotient	CS	
RfC	mg/m3	Inhalation Reference Concentration	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
VF	m3/kg	Volatilization Factor	CS	
PEF	m3/kg	Particulate emission factor	1.36E+09	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
AT-C	hours	Averaging time, carcinogens	613,200	
AT-N	hours	Averaging time, noncarcinogens	219,000	

						Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
Arsenic	3.04	NA	2.24E-09	4.3E-03	1.5E-05	1.8E-10	7.8E-10	10.6%	5.1E-10	3.4E-05	9.0%
Cobalt	12.3	NA	9.04E-09	9.0E-03	6.0E-06	7.4E-10	6.6E-09	89.4%	2.1E-09	3.4E-04	91.0%
Thallium	0.320	NA	2.35E-10	NA	NA	1.9E-11	--	--	5.4E-11	--	--
Vanadium	216	NA	1.59E-07	NA	NA	1.3E-08	--	--	3.6E-08	--	--
						Total ILCR:	7.4E-09	100.0%	Total HI:	3.8E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SEDIMENT (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of sediment	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.36	1.5E+00	3.0E-04	1.2E-06	1.8E-06	100.0%	3.3E-06	1.1E-02	8.4%
Cadmium	13.4	NA	1.0E-03	4.7E-06	--	--	1.3E-05	1.3E-02	10.0%
Cobalt	14.6	NA	3.0E-04	5.1E-06	--	--	1.4E-05	4.8E-02	36.4%
Lead	353	NA	NA	1.2E-04	--	--	3.5E-04	--	--
Thallium	0.110	NA	1.0E-05	3.8E-08	--	--	1.1E-07	1.1E-02	8.2%
Vanadium	247	NA	5.0E-03	8.6E-05	--	--	2.4E-04	4.8E-02	37.0%
				Total ILCR:	1.8E-06	100.0%	Total HI:	1.3E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SEDIMENT (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.3	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.36	3.0E-02	1.5E+00	3.0E-04	3.5E-07	5.2E-07	100.0%	9.8E-07	3.3E-03	17.9%
Cadmium	13.4	1.0E-03	NA	3.0E-05	4.6E-08	--	--	1.3E-07	4.3E-03	23.8%
Cobalt	14.6	1.0E-02	NA	3.0E-04	5.1E-07	--	--	1.4E-06	4.7E-03	26.0%
Lead	353	1.0E-02	NA	NA	1.2E-05	--	--	3.4E-05	--	--
Thallium	0.110	1.0E-02	NA	1.0E-05	3.8E-09	--	--	1.1E-08	1.1E-03	5.9%
Vanadium	247	1.0E-02	NA	5.0E-03	8.5E-06	--	--	2.4E-05	4.8E-03	26.4%
					Total ILCR:	5.2E-07	100.0%	Total HI:	1.8E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
CDI	mg/kg/d	Chronic daily intake	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDo	mg/kg/d	Oral reference dose	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
IR-S	mg/day	Ingestion rate of soil	100	200
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06
FI	NA	Fraction of soil ingested from site	1	1
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	1.5E+00	3.0E-04	1.4E-06	2.1E-06	100.0%	4.2E-06	1.4E-02	8.0%	3.3E-06	5.0E-06	100.0%	3.9E-05	1.3E-01	8.0%
Cobalt	12.3	NA	3.0E-04	5.8E-06	--	--	1.7E-05	5.6E-02	32.5%	1.3E-05	--	--	1.6E-04	5.2E-01	32.5%
Thallium	0.320	NA	1.0E-05	1.5E-07	--	--	4.4E-07	4.4E-02	25.3%	3.5E-07	--	--	4.1E-06	4.1E-01	25.3%
Vanadium	216	NA	5.0E-03	1.0E-04	--	--	3.0E-04	5.9E-02	34.2%	2.4E-04	--	--	2.8E-03	5.5E-01	34.2%
				Total ILCR:	2.1E-06	100.0%	Total HI:	1.7E-01	100.0%	Total ILCR:	5.0E-06	100.0%	Total HI:	1.6E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
DAD	mg/kg/d	Dermally absorbed dose	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDd	mg/kg/d	Dermal reference dose	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06
AF	mg/cm2	Soil to skin adherence factor	0.07	0.2
ABS	NA	Absorption fraction	CS	CS
SA	cm2/day	Skin surface area available for contact	5,700	2,800
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	3.0E-02	1.5E+00	3.0E-04	1.7E-07	2.6E-07	100.0%	5.0E-07	1.7E-03	20.7%	2.8E-07	4.2E-07	100.0%	3.3E-06	1.1E-02	20.7%
Cobalt	12.3	1.0E-02	NA	3.0E-04	2.3E-07	--	--	6.7E-07	2.2E-03	28.0%	3.8E-07	--	--	4.4E-06	1.5E-02	28.0%
Thallium	0.320	1.0E-02	NA	1.0E-05	6.0E-09	--	--	1.7E-08	1.7E-03	21.8%	9.8E-09	--	--	1.1E-07	1.1E-02	21.8%
Vanadium	216	1.0E-02	NA	5.0E-03	4.0E-06	--	--	1.2E-05	2.4E-03	29.5%	6.6E-06	--	--	7.7E-05	1.5E-02	29.5%
					Total ILCR:	2.6E-07	100.0%	Total HI:	8.0E-03	100.0%	Total ILCR:	4.2E-07	100.0%	Total HI:	5.2E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT ILCR = EC*IUR*1000 ug/mg
Where: Ca = C/VF + C/PEF HQ = EC/RfC CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
EC	mg/m3	Exposure Concentration	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfC	mg/m3	Inhalation Reference Concentration	CS	CS
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
VF	m3/kg	Volatilization Factor	CS	CS
PEF	m3/kg	Particulate emission factor	1.36E+09	1.36E+09
ET	hours/day	Exposure time	24	24
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
AT-C	hours	Averaging time, carcinogens	613,200	613,200
AT-N	hours	Averaging time, noncarcinogens	210,240	52,560

						Adult						Young Child					
						Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC mg/m3	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
Arsenic	3.04	NA	2.24E-09	4.3E-03	1.5E-05	7.3E-10	3.2E-09	10.6%	2.1E-09	1.4E-04	9.0%	1.8E-10	7.9E-10	10.6%	2.1E-09	1.4E-04	9.0%
Cobalt	12.3	NA	9.04E-09	9.0E-03	6.0E-06	3.0E-09	2.7E-08	89.4%	8.7E-09	1.4E-03	91.0%	7.4E-10	6.7E-09	89.4%	8.7E-09	1.4E-03	91.0%
Thallium	0.320	NA	2.35E-10	NA	NA	7.7E-11	--	--	2.3E-10	--	--	1.9E-11	--	--	2.3E-10	--	--
Vanadium	216	NA	1.59E-07	NA	NA	5.2E-08	--	--	1.5E-07	--	--	1.3E-08	--	--	1.5E-07	--	--
						Total ILCR:	3.0E-08	100.0%	Total HI:	1.6E-03	100.0%	Total ILCR:	7.5E-09	100.0%	Total HI:	1.6E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
CDI	mg/kg/d	Chronic daily intake	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDo	mg/kg/d	Oral reference dose	CS	CS
C	mg/L	Concentration of chemical in water	CS	CS
IR-W	L/day	Ingestion rate of water	2	1
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.5E+00	3.0E-04	5.3E-06	7.9E-06	100.0%	1.5E-05	5.1E-02	4.5%	3.1E-06	4.6E-06	100.0%	3.6E-05	1.2E-01	4.5%
Barium	0.580	NA	2.0E-01	5.4E-03	--	--	1.6E-02	7.9E-02	7.0%	3.2E-03	--	--	3.7E-02	1.9E-01	7.0%
Cobalt	0.0110	NA	3.0E-04	1.0E-04	--	--	3.0E-04	1.0E+00	88.5%	6.0E-05	--	--	7.0E-04	2.3E+00	88.5%
				Total ILCR:	7.9E-06	100.0%	Total HI:	1.1E+00	100.0%	Total ILCR:	4.6E-06	100.0%	Total HI:	2.6E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*Kp*SA*EF*ED*ET)/(BW*AT) — Inorganics
DAD (mg/kg/d) = (C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT) — ET ≤ t* (Organics)
DAD (mg/kg/d) = (C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B+B^2)/(1+B)^2))*SA*EF*ED)/(BW*AT) — ET > t* (Benzene & Vinyl Chloride)

ILCR = CDI*CSFo Adj
HQ = CDI/RfDo Adj

CSF Adj = CSF/AD
RfD Adj = RfD*AD

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
SA	cm2	Skin surface area available for contact	18,000	6,600	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	24	6	
ET	hours/day	Exposure time	0.58	1.00	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	2,190	
C	mg/L	Concentration of chemical in water	CS	CS	
CF	L/cm3	Conversion factor	1.00E-03	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	CS	
AD	NA	Adjustment for absorbed dose	CS	CS	

								Adult						Young Child					
								Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	tau (hours)	t* (hours)	B	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.00E-03 [61]	NA	NA	NA	1.5E+00	3.0E-04	2.7E-08	4.1E-08	100.0%	8.0E-08	2.7E-04	3.2%	2.0E-08	3.0E-08	100.0%	2.4E-07	7.9E-04	3.2%
Barium	0.580	1.00E-03 [61]	NA	NA	NA	NA	1.4E-02	2.8E-05	--	--	8.3E-05	5.9E-03	71.5%	2.1E-05	--	--	2.4E-04	1.7E-02	71.5%
Cobalt	0.0110	4.00E-04 [61]	NA	NA	NA	NA	3.0E-04	2.2E-07	--	--	6.3E-07	2.1E-03	25.3%	1.6E-07	--	--	1.9E-06	6.2E-03	25.3%
								Total ILCR:	4.1E-08	100.0%	Total HI:	8.3E-03	100.0%	Total ILCR:	3.0E-08	100.0%	Total HI:	2.4E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

Kp, tau, t*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SEDIMENT (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
CDI	mg/kg/d	Chronic daily intake	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDo	mg/kg/d	Oral reference dose	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
IR-S	mg/day	Ingestion rate of sediment	100	200
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06
FI	NA	Fraction of soil ingested from site	1	1
EF	days/year	Exposure frequency	52	52
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.36	1.5E+00	3.0E-04	2.3E-07	3.5E-07	100.0%	6.8E-07	2.3E-03	8.4%	5.5E-07	8.2E-07	100.0%	6.4E-06	2.1E-02	8.4%
Cadmium	13.4	NA	1.0E-03	9.4E-07	--	--	2.7E-06	2.7E-03	10.0%	2.2E-06	--	--	2.5E-05	2.5E-02	10.0%
Cobalt	14.6	NA	3.0E-04	1.0E-06	--	--	3.0E-06	9.9E-03	36.4%	2.4E-06	--	--	2.8E-05	9.2E-02	36.4%
Lead	353	NA	NA	2.5E-05	--	--	7.2E-05	--	--	5.7E-05	--	--	6.7E-04	--	--
Thallium	0.110	NA	1.0E-05	7.7E-09	--	--	2.2E-08	2.2E-03	8.2%	1.8E-08	--	--	2.1E-07	2.1E-02	8.2%
Vanadium	247	NA	5.0E-03	1.7E-05	--	--	5.0E-05	1.0E-02	37.0%	4.0E-05	--	--	4.7E-04	9.4E-02	37.0%
				Total ILCR:	3.5E-07	100.0%	Total HI:	2.7E-02	100.0%	Total ILCR:	8.2E-07	100.0%	Total HI:	2.5E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SEDIMENT (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

CS - Chemical Specific

Parameter	Units	Description	Adult	Young Child
DAD	mg/kg/d	Dermally absorbed dose	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfDd	mg/kg/d	Dermal reference dose	CS	CS
C	mg/kg	Concentration of chemical in soil	CS	CS
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06
AF	mg/cm2	Soil to skin adherence factor	0.3	0.3
ABS	NA	Absorption fraction	CS	CS
SA	cm2/day	Skin surface area available for contact	5,700	2,800
EF	days/year	Exposure frequency	52	52
ED	years	Exposure duration	24	6
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.36	3.0E-02	1.5E+00	3.0E-04	1.2E-07	1.8E-07	100.0%	3.5E-07	1.2E-03	17.9%	6.9E-08	1.0E-07	100.0%	8.0E-07	2.7E-03	17.9%
Cadmium	13.4	1.0E-03	NA	3.0E-05	1.6E-08	--	--	4.7E-08	1.6E-03	23.8%	9.2E-09	--	--	1.1E-07	3.6E-03	23.8%
Cobalt	14.6	1.0E-02	NA	3.0E-04	1.7E-07	--	--	5.1E-07	1.7E-03	26.0%	1.0E-07	--	--	1.2E-06	3.9E-03	26.0%
Lead	353	1.0E-02	NA	NA	4.2E-06	--	--	1.2E-05	--	--	2.4E-06	--	--	2.8E-05	--	--
Thallium	0.110	1.0E-02	NA	1.0E-05	1.3E-09	--	--	3.8E-09	3.8E-04	5.9%	7.5E-10	--	--	8.8E-09	8.8E-04	5.9%
Vanadium	247	1.0E-02	NA	5.0E-03	2.9E-06	--	--	8.6E-06	1.7E-03	26.4%	1.7E-06	--	--	2.0E-05	3.9E-03	26.4%
					Total ILCR:	1.8E-07	100.0%	Total HI:	6.5E-03	100.0%	Total ILCR:	1.0E-07	100.0%	Total HI:	1.5E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	1.5E+00	3.0E-04	1.1E-06	1.6E-06	100.0%	3.0E-06	9.9E-03	8.0%
Cobalt	12.3	NA	3.0E-04	4.3E-06	--	--	1.2E-05	4.0E-02	32.5%
Thallium	0.320	NA	1.0E-05	1.1E-07	--	--	3.1E-07	3.1E-02	25.3%
Vanadium	216	NA	5.0E-03	7.5E-05	--	--	2.1E-04	4.2E-02	34.2%
				Total ILCR:	1.6E-06	100.0%	Total HI:	1.2E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.2	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	3.0E-02	1.5E+00	3.0E-04	2.1E-07	3.2E-07	100.0%	5.9E-07	2.0E-03	20.7%
Cobalt	12.3	1.0E-02	NA	3.0E-04	2.8E-07	--	--	7.9E-07	2.6E-03	28.0%
Thallium	0.320	1.0E-02	NA	1.0E-05	7.4E-09	--	--	2.1E-08	2.1E-03	21.8%
Vanadium	216	1.0E-02	NA	5.0E-03	5.0E-06	--	--	1.4E-05	2.8E-03	29.5%
					Total ILCR:	3.2E-07	100.0%	Total HI:	9.5E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	
EC	mg/m3	Exposure Concentration	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	
HQ	NA	Hazard quotient	CS	
RfC	mg/m3	Inhalation Reference Concentration	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
VF	m3/kg	Volatilization Factor	CS	
PEF	m3/kg	Particulate emission factor	1.36E+09	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
AT-C	hours	Averaging time, carcinogens	613,200	
AT-N	hours	Averaging time, noncarcinogens	219,000	

						Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
Arsenic	3.04	NA	2.24E-09	4.3E-03	1.5E-05	1.8E-10	7.8E-10	10.6%	5.1E-10	3.4E-05	9.0%
Cobalt	12.3	NA	9.04E-09	9.0E-03	6.0E-06	7.4E-10	6.6E-09	89.4%	2.1E-09	3.4E-04	91.0%
Thallium	0.320	NA	2.35E-10	NA	NA	1.9E-11	--	--	5.4E-11	--	--
Vanadium	216	NA	1.59E-07	NA	NA	1.3E-08	--	--	3.6E-08	--	--
						Total ILCR:	7.4E-09	100.0%	Total HI:	3.8E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/L	Concentration of chemical in water	CS	
IR-W	L/day	Ingestion rate of water	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	25	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.5E+00	3.0E-04	2.0E-06	2.9E-06	100.0%	5.5E-06	1.8E-02	4.5%
Barium	0.580	NA	2.0E-01	2.0E-03	--	--	5.7E-03	2.8E-02	7.0%
Cobalt	0.0110	NA	3.0E-04	3.8E-05	--	--	1.1E-04	3.6E-01	88.5%
				Total ILCR:	2.9E-06	100.0%	Total HI:	4.1E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	330	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	1.5E+00	3.0E-04	1.4E-07	2.1E-07	100.0%	9.8E-06	3.3E-02	8.0%
Cobalt	12.3	NA	3.0E-04	5.7E-07	--	--	4.0E-05	1.3E-01	32.5%
Thallium	0.320	NA	1.0E-05	1.5E-08	--	--	1.0E-06	1.0E-01	25.3%
Vanadium	216	NA	5.0E-03	1.0E-05	--	--	7.0E-04	1.4E-01	34.2%
				Total ILCR:	2.1E-07	100.0%	Total HI:	4.1E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*AF*ABS*SA*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.3	
ABS	NA	Absorption fraction	CS	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

					Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	3.04	3.0E-02	1.5E+00	3.0E-04	1.3E-08	1.9E-08	100.0%	8.8E-07	2.9E-03	20.7%
Cobalt	12.3	1.0E-02	NA	3.0E-04	1.7E-08	--	--	1.2E-06	4.0E-03	28.0%
Thallium	0.320	1.0E-02	NA	1.0E-05	4.4E-10	--	--	3.1E-08	3.1E-03	21.8%
Vanadium	216	1.0E-02	NA	5.0E-03	3.0E-07	--	--	2.1E-05	4.2E-03	29.5%
					Total ILCR:	1.9E-08	100.0%	Total HI:	1.4E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SOIL (2010) - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

EC (mg/m3) = (Ca*ET*EF*ED)/AT
Where: Ca = C/VF + C/PEF

ILCR = EC*IUR*1000 ug/mg
HQ = EC/RfC

Parameter	Units	Description	Adult	
EC	mg/m3	Exposure Concentration	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
IUR	1/(µg/m3)	Inhalation Unit Risk	CS	
HQ	NA	Hazard quotient	CS	
RfC	mg/m3	Inhalation Reference Concentration	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
VF	m3/kg	Volatilization Factor	CS	
PEF	m3/kg	Particulate emission factor	2.99E+06	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
AT-C	hours	Averaging time, carcinogens	613,200	
AT-N	hours	Averaging time, noncarcinogens	8,760	

						Carcinogens			Noncarcinogens		
Parameter	C (mg/kg)	VF (m3/kg)	Ca (mg/m3)	IUR 1/(µg/m3)	RfC (mg/m3)	EC (mg/m3)	ILCR	% Contrib. Total ILCR	EC (mg/m3)	HQ	% Contrib. HI
Arsenic	3.04	NA	1.02E-06	4.3E-03	1.5E-05	3.3E-09	1.4E-08	10.6%	2.3E-07	1.5E-02	9.0%
Cobalt	12.3	NA	4.11E-06	9.0E-03	6.0E-06	1.3E-08	1.2E-07	89.4%	9.4E-07	1.6E-01	91.0%
Thallium	0.320	NA	1.07E-07	NA	NA	3.5E-10	--	--	2.4E-08	--	--
Vanadium	216	NA	7.22E-05	NA	NA	2.4E-07	--	--	1.6E-05	--	--
						Total ILCR:	1.3E-07	100.0%	Total HI:	1.7E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

PARTICULATE EMISSION FACTOR - CONSTRUCTION WORKERS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

$$PEF = Q/C_{sr} \times 1/F_D \times \left[\frac{T \times A_R}{556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)} \right]$$

$$Q/C_{sr} = A \times \exp\left((\ln A_S - B)^2/C\right)$$

Symbol	Definition (units)	Default	Reference
Q/C_{sr}	Inverse of a 1-h avg. air concentration along a straight road bisecting a 7 acre square site (g/m2 -s/kg/m3)	15.8	USEPA 2002
A	Constant (unitless)	12.9351	USEPA 2002
A_S	Arial extent of site surface soil contamination (acres)	7	Site-specific
B	Constant (unitless)	5.7383	USEPA 2002
C	Constant (unitless)	71.7711	USEPA 2002
F_D	Dispersion correction factor	0.185	USEPA 2002
T	Total time over which construction occurs (s)	7.20E+06	USEPA 2002
A_R	Surface area of contaminated road segment (m^2)	2,565	Site-specific
W	Mean vehicle weight (tons)	11	USEPA 2002
p	Number of days with at least 0.01 inches of precipitation (days/year)	120	USEPA 2002
Sum(VKT)	Sum of fleet vehicle kilometers traveled during the exposure duration (km)	840	USEPA 2002
PEF	Particulate Emission Factor (m^3/kg)	2.99E+06	Site-specific

Q/C_{sr} Calculation

$\ln A_S$	1.946	
$(\ln A_S - B)^2$	14.4	
$(\ln A_S - B)^2/C$	0.200	
$e^{(\ln AS - B)2/C}$	1.22	
$A \times e^{(\ln AS - B)2/C}$	15.8	Q/C_{sr}

PEF Calculation

$Q/C_{sr} \times 1/F_D$	85	
$T \times A_R$	18,468,162,855	
$(W/3)^{0.4}$	1.68	
(365-p)/365	0.671	
$556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)$	527,152	
$T \times A_R/556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)$	35,034	
PEF	2,993,052	
7 acres / 0.000247 acres / m2 =	28,340	m^2
sqrt (28340) / 1000 =	0.168	km

Assumptions

W assumptions: 10 - 2-ton cars and 10 - 20-ton trucks = 20 vehicles

Sum(VKT) assumptions:

Assume that the site is 7 acres configured as a square with the unpaved road segment dividing the square evenly. The road length equals the square root of the 7 acres (0.168 km). Assume that each vehicle travels the length of the road 1 time per day, 5 days per week, for a total of 12 months (1 year) = 20 vehicles x 0.168 km/day x 50 weeks/yr x 5 days/week = 840 km

A_R assumptions:

Based on VKT, the road length is 168 m and assume the road width is 50 ft. (15.24).

Reference

USEPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

CDI (mg/kg/d) = (C*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/L	Concentration of chemical in water	CS	
IR-W	L/day	Ingestion rate of water	0.02	
EF	days/year	Exposure frequency	50	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

				Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.5E+00	3.0E-04	3.1E-10	4.7E-10	100.0%	2.2E-08	7.3E-05	4.5%
Barium	0.580	NA	2.0E-01	3.2E-07	--	--	2.3E-05	1.1E-04	7.0%
Cobalt	0.0110	NA	3.0E-04	6.2E-09	--	--	4.3E-07	1.4E-03	88.5%
				Total ILCR:	4.7E-10	100.0%	Total HI:	1.6E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER - SWMU 69 (AIRCRAFT PARKING AREA)
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

DAD (mg/kg/d) = (C*CF*Kp*SA*EF*ED*ET)/(BW*AT — Inorganics — ILCR = CDI*CSFo Adj — CSF Adj = CSF/AD
DAD (mg/kg/d) = (C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT) — ET ≤ t* (Organics) — HQ = CDI/RfDo Adj — RfD Adj = RfD*AD
DAD (mg/kg/d) = (C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B+E^2)/(1+B)^2))*SA*EF*ED)/(BW*AT) — ET > t* (Benzene & Vinyl Chloride)

Parameter	Units	Description	Adult	
DAD	mg/kg/d	Dermally absorbed dose	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
SA	cm2	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	50	
ED	years	Exposure duration	1	
ET	hours/day	Exposure time	2.00	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	
C	mg/L	Concentration of chemical in water	CS	
CF	L/cm3	Conversion factor	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	
AD	NA	Adjustment for absorbed dose	CS	

								Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	tau (hours)	t* (hours)	B	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Arsenic	0.00056	1.00E-03 (61)	NA	NA	NA	1.5E+00	3.0E-04	1.0E-10	1.5E-10	100.0%	7.2E-09	2.4E-05	3.2%
Barium	0.580	1.00E-03 (61)	NA	NA	NA	NA	1.4E-02	1.1E-07	--	--	7.5E-06	5.4E-04	71.5%
Cobalt	0.0110	4.00E-04 (61)	NA	NA	NA	NA	3.0E-04	8.1E-10	--	--	5.7E-08	1.9E-04	25.3%
								Total ILCR:	1.5E-10	100.0%	Total HI:	7.5E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

Kp, tau, t*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted

APPENDIX K
RAGS PART D TABLES

2008 CORRECTIVE MEASURES STUDY INVESTIGATION HHRA

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil (2008)	Soil (2008)	Soil (2008)	Trespassers	Adult and Youth	Ingestion Dermal	Quantitative	Current access of the site without permission
				On-Site Workers	Adult	Ingestion Dermal	Quantitative	Current landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
		Air	Fugitive Dusts	Trespassers	Adult and Youth	Inhalation	Quantitative	Current access of the site without permission
				On-Site Workers	Adult	Inhalation	Quantitative	Current landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Inhalation	NA	Not a current receptor.
				Residents	Adult and Young Child	Inhalation	NA	Not a current receptor.
				Construction Workers	Adult	Inhalation	NA	Not a current receptor.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (Cont)	Groundwater (2008)	Groundwater (2008)	Groundwater (2008)	Trespassers	Adult and Youth	Ingestion Dermal	NA	Not currently exposed to this medium.
				On-Site Workers	Adult	Ingestion Dermal	NA	Not currently exposed to this medium.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
		Air	Volatile Emissions to Indoor Air	Industrial / Commercial Workers	Adult	Inhalation	NA	Incomplete pathway for this medium.
				Residents	Adult	Inhalation	NA	Incomplete pathway for this medium.
			Volatile Emissions to Trench Air	Construction Workers	Adult	Inhalation	NA	Incomplete pathway for this medium.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Soil (2008)	Soil (2008)	Soil (2008)	Trespassers	Adult and Youth	Ingestion Dermal	Quantitative	Future potential access of the site without permission
				On-Site Workers	Adult	Ingestion Dermal	Quantitative	Future potential landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	Quantitative	Future potential indoor workers walking around the site.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
		Air	Fugitive Dusts	Trespassers	Adult and Youth	Inhalation	Quantitative	Future potential access of the site without permission
				On-Site Workers	Adult	Inhalation	Quantitative	Future potential landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Inhalation	Quantitative	Future potential indoor workers walking around the site.
				Residents	Adult and Young Child	Inhalation	Quantitative	Future potential residential development.
				Construction Workers	Adult	Inhalation	Quantitative	Future potential excavation or construction activities for development.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (Cont)	Groundwater (2008)	Groundwater (2008)	Groundwater (2008)	Trespassers	Adult and Youth	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				On-Site Workers	Adult	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
		Air	Volatile Emissions to Indoor Air	Industrial / Commercial Workers	Adult	Inhalation	NA	Incomplete pathway for this medium.
				Residents	Adult	Inhalation	NA	Incomplete pathway for this medium.
			Volatile Emissions to Trench Air	Construction Workers	Adult	Inhalation	NA	Incomplete pathway for this medium.

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Soil (2008)
Exposure Medium: Surface Soil (2008)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil		**Volatile Organic Compounds (ug/kg)**													
	110-57-6	1,4-Dichloro-2-butene (trans)	59 J	59 J	µg/kg	69SB14	1/25	1.7UJ - 23UJ	59	ND	6.90E+00	N/A	N/A	YES	ASL
	591-78-6	2-Hexanone (MBK)	2 J	2 J	µg/kg	69SB11	1/25	1.1U - 16UJ	2	ND	2.10E+04	N/A	N/A	NO	BSL
	108-10-1	4-Methyl-2-pentanone (MIBK)	7.7 J	7.7 J	µg/kg	69SB22	1/25	1.6U - 22UJ	7.7	ND	5.30E+05	N/A	N/A	NO	BSL
	67-64-1	Acetone	9.1 J	260	µg/kg	69SB05	15/22	5.8U - 33UJ	260	ND	6.10E+06	N/A	N/A	NO	BSL
	71-43-2	Benzene	0.99 J	0.99 J	µg/kg	69SB22	1/25	0.43U - 5.9UJ	0.99	ND	1.10E+03	N/A	N/A	NO	BSL
	100-41-4	Ethylbenzene	2.2 J	6.2 J	µg/kg	69SB09	2/25	0.41U - 3.1UJ	6.2	ND	5.40E+03	N/A	N/A	NO	BSL
	108-88-3	Toluene	0.53 J	3.3 J	µg/kg	69SB02	3/25	0.48U - 5.9UJ	3.3	ND	5.00E+05	N/A	N/A	NO	BSL
	1330-20-7	Xylenes, total	4.9 J	28 J	µg/kg	69SB09	5/25	1.2U - 9.5UJ	28	ND	6.30E+04	N/A	N/A	NO	BSL
		Semivolatile Organic Compounds (ug/kg)													
	95-94-3	1,2,4,5-Tetrachlorobenzene	26 J	29 J	µg/kg	69SB11	2/25	7U - 23UJ	29	ND	1.80E+03	N/A	N/A	NO	BSL
	91-57-6	2-Methylnaphthalene	2.3 J	9.2 J	µg/kg	69SB05	2/25	1.9U - 6.2UJ	9.2	ND	3.10E+04	N/A	N/A	NO	BSL
	83-32-9	Acenaphthene	0.79 J	10 J	µg/kg	69SB05	5/25	0.63U - 1.2UJ	10	ND	3.40E+05	N/A	N/A	NO	BSL
	208-96-8	Acenaphthylene	9.8 J	11 J	µg/kg	69SB05	2/25	1.9U - 3.5UJ	11	ND	3.40E+05 (7)	N/A	N/A	NO	BSL
	120-12-7	Anthracene	3.8 J	34 J	µg/kg	69SB05	6/25	1.9U - 3.5UJ	34	ND	1.70E+06	N/A	N/A	NO	BSL
	56-55-3	Benzo(a)anthracene	4.8 J	460 J	µg/kg	69SB05	14/25	1.9U - 2.7UJ	460	ND	1.50E+02	N/A	N/A	YES	ASL
	50-32-8	Benzo(a)pyrene (BaP)	2.8 J	530 J	µg/kg	69SB05	17/25	0.73U - 3.3UJ	530	ND	1.50E+01	N/A	N/A	YES	ASL
	205-99-2	Benzo(b)fluoranthene	5.6 J	1,300 J	µg/kg	69SB05	18/25	0.84U - 5.5UJ	1,300	ND	1.50E+02	N/A	N/A	YES	ASL
	191-24-2	Benzo(g,h,i)perylene	7.8 J	1,400 J	µg/kg	69SB05	17/25	1.9U - 14UJ	1,400	ND	1.70E+05 (8)	N/A	N/A	NO	BSL
	207-08-9	Benzo(k)fluoranthene	2.9 J	140	µg/kg	69SB11	3/25	1.1U - 3.7UJ	140	ND	1.50E+03	N/A	N/A	YES	CHEM
	117-81-7	Bis(2-ethylhexyl) Phthalate (BEHP)	9.4 J	1,000 J	µg/kg	69SB05	9/25	18U - 80U	1,000	ND	3.50E+04	N/A	N/A	NO	BSL
	85-68-7	Butyl Benzyl Phthalate	16 J	300 J	µg/kg	69SB05	11/25	8U - 15UJ	300	ND	2.60E+05	N/A	N/A	NO	BSL
	218-01-9	Chrysene	3.9 J	1,000 J	µg/kg	69SB05	19/25	0.68U - 4.2UJ	1,000	ND	1.50E+04	N/A	N/A	YES	CHEM
	53-70-3	Dibenz(a,h)anthracene	3 J	220 J	µg/kg	69SB05	14/25	0.65U - 5UJ	220	ND	1.50E+01	N/A	N/A	YES	ASL
	117-84-0	Di-n-octyl Phthalate	26 J	26 J	µg/kg	69SB11	1/25	3.7U - 12UJ	26	ND	N/A	N/A	N/A	YES	NSC
	206-44-0	Fluoranthene	2.1 J	1,100 J	µg/kg	69SB05	19/25	1.9U - 4.3UJ	1,100	ND	2.30E+05	N/A	N/A	NO	BSL
	86-73-7	Fluorene	1.3 J	14 J	µg/kg	69SB05	4/25	0.85U - 6.7UJ	14	ND	2.30E+05	N/A	N/A	NO	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	8.6 J	1,400 J	µg/kg	69SB05	16/25	1.3UJ - 4.2UJ	1,400	ND	1.50E+02	N/A	N/A	YES	ASL
	91-20-3	Naphthalene	0.75 J	3.4 J	µg/kg	69SB05	3/25	0.66U - 2.2UJ	3.4	ND	3.60E+03	N/A	N/A	NO	BSL
	608-93-5	Pentachlorobenzene	13 J	13 J	µg/kg	69SB05	1/25	6.9U - 23UJ	13	ND	4.90E+03	N/A	N/A	NO	BSL
	85-01-8	Phenanthrene	2.4 J	270 J	µg/kg	69SB05	15/25	1.9UJ - 5U	270	ND	1.70E+05 (8)	N/A	N/A	NO	BSL
	129-00-0	Pyrene	2.4 J	1,200 J	µg/kg	69SB05	20/25	1.9U - 2.2UJ	1,200	ND	1.70E+05	N/A	N/A	NO	BSL

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Soil (2008)
Exposure Medium: Surface Soil (2008)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil (Cont)		**Metals (mg/kg)**													
	7440-36-0	Antimony	2 J	2 J	mg/kg	69SB05	1/25	0.09UJ - 0.83UJ	2	2.43	3.10E+00	N/A	N/A	NO	BSL
	7440-38-2	Arsenic	1.4	5.4	mg/kg	69SB05	25/25	(6)	5.4	2.37	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	14	800	mg/kg	69SB05	25/25	(6)	800	233	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.037 J	0.35	mg/kg	69SB05	25/25	(6)	0.35	0.717	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.051 J	36 J	mg/kg	69SB05	24/25	0.039UJ - 0.039UJ	36	0.655	7.00E+00	N/A	N/A	YES	ASL
	7440-47-3	Chromium	15 J	89 J	mg/kg	69SB05	25/25	(6)	89	87.6	1.20E+04 (9)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	5.7	18	mg/kg	69SB27	25/25	(6)	18	51.9	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	16	130 J	mg/kg	69SB05, 69SB09	25/25	(6)	130	225	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.93 J	520	mg/kg	69SB05	24/25	0.71U - 0.71U	520	28.2	4.00E+02 (10)	N/A	N/A	YES	ASL
	7439-97-6	Mercury	0.0066 J	0.16	mg/kg	69SB04	25/25	(6)	0.16	0.112	5.60E-01	N/A	N/A	NO	BSL
	7440-02-0	Nickel	4	34	mg/kg	69SB05	25/25	(6)	34	27.0	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.13 J	1.8	mg/kg	69SB04	21/25	0.13U - 0.18U	1.8	1.85	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.021 J	0.54	mg/kg	69SB05	20/25	0.017U - 0.084U	0.54	--	3.90E+01	N/A	N/A	NO	BSL
	7440-31-5	Tin	9 J	9 J	mg/kg	69SB05	1/25	4U - 14UJ	9	3.68	4.70E+03	N/A	N/A	NO	BSL
	7440-62-2	Vanadium	46 J	280	mg/kg	69SB08	25/25	(6)	280	367	5.50E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	9	650	mg/kg	69SB05	25/25	(6)	650	113	2.30E+03	N/A	N/A	NO	BSL

(1) J - Analyte present - Reported value is estimated
U - Not detected
UJ - Reported quantitation limit is qualified as estimated

mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram

Definitions: N/A = Not Applicable
ND = Not Detected
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Regional Screening Levels, Residential Soil (Nov 2010)
(5) Rationale Codes

Selection Reason: Same chemical class (CHEM)
No Screening Criteria (NSC)
Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

(6) No detection limits given; analyte detected in every sample.
(7) Value for acenaphthene used as a surrogate.
(8) Value for pyrene used as a surrogate.
(9) Value for chromium III used as a surrogate.
(10) USEPA Residential Soil Action Level

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Total Soil (2008)
Exposure Medium: Total Soil (2008)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Total Soil (2008)		**Volatile Organic Compounds (ug/kg)**													
	110-57-6	1,4-Dichloro-2-butene (trans)	59 J	59 J	µg/kg	69SB14	1/35	1.7UJ - 120U	59	ND	6.90E+00	N/A	N/A	YES	ASL
	126-99-8	2-Chloro-1,3-butadiene (Chloroprene	7.6 J	7.6 J	µg/kg	69SB07	1/35	0.31U - 22UJ	7.6	ND	9.40E+00	N/A	N/A	NO	BSL
	591-78-6	2-Hexanone (MBK)	2 J	6.3 J	µg/kg	69SB08	2/35	1.1U - 80U	6.3	ND	2.10E+04	N/A	N/A	NO	BSL
	108-10-1	4-Methyl-2-pentanone (MIBK)	3.7 J	7.7 J	µg/kg	69SB22	2/35	1.6U - 110U	7.7	ND	5.30E+05	N/A	N/A	NO	BSL
	67-64-1	Acetone	7 J	260	µg/kg	69SB05	22/31	4.1UJ - 33UJ	260	ND	6.10E+06	N/A	N/A	NO	BSL
	71-43-2	Benzene	0.99 J	0.99 J	µg/kg	69SB22	1/35	0.43U - 30U	0.99	ND	1.10E+03	N/A	N/A	NO	BSL
	75-15-0	Carbon Disulfide	0.59 J	0.59 J	µg/kg	69SB27	1/35	0.28U - 19U	0.59	ND	8.20E+04	N/A	N/A	NO	BSL
	100-41-4	Ethylbenzene	2.2 J	6.2 J	µg/kg	69SB09	2/35	0.41U - 29U	6.2	ND	5.40E+03	N/A	N/A	NO	BSL
	108-88-3	Toluene	0.53 J	3.3 J	µg/kg	69SB02	3/35	0.48U - 30U	3.3	ND	5.00E+05	N/A	N/A	NO	BSL
	1330-20-7	Xylenes, total	4.9 J	28 J	µg/kg	69SB09	5/35	1.2U - 88U	28	ND	6.30E+04	N/A	N/A	NO	BSL
		Semivolatile Organic Compounds (ug/kg)													
	95-94-3	1,2,4,5-Tetrachlorobenzene	26 J	29 J	µg/kg	69SB11	2/35	7U - 23UJ	29	ND	1.80E+03	N/A	N/A	NO	BSL
	91-57-6	2-Methylnaphthalene	2.3 J	9.2 J	µg/kg	69SB05	2/35	1.9U - 6.2UJ	9.2	ND	3.10E+04	N/A	N/A	NO	BSL
	83-32-9	Acenaphthene	0.79 J	10 J	µg/kg	69SB05	5/35	0.63U - 1.2UJ	10	ND	3.40E+05	N/A	N/A	NO	BSL
	208-96-8	Acenaphthylene	9.8 J	11 J	µg/kg	69SB05	2/35	1.9U - 3.5UJ	11	ND	3.40E+05 (7)	N/A	N/A	NO	BSL
	120-12-7	Anthracene	3.8 J	34 J	µg/kg	69SB05	6/35	1.9U - 3.5UJ	34	ND	1.70E+06	N/A	N/A	NO	BSL
	56-55-3	Benzo(a)anthracene	4.8 J	460 J	µg/kg	69SB05	14/35	1.9U - 2.7UJ	460	ND	1.50E+02	N/A	N/A	YES	ASL
	50-32-8	Benzo(a)pyrene (BaP)	2.8 J	530 J	µg/kg	69SB05	17/35	0.73U - 3.3UJ	530	ND	1.50E+01	N/A	N/A	YES	ASL
	205-99-2	Benzo(b)fluoranthene	5.6 J	1,300 J	µg/kg	69SB05	18/35	0.84U - 5.5UJ	1,300	ND	1.50E+02	N/A	N/A	YES	ASL
	191-24-2	Benzo(g,h,i)perylene	7.8 J	1,400 J	µg/kg	69SB05	17/35	1.9U - 14UJ	1,400	ND	1.70E+05 (8)	N/A	N/A	NO	BSL
	207-08-9	Benzo(k)fluoranthene	2.9 J	140	µg/kg	69SB11	3/35	1.1U - 3.7UJ	140	ND	1.50E+03	N/A	N/A	YES	CHEM
	117-81-7	Bis(2-ethylhexyl) Phthalate (BEHP)	9.4 J	1,000 J	µg/kg	69SB05	10/35	18U - 80U	1,000	ND	3.50E+04	N/A	N/A	NO	BSL
	85-68-7	Butyl Benzyl Phthalate	16 J	300 J	µg/kg	69SB05	11/35	8U - 15UJ	300	ND	2.60E+05	N/A	N/A	NO	BSL
	218-01-9	Chrysene	3.9 J	1,000 J	µg/kg	69SB05	19/35	0.68U - 4.2UJ	1,000	ND	1.50E+04	N/A	N/A	YES	CHEM
	53-70-3	Dibenz(a,h)anthracene	3 J	220 J	µg/kg	69SB05	14/35	0.65U - 5UJ	220	ND	1.50E+01	N/A	N/A	YES	ASL
	117-84-0	Di-n-octyl Phthalate	26 J	26 J	µg/kg	69SB11	1/35	3.7U - 12UJ	26	ND	N/A	N/A	N/A	YES	NSC
	206-44-0	Fluoranthene	2.1 J	1,100 J	µg/kg	69SB05	19/35	1.9U - 4.3UJ	1,100	ND	2.30E+05	N/A	N/A	NO	BSL
	86-73-7	Fluorene	1.3 J	14 J	µg/kg	69SB05	4/35	0.85U - 6.7UJ	14	ND	2.30E+05	N/A	N/A	NO	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	8.6 J	1,400 J	µg/kg	69SB05	16/35	1.3UJ - 4.2UJ	1,400	ND	1.50E+02	N/A	N/A	YES	ASL
	91-20-3	Naphthalene	0.75 J	3.4 J	µg/kg	69SB05	3/35	0.66U - 2.2UJ	3.4	ND	3.60E+03	N/A	N/A	NO	BSL
	608-93-5	Pentachlorobenzene	13 J	13 J	µg/kg	69SB05	1/35	6.9U - 23UJ	13	ND	4.90E+03	N/A	N/A	NO	BSL
	85-01-8	Phenanthrene	2.4 J	270 J	µg/kg	69SB05	15/35	1.9UJ - 5U	270	ND	1.70E+05 (8)	N/A	N/A	NO	BSL
	129-00-0	Pyrene	2.4 J	1,200 J	µg/kg	69SB05	20/35	1.9U - 2.4U	1,200	ND	1.70E+05	N/A	N/A	NO	BSL

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Total Soil (2008)
Exposure Medium: Total Soil (2008)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Total Soil		**Metals (mg/kg)**													
(2008)	7440-36-0	Antimony	2 J	2 J	mg/kg	69SB05	1/35	0.083U - 0.83UJ	2	2.43	3.10E+00	N/A	N/A	NO	BSL
(Cont)	7440-38-2	Arsenic	0.83	5.4	mg/kg	69SB05	35/35	(6)	5.4	2.37	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	14	800	mg/kg	69SB05	31/31	(6)	800	233	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.037 J	0.35	mg/kg	69SB05, 69SB27	35/35	(6)	0.35	0.717	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.046 J	36 J	mg/kg	69SB05	27/35	0.034UJ - 0.041UJ	36	0.655	7.00E+00	N/A	N/A	YES	ASL
	7440-47-3	Chromium	9	89 J	mg/kg	69SB05	35/35	(6)	89	87.6	1.20E+04 (9)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	2.4 J	27	mg/kg	69SB12	35/35	(6)	27	51.9	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	16	270	mg/kg	69SB27	35/35	(6)	270	225	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.93 J	520	mg/kg	69SB05	24/25	0.71U - 0.71U	520	28.2	4.00E+02 (10)	N/A	N/A	YES	ASL
	7439-97-6	Mercury	0.0066 J	0.16	mg/kg	69SB04	34/35	0.0057U - 0.0057U	0.16	0.112	5.60E-01	N/A	N/A	NO	BSL
	7440-02-0	Nickel	2.7	34	mg/kg	69SB05	35/35	(6)	34	27.0	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.13 J	1.8	mg/kg	69SB04	31/35	0.13U - 0.18U	1.8	1.85	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.021 J	0.54	mg/kg	69SB05	26/35	0.017U - 0.084U	0.54	--	3.90E+01	N/A	N/A	NO	BSL
	7440-31-5	Tin	9 J	9 J	mg/kg	69SB05	1/35	4U - 14UJ	9	3.68	4.70E+03	N/A	N/A	NO	BSL
	7440-62-2	Vanadium	46 J	460 J	mg/kg	69SB08	35/35	(6)	460	367	5.50E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	9	650	mg/kg	69SB05	25/25	(6)	650	113	2.30E+03	N/A	N/A	NO	BSL

(1) J - Analyte present - Reported value is estimated
U - Not detected
UJ - Reported quantitation limit is qualified as estimated

mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram

Definitions: N/A = Not Applicable
ND = Not Detected
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Regional Screening Levels, Residential Soil (Nov 2010)
(5) Rationale Codes

Selection Reason: Same chemical class (CHEM)
No Screening Criteria (NSC)
Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

(6) No detection limits given; analyte detected in every sample.
(7) Value for acenaphthene used as a surrogate.
(8) Value for pyrene used as a surrogate.
(9) Value for chromium III used as a surrogate.
(10) USEPA Residential Soil Action Level

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater (2008)
Exposure Medium: Groundwater (2008)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater (2008)		**Volatile Organic Compounds (ug/L)**													
	591-78-6	2-Hexanone (MBK)	1.1 J	1.1 J	µg/L	69GW26	1/7	0.68U - 0.68U	1.1	ND	4.70E+00	N/A		NO	BSL
	67-64-1	Acetone	15 J	15 J	µg/L	69GW27	1/7	5U - 5U	15	ND	2.20E+03	N/A		NO	BSL
	74-87-3	Chloromethane	1.5 J	1.5 J	µg/L	69GW25	1/7	0.28U - 0.28U	1.5	ND	1.90E+01	N/A		NO	BSL
		Semivolatile Organic Compounds (ug/L)													
	83-32-9	Acenaphthene	0.11 J	0.11 J	µg/L	69GW27	1/7	0.019U - 0.019U	0.11	ND	2.20E+02	N/A		NO	BSL
	117-81-7	Bis(2-ethylhexyl) Phthalate (BEHP)	0.6 J	0.6 J	µg/L	69GW25	1/7	0.34UJ - 0.78U	0.6	ND	4.80E+00	6	MCL	NO	BSL
	1319-77-3	Cresol (Mixed Isomers)	2.1	2.1	µg/L	69GW27	1/7	0.15U - 0.15U	2.1	ND	9.30E+01	N/A		NO	BSL
	132-64-9	Dibenzofuran	0.36 J	0.36 J	µg/L	69GW27	1/7	0.097U - 0.097U	0.36	ND	3.70E+00	N/A		NO	BSL
	86-73-7	Fluorene	0.083 J	0.083 J	µg/L	69GW26	1/7	0.018U - 0.018U	0.083	ND	1.50E+02	N/A		NO	BSL
	85-01-8	Phenanthrene	0.28	0.28	µg/L	69GW26	1/7	0.017U - 0.017U	0.28	ND	1.10E+02 (7)	N/A		NO	BSL
		Dissolved Metals (ug/L)													
	d7440-38-2	Arsenic	0.32 J	0.38 J	µg/L	69GW27	3/7	0.28U - 1.5U	0.38	14.2	4.50E-02	10	MCL	YES	ASL
	d7440-39-3	Barium	12	570	µg/L	69GW12	7/7	(6)	570	267	7.30E+02	2000	MCL	NO	BSL
	d7440-43-9	Cadmium	0.14 J	0.16 J	µg/L	69GW12	2/7	0.12U - 0.12U	0.16	13.6	1.80E+00	5	MCL	NO	BSL
	d7440-48-4	Cobalt	0.71 J	12 J	µg/L	69GW12	5/7	0.41U - 0.43U	12	35.2	1.10E+00	N/A		YES	ASL
	d7440-02-0	Nickel	0.42 J	0.89 J	µg/L	69GW25	7/7	(6)	0.89	20.2	7.30E+01	N/A		NO	BSL
	d7440-62-2	Vanadium	2.4 J	6.6	µg/L	69GW11	7/7	(6)	6.6	21.4	2.60E-01	N/A		YES	ASL
	d7440-66-6	Zinc	7.2 J	16 J	µg/L	69GW26	4/7	6.5U - 6.5U	16	22.7	1.10E+03	N/A		NO	BSL
		Total Metals (ug/L)													
	7440-38-2	Arsenic	0.34 J	0.56 J	µg/L	69GW27	4/7	1.5U - 1.7U	0.56	8.01	4.50E-02	10	MCL	YES	ASL
	7440-39-3	Barium	12	580	µg/L	69GW12	7/7	(6)	580	694	7.30E+02	2000	MCL	NO	BSL
	7440-43-9	Cadmium	0.12 J	0.16 J	µg/L	69GW12	2/7	0.12UJ - 0.12UJ	0.16	13.6	1.80E+00	5	MCL	NO	BSL
	7440-48-4	Cobalt	0.81 J	11	µg/L	69GW11	4/7	0.24U - 0.32U	11	35.2	1.10E+00	N/A		YES	ASL
	7440-02-0	Nickel	0.44 J	0.9 J	µg/L	69GW25	7/7	(6)	0.9	96.9	7.30E+01	N/A		NO	BSL
	7440-62-2	Vanadium	2.7 J	6.9	µg/L	69GW07	7/7	(6)	6.9	21.4	2.60E-01	N/A		YES	ASL
	7440-66-6	Zinc	7.2 J	10 J	µg/L	69GW26	4/7	6.5U - 6.5U	10	22.7	1.10E+03	N/A		NO	BSL

(1) J - Analyte present - Reported value is estimated
U - Not detected
UJ - Reported quantitation limit is qualified as estimated

ug/L = microgram per liter

Definitions: N/A = Not Applicable
ND = Not Detected
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
COPC = Chemical of Potential Concern
MCL = Medium Contaminant Level

(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev)
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Regional Screening Levels, Tapwater (Nov 2010)
(5) Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

(6) No detection limits given; analyte detected in every sample.
(7) Value for pyrene used as a surrogate.

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Soil (2008)

Exposure Point Soil	Chemical of Potential Concern	Exposure Point Concentration			
		Value	Units	Statistic (2)	Rationale (ProUCL)
SS	1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	Max	Less than 4 detections
SS	Benzo(a)anthracene	0.254	mg/kg	95% UCL (NP)	99% KM (Chebyshev) UCL
SS	Benzo(a)pyrene (BaP)	0.116	mg/kg	95% UCL (NP)	95% KM (BCA) UCL
SS	Benzo(b)fluoranthene	0.799	mg/kg	95% UCL (NP)	99% KM (Chebyshev) UCL
SS	Benzo(k)fluoranthene	0.140	mg/kg	Max	Less than 4 detections
SS	Chrysene	0.303	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
SS	Dibenz(a,h)anthracene	0.0401	mg/kg	95% UCL (NP)	95% KM (BCA) UCL
SS	Di-n-octyl Phthalate	0.0260	mg/kg	Max	Less than 4 detections
SS	Indeno(1,2,3-cd)pyrene	0.441	mg/kg	95% UCL (NP)	97.5% KM (Chebyshev) UCL
SS	Arsenic	3.78	mg/kg	95% UCL (N)	95% Student's-t UCL
SS	Cadmium	18.6	mg/kg	95% UCL (NP)	99% KM (Chebyshev) UCL
TS	Cobalt	12.0	mg/kg	95% UCL (N)	95% Student's-t UCL
SS	Lead	158	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
TS	Vanadium	201	mg/kg	95% UCL (G)	95% Approximate Gamma UCL

Notes:

UCL = Upper Confidence Level

SS = Surface Soil
TS = Total Soil

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(N) - Normal distribution and 95% UCL
(NP) - Non-parametric distribution and 95% UCL
(G) - Gamma distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 3.2.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater (2008)
Exposure Medium: Groundwater (2008)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater (2008)									
	Arsenic	µg/L	0.606	Not Determined	0.56 J	0.00056	mg/L	Max	Less than 8 samples
	Cobalt	µg/L	3.40	Not Determined	11	0.0110	mg/L	Max	Less than 8 samples
	Vanadium	µg/L	5.01	Not Determined	6.9	0.00690	mg/L	Max	Less than 8 samples

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were not determined because data sets contained less than 8 samples or less than 4 detections.
(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Soil (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion									Chronic Daily Intake (CDI) Equations
	Current and Future Trespassers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1991	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	24	years	USEPA, 1991	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Youth	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1991	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	11	years	Prof Judge (4)	
				BW	Body Weight	45	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	4,015	days	USEPA, 1989	
	Current and Future On-Site Workers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	250	days/year	USEPA, 2004	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	25	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	
	Future Industrial / Commercial Workers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	250	days/year	USEPA, 2004	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	25	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Soil (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion (Cont)									Chronic Daily Intake (CDI) Equations
	Future Residents	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1991	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	350	days/year	USEPA, 2004	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	24	years	USEPA, 1991	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Young Child	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	200	mg/day	USEPA, 1991	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	350	days/year	USEPA, 2004	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	6	years	USEPA, 1991	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
	Future Construction Workers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	330	mg/day	USEPA, 2002	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge (2)	CDI (mg/kg-day) =
				EF	Exposure Frequency	250	days/year	USEPA, 2004	C x IR x CF x Fi x EF x ED x 1/BW x 1/AT
				ED	Exposure Duration	1	years	Prof Judge (5)	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Soil (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal									Dermally Adjusted Dose (DAD) Equations
	Current and Future Trespassers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	5,700	cm2/day	USEPA, 2004	
				AF	Soil to Skin Adherence Factor	0.07	mg/cm2	USEPA, 2004	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	1/BW x1/AT
				ED	Exposure Duration	24	years	USEPA, 1991	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Youth	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	3,200	cm2/day	USEPA, 1997	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2	USEPA, 2004	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	1/BW x1/AT
				ED	Exposure Duration	11	years	Prof Judge (4)	
				BW	Body Weight	45	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	4,015	days	USEPA, 1989	
	Current and Future On-Site Workers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	3,300	cm2/day	USEPA, 2004	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2	USEPA, 2004	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	250	days/year	USEPA, 2004	1/BW x1/AT
				ED	Exposure Duration	25	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Soil (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (Cont)									Dermally Adjusted Dose (DAD) Equations
	Future Industrial / Commercial Workers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	3,300	cm2/day	USEPA, 2004	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2	USEPA, 2004	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	250	days/year	USEPA, 2004	1/BW x1/AT
				ED	Exposure Duration	25	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	
	Future Residents	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	5,700	cm2/day	USEPA, 2004	
				AF	Soil to Skin Adherence Factor	0.07	mg/cm2	USEPA, 2004	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	350	days/year	USEPA, 2004	1/BW x1/AT
				ED	Exposure Duration	24	years	USEPA, 1991	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Young Child	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	2,800	cm2/day	USEPA, 2004	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2	USEPA, 2004	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	350	days/year	USEPA, 2004	1/BW x1/AT
				ED	Exposure Duration	6	years	USEPA, 1991	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Soil (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (Cont)									Dermally Adjusted Dose (DAD) Equations
	Future Construction Workers	Adult	Soil (2008)	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	3,300	cm2/day	USEPA, 2004	
				AF	Soil to Skin Adherence Factor	0.3	mg/cm2	USEPA, 2002	DAD (mg/kg-day) =
				ABS	Absorption Factor	CS	NA	USEPA, 2004	C x CF x SA x AF x ABS x EF x ED x
				EF	Exposure Frequency	250	days/year	USEPA, 2004	1/BW x1/AT
				ED	Exposure Duration	1	years	Prof Judge (5)	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

Notes

Chemical Specific - See Table 3.1

NA - Not Applicable

Prof Judge - Professional Judgment

(2) Conservative assumption of 100% ingested from source.
(3) Assumes individuals trespass on site 1 day/week. This value represents the default value for NAPR but may be revised based on site-specific factors such as accessibility and attractiveness to trespassers
(4) Represents youths from 6 to 16 years of age.
(5) Assumes a construction period of 1 year.

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002
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USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005

TABLE 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation									Exposure Concentration (EC) Equations
	Current and Future Trespassers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	
				ED	Exposure Duration	24	years	USEPA, 1991	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	210,240	hours	USEPA, 1989	
		Youth	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	
				ED	Exposure Duration	11	years	Prof Judge (4)	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	96,360	hours	USEPA, 1989	
	Current and Future On-Site Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	219,000	hours	USEPA, 1989	
	Future Industrial / Commercial Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	219,000	hours	USEPA, 1989	

TABLE 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2008)
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation									Exposure Concentration (EC) Equations
	Future Residents	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	24	hours/day	Prof Judge (8)	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	24	years	USEPA, 1991	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	210,240	hours	USEPA, 1989	
		Young Child	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	24	hours/day	Prof Judge (8)	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	6	years	USEPA, 1991	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	52,560	hours	USEPA, 1989	
	Future Construction Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	1	years	Prof Judge (5)	EC (mg/m3) =
				PEF	Particulate Emission Factor	2.99E+06	m3/kg	USEPA, 2002 (14)	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	hours	USEPA, 1989	

Notes

Chemical Specific - See Table 3.1 Prof Judge - Professional Judgment

(3) Assumes individuals trespass on site 1 day/week. This value represents the default value for NAPR but may be revised based on site-specific factors such as accessibility and attractiveness to trespassers
(4) Represents youths from 6 to 16 years of age.
(5) Assumes a construction period of 1 year.
(6) Recommended outdoor activity factor for adults.
(7) Assumes an 8 hour work day.
(8) Conservatively assumes receptor remains at residence 24 hours/day.

Sources:

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002
USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002
USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.
USEPA, 2002. Draft Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater (2008)
Exposure Medium: Groundwater (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion									Chronic Daily Intake (CDI) Equations
	Future Residents	Adult	Groundwater (2008	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	2	L/hour	USEPA, 1989	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	CDI (mg/kg-day) =
				ED	Exposure Duration	24	years	USEPA, 1991	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Young Child	Groundwater (2008	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	1	L/hour	USEPA, 1989	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	CDI (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
	Future Construction Workers	Adult	Groundwater (2008	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.02	L/hour	VDEQ, 2010	
				EF	Exposure Frequency	50	days/year	Prof Judge (12)	CDI (mg/kg-day) =
				ED	Exposure Duration	1	years	Prof Judge (5)	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
Dermal									Dermally Adjusted Dose (DAD) Equations
	Future Residents	Adult	Groundwater (2008	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	DAD (mg/kg-day) =
				SA	Surface Area Available for Contact	18,000	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	Inorganics
				tau	Lag Time	Chemical Specific	hour	USEPA, 2004	(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2004	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2004	Organics: ET <= t*
				ET	Exposure Time	0.58	hours/day	USEPA, 2004	(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	24	years	USEPA, 1991	Organics: ET > t*
				BW	Body Weight	70	kg	USEPA, 1997	(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B)))*SA*EF*ED)/(BW*AT)
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Young Child	Groundwater (2008	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	DAD (mg/kg-day) =
				SA	Surface Area Available for Contact	6,600	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	Inorganics
				tau	Lag Time	Chemical Specific	hour	USEPA, 2004	(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2004	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2004	Organics: ET <= t*
				ET	Exposure Time	1	hours/day	USEPA, 2004	(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	6	years	USEPA, 1991	Organics: ET > t*
				BW	Body Weight	15	kg	USEPA, 1997	(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B)))*SA*EF*ED)/(BW*AT)
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater (2008)
Exposure Medium: Groundwater (2008)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal									Dermally Adjusted Dose (DAD) Equations
	Future Construction Workers	Adult	Groundwater (2008	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	DAD (mg/kg-day) =
				SA	Surface Area Available for Contact	3,300	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	Inorganics
				tau	Lag Time	Chemical Specific	hour	USEPA, 2004	(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2004	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2004	Organics: ET <= t*
				ET	Exposure Time	2	hours/day	Prof Judge (13)	(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)
				EF	Exposure Frequency	50	days/year	Prof Judge (12)	
				ED	Exposure Duration	1	years	Prof Judge (5)	Organics: ET > t*
				BW	Body Weight	70	kg	USEPA, 1997	(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B)))*SA*EF*ED)/(BW*AT)
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

Notes

Chemical Specific - See Table 3.2

NA - Not Applicable

Prof Judge - Professional Judgment

(5) Assumes a construction period of 1 year.
(12) Assumes 20% of time spent in trench.
(13) Assumes 2 hours/event in trench.

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
1,4-Dichloro-2-butene (trans)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene (BaP)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	Chronic	3.00E-04	mg/kg/day	100%	3.00E-04	mg/kg/day	Skin / CVS	3/1	IRIS	4/3/2011
Cadmium	Chronic	1.00E-03	mg/kg/day	3%	3.00E-05	mg/kg/day	Kidney	10/1	IRIS	11/22/2010
Cobalt	Chronic	3.00E-04	mg/kg/day	100%	3.00E-04	mg/kg/day	CVS	10/1	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	Chronic	7.00E-05	mg/kg/day	3%	1.82E-06	mg/kg/day	GIS / Kidney	100/1	PPRTV	7/1/1997

Notes:

(1) Refer to RAGS, Part E
(2) Adjusted dermal RfD = Oral RfD * Adj Factor

NA = Not Applicable / Not Available

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Sources:
IRIS = Integrated Risk Information System
PPRTV = Provisional Peer Reviewed Toxicity Values

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s)
1,4-Dichloro-2-butene (trans)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene (BaP)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	Chronic	1.50E-05	mg/m3	NA	NA	NA	NA	Cal EPA	NA
Cadmium	Chronic	1.00E-05	mg/m3	NA	NA	Kidney	1/1	ATSDR	3/4/1999
Cobalt	Chronic	6.00E-06	mg/m3	NA	NA	RsS	NA	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	Chronic	1.00E-04	mg/m3	NA	NA	NA	NA	ATSDR	NA

Notes:

NA = Not Applicable / Not Available

Target Organ Abbreviations:
RsS = Respiratory System

Sources:
PPRTV = Provisional Peer Reviewed Toxicity Values
ATSDR = Agency for Toxic Substances and Disease Registry
Cal EPA = California Environmental Protection Agency

TABLE 6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s)
1,4-Dichloro-2-butene (trans)	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	7.30E-01	1 / (mg/kg/day)	100%	7.30E-01	1 / (mg/kg/day)	B2	ECAO	4/26/2000
Benzo(a)pyrene (BaP)	7.30E+00	1 / (mg/kg/day)	100%	7.30E+00	1 / (mg/kg/day)	B2	IRIS	11/1/2010
Benzo(b)fluoranthene	7.30E-01	1 / (mg/kg/day)	100%	7.30E-01	1 / (mg/kg/day)	B2	ECAO	4/26/2000
Benzo(k)fluoranthene	7.30E-02	1 / (mg/kg/day)	100%	7.30E-02	1 / (mg/kg/day)	B2	ECAO	4/26/2000
Chrysene	7.30E-03	1 / (mg/kg/day)	100%	7.30E-03	1 / (mg/kg/day)	B2	ECAO	4/26/2000
Dibenz(a,h)anthracene	7.30E+00	1 / (mg/kg/day)	100%	7.30E+00	1 / (mg/kg/day)	B2	ECAO	4/26/2000
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	7.30E-01	1 / (mg/kg/day)	100%	7.30E-01	1 / (mg/kg/day)	B2	ECAO	4/26/2000
Arsenic	1.50E+00	1 / (mg/kg/day)	100%	1.50E+00	1 / (mg/kg/day)	A	IRIS	4/3/2011
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

(1) Refer to RAGS, Part E
(2) Adjusted dermal CSF = Oral CSF / Adj Factor

NA = Not Applicable / Not Available

Sources:
IRIS = Integrated Risk Information System
ECAO = Environmental Criteria and Assessment Office

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Weight of Evidence:
Known/Likely (EPA classes A, B1, B2, C)
Cannot be Determined (EPA class D)
Not Likely (EPA class E)

TABLE 6.2
CANCER TOXICITY DATA -- INHALATION
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s)
1,4-Dichloro-2-butene (trans)	4.20E-03	1/(µg/m3)	NA	NA	D	PPRTV	NA
Benzo(a)anthracene	1.10E-04	1/(µg/m3)	NA	NA	D	Cal EPA	NA
Benzo(a)pyrene (BaP)	1.10E-03	1/(µg/m3)	NA	NA	B2	Cal EPA	4/26/2000
Benzo(b)fluoranthene	1.10E-04	1/(µg/m3)	NA	NA	B2	Cal EPA	NA
Benzo(k)fluoranthene	1.10E-04	1/(µg/m3)	NA	NA	B2	Cal EPA	NA
Chrysene	1.10E-05	1/(µg/m3)	NA	NA	B2	Cal EPA	9/20/2002
Dibenz(a,h)anthracene	1.20E-03	1/(µg/m3)	NA	NA	D	Cal EPA	NA
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.10E-04	1/(µg/m3)	NA	NA	B2	Cal EPA	9/20/2002
Arsenic	4.30E-03	1/(µg/m3)	NA	NA	A	IRIS	4/3/2011
Cadmium	1.80E-03	1/(µg/m3)	NA	NA	B1	IRIS	11/22/2010
Cobalt	9.00E-03	1/(µg/m3)	NA	NA	D	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA

Notes:

EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Sources:

IRIS = Integrated Risk Information System
PPRTV = Provisional Peer Reviewed Toxicity Values
Cal EPA = California Environmental Protection Agency

NA = Not Applicable / Not Available

Weight of Evidence:
- Known/Likely (EPA classes A, B1, B2, C)
- Cannot be Determined (EPA class D)
- Not Likely (EPA class E)

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	4.1E-09	mg/kg-day	NA	--	--	1.2E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.8E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.3E-08	5.2E-08	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	8.1E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.9E-08	2.4E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	5.6E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.1E-08	1.6E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	9.8E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	7.1E-10	2.8E-08	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	2.1E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.5E-10	6.2E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	2.8E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.0E-08	8.2E-09	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.8E-09	mg/kg-day	NA	--	--	5.3E-09	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	3.1E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.2E-08	9.0E-08	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	2.6E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.0E-07	7.7E-07	mg/kg-day	3.0E-04	mg/kg-day	2.6E-03
				Cadmium	18.6	mg/kg	1.3E-06	mg/kg-day	NA	--	--	3.8E-06	mg/kg-day	1.0E-03	mg/kg-day	3.8E-03
				Cobalt	12.0	mg/kg	8.4E-07	mg/kg-day	NA	--	--	2.4E-06	mg/kg-day	3.0E-04	mg/kg-day	8.1E-03
				Lead	158	mg/kg	1.1E-05	mg/kg-day	NA	--	--	3.2E-05	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	1.4E-05	mg/kg-day	NA	--	--	4.1E-05	mg/kg-day	7.0E-05	mg/kg-day	5.8E-01
			Ingestion Total								5.5E-07					6.0E-01
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.6E-09	mg/kg-day	NA	--	--	4.8E-09	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	9.2E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	6.7E-09	2.7E-08	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	4.2E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.1E-08	1.2E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	2.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.1E-08	8.4E-08	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	5.1E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.7E-10	1.5E-08	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.1E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	8.0E-11	3.2E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.5E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.1E-08	4.2E-09	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	7.2E-09	mg/kg-day	NA	--	--	2.1E-08	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.6E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.2E-08	4.7E-08	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	3.2E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.7E-08	9.2E-08	mg/kg-day	3.0E-04	mg/kg-day	3.1E-04
				Cadmium	18.6	mg/kg	5.2E-09	mg/kg-day	NA	--	--	1.5E-08	mg/kg-day	3.0E-05	mg/kg-day	5.0E-04
				Cobalt	12.0	mg/kg	3.3E-08	mg/kg-day	NA	--	--	9.7E-08	mg/kg-day	3.0E-04	mg/kg-day	3.2E-04
				Lead	158	mg/kg	4.4E-07	mg/kg-day	NA	--	--	1.3E-06	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	5.6E-07	mg/kg-day	NA	--	--	1.6E-06	mg/kg-day	1.8E-06	mg/kg-day	9.0E-01
			Dermal Total								1.3E-07					9.0E-01
		Exposure Point Total									6.8E-07					**1.5E+00**
	Exposure Medium Total										6.8E-07					**1.5E+00**

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.7E-13	mg/m3	4.2E-03	1/(µg/m3)	7.3E-13	5.0E-13	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	5.8E-11	mg/m3	1.1E-04	1/(µg/m3)	6.4E-12	1.7E-10	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	1.4E-11	mg/m3	1.1E-03	1/(µg/m3)	1.5E-11	4.0E-11	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	1.6E-10	mg/m3	1.1E-04	1/(µg/m3)	1.7E-11	4.6E-10	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	1.3E-11	mg/m3	1.1E-04	1/(µg/m3)	1.4E-12	3.8E-11	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	4.5E-10	mg/m3	1.1E-05	1/(µg/m3)	5.0E-12	1.3E-09	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	2.0E-12	mg/m3	1.2E-03	1/(µg/m3)	2.4E-12	5.8E-12	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	6.9E-12	mg/m3	NA	--	--	2.0E-11	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	2.3E-11	mg/m3	1.1E-04	1/(µg/m3)	2.6E-12	6.8E-11	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	1.1E-11	mg/m3	4.3E-03	1/(µg/m3)	4.8E-11	3.2E-11	mg/m3	1.5E-05	mg/m3	2.2E-06
				Cadmium	18.6	mg/kg	5.4E-11	mg/m3	1.8E-03	1/(µg/m3)	9.8E-11	1.6E-10	mg/m3	1.0E-05	mg/m3	1.6E-05
				Cobalt	12.0	mg/kg	3.5E-11	mg/m3	9.0E-03	1/(µg/m3)	3.2E-10	1.0E-10	mg/m3	6.0E-06	mg/m3	1.7E-05
				Lead	158	mg/kg	4.6E-10	mg/m3	NA	--	--	1.3E-09	mg/m3	NA	--	--
				Vanadium	201	mg/kg	5.9E-10	mg/m3	NA	--	--	1.7E-09	mg/m3	1.0E-04	mg/m3	1.7E-05
			Inhalation Total								5.1E-10					5.2E-05
		Exposure Point Total									5.1E-10					5.2E-05
	Exposure Medium Total										5.1E-10					5.2E-05
Soil (2008) Total											6.8E-07					**1.5E+00**
										Total of Receptor Risks Across All Media	6.8E-07	Total of Receptor Hazards Across All Media				**1.5E+00**

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	2.9E-09	mg/kg-day	NA	--	--	1.9E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.3E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.2E-09	8.0E-08	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	5.8E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.2E-08	3.7E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	4.0E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.9E-08	2.5E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	7.0E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	5.1E-10	4.4E-08	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.5E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.1E-10	9.6E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	2.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.5E-08	1.3E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.3E-09	mg/kg-day	NA	--	--	8.2E-09	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	2.2E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.6E-08	1.4E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	1.9E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.8E-07	1.2E-06	mg/kg-day	3.0E-04	mg/kg-day	4.0E-03
				Cadmium	18.6	mg/kg	9.3E-07	mg/kg-day	NA	--	--	5.9E-06	mg/kg-day	1.0E-03	mg/kg-day	5.9E-03
				Cobalt	12.0	mg/kg	6.0E-07	mg/kg-day	NA	--	--	3.8E-06	mg/kg-day	3.0E-04	mg/kg-day	1.3E-02
				Lead	158	mg/kg	7.9E-06	mg/kg-day	NA	--	--	5.0E-05	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	1.0E-05	mg/kg-day	NA	--	--	6.4E-05	mg/kg-day	7.0E-05	mg/kg-day	9.1E-01
			Ingestion Total								3.9E-07					9.3E-01
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.9E-09	mg/kg-day	NA	--	--	1.2E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.1E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	7.7E-09	6.7E-08	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	4.8E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.5E-08	3.1E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	3.3E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.4E-08	2.1E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	5.8E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	4.2E-10	3.7E-08	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.3E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	9.2E-11	8.0E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.7E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.2E-08	1.1E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	8.3E-09	mg/kg-day	NA	--	--	5.3E-08	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.8E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.3E-08	1.2E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	3.6E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	5.4E-08	2.3E-07	mg/kg-day	3.0E-04	mg/kg-day	7.7E-04
				Cadmium	18.6	mg/kg	5.9E-09	mg/kg-day	NA	--	--	3.8E-08	mg/kg-day	3.0E-05	mg/kg-day	1.3E-03
				Cobalt	12.0	mg/kg	3.8E-08	mg/kg-day	NA	--	--	2.4E-07	mg/kg-day	3.0E-04	mg/kg-day	8.1E-04
				Lead	158	mg/kg	5.0E-07	mg/kg-day	NA	--	--	3.2E-06	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	6.4E-07	mg/kg-day	NA	--	--	4.1E-06	mg/kg-day	1.8E-06	mg/kg-day	**2.2E+00**
			Dermal Total								1.5E-07					**2.2E+00**
		Exposure Point Total									5.4E-07					**3.2E+00**
	Exposure Medium Total										5.4E-07					**3.2E+00**

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	7.9E-14	mg/m3	4.2E-03	1/(µg/m3)	3.3E-13	5.0E-13	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	2.6E-11	mg/m3	1.1E-04	1/(µg/m3)	2.9E-12	1.7E-10	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	6.3E-12	mg/m3	1.1E-03	1/(µg/m3)	6.9E-12	4.0E-11	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	7.2E-11	mg/m3	1.1E-04	1/(µg/m3)	7.9E-12	4.6E-10	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	6.0E-12	mg/m3	1.1E-04	1/(µg/m3)	6.6E-13	3.8E-11	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	2.1E-10	mg/m3	1.1E-05	1/(µg/m3)	2.3E-12	1.3E-09	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	9.2E-13	mg/m3	1.2E-03	1/(µg/m3)	1.1E-12	5.8E-12	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	3.2E-12	mg/m3	NA	--	--	2.0E-11	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.1E-11	mg/m3	1.1E-04	1/(µg/m3)	1.2E-12	6.8E-11	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	5.1E-12	mg/m3	4.3E-03	1/(µg/m3)	2.2E-11	3.2E-11	mg/m3	1.5E-05	mg/m3	2.2E-06
				Cadmium	18.6	mg/kg	2.5E-11	mg/m3	1.8E-03	1/(µg/m3)	4.5E-11	1.6E-10	mg/m3	1.0E-05	mg/m3	1.6E-05
				Cobalt	12.0	mg/kg	1.6E-11	mg/m3	9.0E-03	1/(µg/m3)	1.4E-10	1.0E-10	mg/m3	6.0E-06	mg/m3	1.7E-05
				Lead	158	mg/kg	2.1E-10	mg/m3	NA	--	--	1.3E-09	mg/m3	NA	--	--
				Vanadium	201	mg/kg	2.7E-10	mg/m3	NA	--	--	1.7E-09	mg/m3	1.0E-04	mg/m3	1.7E-05
			Inhalation Total								2.3E-10					5.2E-05
		Exposure Point Total									2.3E-10					5.2E-05
	Exposure Medium Total										2.3E-10					5.2E-05
Soil (2008) Total											5.4E-07					**3.2E+00**
										Total of Receptor Risks Across All Media	5.4E-07	Total of Receptor Hazards Across All Media				**3.2E+00**

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	2.1E-08	mg/kg-day	NA	--	--	5.8E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	8.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	6.5E-08	2.5E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	4.1E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.0E-07	1.1E-07	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	2.8E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-07	7.8E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	4.9E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.6E-09	1.4E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.1E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	7.7E-10	3.0E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.4E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.0E-07	3.9E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	9.1E-09	mg/kg-day	NA	--	--	2.5E-08	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.5E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-07	4.3E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	1.3E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.0E-06	3.7E-06	mg/kg-day	3.0E-04	mg/kg-day	1.2E-02
				Cadmium	18.6	mg/kg	6.5E-06	mg/kg-day	NA	--	--	1.8E-05	mg/kg-day	1.0E-03	mg/kg-day	1.8E-02
				Cobalt	12.0	mg/kg	4.2E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	3.9E-02
				Lead	158	mg/kg	5.5E-05	mg/kg-day	NA	--	--	1.5E-04	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	7.0E-05	mg/kg-day	NA	--	--	2.0E-04	mg/kg-day	7.0E-05	mg/kg-day	**2.8E+00**
			Ingestion Total								2.8E-06					**2.9E+00**
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.4E-08	mg/kg-day	NA	--	--	3.8E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	7.6E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.6E-08	2.1E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	3.5E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.5E-07	9.7E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	2.4E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.7E-07	6.7E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	4.2E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.1E-09	1.2E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	9.1E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	6.6E-10	2.5E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.2E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	8.8E-08	3.4E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	6.0E-08	mg/kg-day	NA	--	--	1.7E-07	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.7E-08	3.7E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	2.6E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.9E-07	7.3E-07	mg/kg-day	3.0E-04	mg/kg-day	2.4E-03
				Cadmium	18.6	mg/kg	4.3E-08	mg/kg-day	NA	--	--	1.2E-07	mg/kg-day	3.0E-05	mg/kg-day	4.0E-03
				Cobalt	12.0	mg/kg	2.8E-07	mg/kg-day	NA	--	--	7.7E-07	mg/kg-day	3.0E-04	mg/kg-day	2.6E-03
				Lead	158	mg/kg	3.6E-06	mg/kg-day	NA	--	--	1.0E-05	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	4.6E-06	mg/kg-day	NA	--	--	1.3E-05	mg/kg-day	1.8E-06	mg/kg-day	**7.1E+00**
			Dermal Total								1.1E-06					**7.1E+00**
		Exposure Point Total									3.8E-06					**1.0E+01**
	Exposure Medium Total										3.8E-06					**1.0E+01**

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	3.5E-12	mg/m3	4.2E-03	1/(µg/m3)	1.5E-11	9.7E-12	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.2E-09	mg/m3	1.1E-04	1/(µg/m3)	1.3E-10	3.2E-09	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	2.8E-10	mg/m3	1.1E-03	1/(µg/m3)	3.0E-10	7.7E-10	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	3.1E-09	mg/m3	1.1E-04	1/(µg/m3)	3.4E-10	8.8E-09	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	2.6E-10	mg/m3	1.1E-04	1/(µg/m3)	2.9E-11	7.3E-10	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	9.1E-09	mg/m3	1.1E-05	1/(µg/m3)	1.0E-10	2.5E-08	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	4.0E-11	mg/m3	1.2E-03	1/(µg/m3)	4.8E-11	1.1E-10	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.4E-10	mg/m3	NA	--	--	3.9E-10	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	4.6E-10	mg/m3	1.1E-04	1/(µg/m3)	5.1E-11	1.3E-09	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	2.2E-10	mg/m3	4.3E-03	1/(µg/m3)	9.5E-10	6.2E-10	mg/m3	1.5E-05	mg/m3	4.1E-05
				Cadmium	18.6	mg/kg	1.1E-09	mg/m3	1.8E-03	1/(µg/m3)	2.0E-09	3.1E-09	mg/m3	1.0E-05	mg/m3	3.1E-04
				Cobalt	12.0	mg/kg	7.0E-10	mg/m3	9.0E-03	1/(µg/m3)	6.3E-09	2.0E-09	mg/m3	6.0E-06	mg/m3	3.3E-04
				Lead	158	mg/kg	9.3E-09	mg/m3	NA	--	--	2.6E-08	mg/m3	NA	--	--
				Vanadium	201	mg/kg	1.2E-08	mg/m3	NA	--	--	3.3E-08	mg/m3	1.0E-04	mg/m3	3.3E-04
			Inhalation Total								1.0E-08					1.0E-03
		Exposure Point Total									1.0E-08					1.0E-03
	Exposure Medium Total										1.0E-08					1.0E-03
Soil (2008) Total											3.8E-06					**1.0E+01**
										Total of Receptor Risks Across All Media	3.8E-06	Total of Receptor Hazards Across All Media				**1.0E+01**

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	2.8E-08	mg/kg-day	NA	--	--	8.1E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	4.1E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.0E-06	3.5E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	1.9E-06	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.4E-05	1.6E-07	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	1.3E-05	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.4E-06	1.1E-06	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	2.3E-06	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.6E-07	1.9E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	4.9E-06	mg/kg-day	7.3E-03	1/(mg/kg-day)	3.6E-08	4.2E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	6.5E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.7E-06	5.5E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.2E-08	mg/kg-day	NA	--	--	3.6E-08	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	7.1E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.2E-06	6.0E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	1.8E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.7E-06	5.2E-06	mg/kg-day	3.0E-04	mg/kg-day	1.7E-02
				Cadmium	18.6	mg/kg	8.7E-06	mg/kg-day	NA	--	--	2.5E-05	mg/kg-day	1.0E-03	mg/kg-day	2.5E-02
				Cobalt	12.0	mg/kg	5.6E-06	mg/kg-day	NA	--	--	1.6E-05	mg/kg-day	3.0E-04	mg/kg-day	5.5E-02
				Lead	158	mg/kg	7.4E-05	mg/kg-day	NA	--	--	2.2E-04	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	9.4E-05	mg/kg-day	NA	--	--	2.8E-04	mg/kg-day	7.0E-05	mg/kg-day	**3.9E+00**
			Ingestion Total								3.9E-05					**4.0E+00**
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.1E-08	mg/kg-day	NA	--	--	3.2E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.6E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-06	1.8E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	7.1E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.2E-06	8.2E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	4.9E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.6E-06	5.7E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	8.6E-07	mg/kg-day	7.3E-02	1/(mg/kg-day)	6.3E-08	9.9E-08	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.9E-06	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.4E-08	2.2E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	2.5E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.8E-06	2.8E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	4.9E-08	mg/kg-day	NA	--	--	1.4E-07	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	2.7E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-06	3.1E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	2.1E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.2E-07	6.2E-07	mg/kg-day	3.0E-04	mg/kg-day	2.1E-03
				Cadmium	18.6	mg/kg	3.5E-08	mg/kg-day	NA	--	--	1.0E-07	mg/kg-day	3.0E-05	mg/kg-day	3.4E-03
				Cobalt	12.0	mg/kg	2.2E-07	mg/kg-day	NA	--	--	6.6E-07	mg/kg-day	3.0E-04	mg/kg-day	2.2E-03
				Lead	158	mg/kg	3.0E-06	mg/kg-day	NA	--	--	8.6E-06	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	3.8E-06	mg/kg-day	NA	--	--	1.1E-05	mg/kg-day	1.8E-06	mg/kg-day	**6.0E+00**
			Dermal Total								1.4E-05					**6.0E+00**
		Exposure Point Total									5.3E-05					**1.0E+01**
	Exposure Medium Total										5.3E-05					**1.0E+01**

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.4E-11	mg/m3	4.2E-03	1/(µg/m3)	5.9E-11	4.1E-11	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	3.4E-08	mg/m3	1.1E-04	1/(µg/m3)	3.7E-09	1.4E-08	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	8.0E-09	mg/m3	1.1E-03	1/(µg/m3)	8.9E-09	3.2E-09	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	9.1E-08	mg/m3	1.1E-04	1/(µg/m3)	1.0E-08	3.7E-08	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	7.6E-09	mg/m3	1.1E-04	1/(µg/m3)	8.4E-10	3.1E-09	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	2.7E-07	mg/m3	1.1E-05	1/(µg/m3)	2.9E-09	1.1E-07	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.2E-09	mg/m3	1.2E-03	1/(µg/m3)	1.4E-09	4.7E-10	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	5.6E-10	mg/m3	NA	--	--	1.6E-09	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.4E-08	mg/m3	1.1E-04	1/(µg/m3)	1.5E-09	5.5E-09	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	8.9E-10	mg/m3	4.3E-03	1/(µg/m3)	3.8E-09	2.6E-09	mg/m3	1.5E-05	mg/m3	1.7E-04
				Cadmium	18.6	mg/kg	4.4E-09	mg/m3	1.8E-03	1/(µg/m3)	7.9E-09	1.3E-08	mg/m3	1.0E-05	mg/m3	1.3E-03
				Cobalt	12.0	mg/kg	2.8E-09	mg/m3	9.0E-03	1/(µg/m3)	2.6E-08	8.3E-09	mg/m3	6.0E-06	mg/m3	1.4E-03
				Lead	158	mg/kg	3.7E-08	mg/m3	NA	--	--	1.1E-07	mg/m3	NA	--	--
				Vanadium	201	mg/kg	4.8E-08	mg/m3	NA	--	--	1.4E-07	mg/m3	1.0E-04	mg/m3	1.4E-03
			Inhalation Total								6.7E-08					4.2E-03
		Exposure Point Total									6.7E-08					4.2E-03
	Exposure Medium Total										6.7E-08					4.2E-03
Soil (2008) Total											5.3E-05					**1.0E+01**
Groundwater (2008)	Groundwater (2008)	Tap	Ingestion													
				Arsenic	0.00056	mg/L	5.3E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	7.9E-06	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	5.1E-02
				Cobalt	0.0110	mg/L	1.0E-04	mg/kg-day	NA	--	--	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	**1.0E+00**
				Vanadium	0.00690	mg/L	6.5E-05	mg/kg-day	NA	--	--	1.9E-04	mg/kg-day	7.0E-05	mg/kg-day	**2.7E+00**
			Ingestion Total								7.9E-06					**3.8E+00**
			Dermal													
				Arsenic	0.00056	mg/L	2.7E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.1E-08	8.0E-08	mg/kg-day	3.0E-04	mg/kg-day	2.7E-04
				Cobalt	0.0110	mg/L	2.2E-07	mg/kg-day	NA	--	--	6.3E-07	mg/kg-day	3.0E-04	mg/kg-day	2.1E-03
				Vanadium	0.00690	mg/L	3.4E-07	mg/kg-day	NA	--	--	9.9E-07	mg/kg-day	1.8E-06	mg/kg-day	5.4E-01
			Dermal Total								4.1E-08					5.4E-01
		Exposure Point Total									7.9E-06					**4.3E+00**
	Exposure Medium Total										7.9E-06					**4.3E+00**
Groundwater (2008) Total											7.9E-06					**4.3E+00**
										Total of Receptor Risks Across All Media	6.1E-05	Total of Receptor Hazards Across All Media				**1.4E+01**

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	6.5E-08	mg/kg-day	NA	--	--	7.5E-07	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	3.6E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.6E-06	3.2E-06	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	1.7E-06	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.2E-05	1.5E-06	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	1.1E-05	mg/kg-day	7.3E-01	1/(mg/kg-day)	8.3E-06	1.0E-05	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	2.0E-06	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.5E-07	1.8E-06	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	4.3E-06	mg/kg-day	7.3E-03	1/(mg/kg-day)	3.2E-08	3.9E-06	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	5.7E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.2E-06	5.1E-07	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	2.8E-08	mg/kg-day	NA	--	--	3.3E-07	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	6.3E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.6E-06	5.6E-06	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	4.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	6.2E-06	4.8E-05	mg/kg-day	3.0E-04	mg/kg-day	1.6E-01
				Cadmium	18.6	mg/kg	2.0E-05	mg/kg-day	NA	--	--	2.4E-04	mg/kg-day	1.0E-03	mg/kg-day	2.4E-01
				Cobalt	12.0	mg/kg	1.3E-05	mg/kg-day	NA	--	--	1.5E-04	mg/kg-day	3.0E-04	mg/kg-day	5.1E-01
				Lead	158	mg/kg	1.7E-04	mg/kg-day	NA	--	--	2.0E-03	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	2.2E-04	mg/kg-day	NA	--	--	2.6E-03	mg/kg-day	7.0E-05	mg/kg-day	**3.7E+01**
			Ingestion Total								3.8E-05					**3.8E+01**
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.8E-08	mg/kg-day	NA	--	--	2.1E-07	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.3E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.6E-07	1.2E-06	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	6.0E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.4E-06	5.4E-07	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	4.1E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.0E-06	3.7E-06	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	7.3E-07	mg/kg-day	7.3E-02	1/(mg/kg-day)	5.3E-08	6.5E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.6E-06	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.1E-08	1.4E-06	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	2.1E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.5E-06	1.9E-07	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	8.0E-08	mg/kg-day	NA	--	--	9.3E-07	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	2.3E-06	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.7E-06	2.1E-06	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	3.5E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	5.2E-07	4.1E-06	mg/kg-day	3.0E-04	mg/kg-day	1.4E-02
				Cadmium	18.6	mg/kg	5.7E-08	mg/kg-day	NA	--	--	6.7E-07	mg/kg-day	3.0E-05	mg/kg-day	2.2E-02
				Cobalt	12.0	mg/kg	3.7E-07	mg/kg-day	NA	--	--	4.3E-06	mg/kg-day	3.0E-04	mg/kg-day	1.4E-02
				Lead	158	mg/kg	4.8E-06	mg/kg-day	NA	--	--	5.7E-05	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	6.2E-06	mg/kg-day	NA	--	--	7.2E-05	mg/kg-day	1.8E-06	mg/kg-day	**4.0E+01**
			Dermal Total								1.2E-05					**4.0E+01**
		Exposure Point Total									5.0E-05					**7.7E+01**
	Exposure Medium Total										5.0E-05					**7.7E+01**

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	3.5E-12	mg/m3	4.2E-03	1/(µg/m3)	1.5E-11	4.1E-11	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.5E-08	mg/m3	1.1E-04	1/(µg/m3)	1.7E-09	1.4E-08	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	3.6E-09	mg/m3	1.1E-03	1/(µg/m3)	4.0E-09	3.2E-09	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	4.1E-08	mg/m3	1.1E-04	1/(µg/m3)	4.5E-09	3.7E-08	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	3.4E-09	mg/m3	1.1E-04	1/(µg/m3)	3.8E-10	3.1E-09	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	1.2E-07	mg/m3	1.1E-05	1/(µg/m3)	1.3E-09	1.1E-07	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	5.3E-10	mg/m3	1.2E-03	1/(µg/m3)	6.3E-10	4.7E-10	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.4E-10	mg/m3	NA	--	--	1.6E-09	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	6.1E-09	mg/m3	1.1E-04	1/(µg/m3)	6.7E-10	5.5E-09	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	2.2E-10	mg/m3	4.3E-03	1/(µg/m3)	9.6E-10	2.6E-09	mg/m3	1.5E-05	mg/m3	1.7E-04
				Cadmium	18.6	mg/kg	1.1E-09	mg/m3	1.8E-03	1/(µg/m3)	2.0E-09	1.3E-08	mg/m3	1.0E-05	mg/m3	1.3E-03
				Cobalt	12.0	mg/kg	7.1E-10	mg/m3	9.0E-03	1/(µg/m3)	6.4E-09	8.3E-09	mg/m3	6.0E-06	mg/m3	1.4E-03
				Lead	158	mg/kg	9.3E-09	mg/m3	NA	--	--	1.1E-07	mg/m3	NA	--	--
				Vanadium	201	mg/kg	1.2E-08	mg/m3	NA	--	--	1.4E-07	mg/m3	1.0E-04	mg/m3	1.4E-03
			Inhalation Total								2.2E-08					4.2E-03
		Exposure Point Total									2.2E-08					4.2E-03
	Exposure Medium Total										2.2E-08					4.2E-03
Soil (2008) Total											5.0E-05					**7.7E+01**
Groundwater (2008)	Groundwater (2008)	Tap	Ingestion													
				Arsenic	0.00056	mg/L	3.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.6E-06	3.6E-05	mg/kg-day	3.0E-04	mg/kg-day	1.2E-01
				Cobalt	0.0110	mg/L	6.0E-05	mg/kg-day	NA	--	--	7.0E-04	mg/kg-day	3.0E-04	mg/kg-day	**2.3E+00**
				Vanadium	0.00690	mg/L	3.8E-05	mg/kg-day	NA	--	--	4.4E-04	mg/kg-day	7.0E-05	mg/kg-day	**6.3E+00**
			Ingestion Total								4.6E-06					**8.8E+00**
			Dermal													
				Arsenic	0.00056	mg/L	2.0E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.0E-08	2.4E-07	mg/kg-day	3.0E-04	mg/kg-day	7.9E-04
				Cobalt	0.0110	mg/L	1.6E-07	mg/kg-day	NA	--	--	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.2E-03
				Vanadium	0.00690	mg/L	2.5E-07	mg/kg-day	NA	--	--	2.9E-06	mg/kg-day	1.8E-06	mg/kg-day	**1.6E+00**
			Dermal Total								3.0E-08					**1.6E+00**
		Exposure Point Total									4.6E-06					**1.0E+01**
	Exposure Medium Total										4.6E-06					**1.0E+01**
Groundwater (2008) Total											4.6E-06					**1.0E+01**
										Total of Receptor Risks Across All Media	5.5E-05	Total of Receptor Hazards Across All Media				**8.8E+01**

TABLE 7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	2.1E-08	mg/kg-day	NA	--	--	5.8E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	8.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	6.5E-08	2.5E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	4.1E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.0E-07	1.1E-07	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	2.8E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-07	7.8E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	4.9E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.6E-09	1.4E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.1E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	7.7E-10	3.0E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.4E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.0E-07	3.9E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	9.1E-09	mg/kg-day	NA	--	--	2.5E-08	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.5E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-07	4.3E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	1.3E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.0E-06	3.7E-06	mg/kg-day	3.0E-04	mg/kg-day	1.2E-02
				Cadmium	18.6	mg/kg	6.5E-06	mg/kg-day	NA	--	--	1.8E-05	mg/kg-day	1.0E-03	mg/kg-day	1.8E-02
				Cobalt	12.0	mg/kg	4.2E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	3.9E-02
				Lead	158	mg/kg	5.5E-05	mg/kg-day	NA	--	--	1.5E-04	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	7.0E-05	mg/kg-day	NA	--	--	2.0E-04	mg/kg-day	7.0E-05	mg/kg-day	**2.8E+00**
			Ingestion Total								2.8E-06					**2.9E+00**
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	1.4E-08	mg/kg-day	NA	--	--	3.8E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	7.6E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.6E-08	2.1E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	3.5E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.5E-07	9.7E-08	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	2.4E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.7E-07	6.7E-07	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	4.2E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.1E-09	1.2E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	9.1E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	6.6E-10	2.5E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.2E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	8.8E-08	3.4E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	6.0E-08	mg/kg-day	NA	--	--	1.7E-07	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	1.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.7E-08	3.7E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	2.6E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.9E-07	7.3E-07	mg/kg-day	3.0E-04	mg/kg-day	2.4E-03
				Cadmium	18.6	mg/kg	4.3E-08	mg/kg-day	NA	--	--	1.2E-07	mg/kg-day	3.0E-05	mg/kg-day	4.0E-03
				Cobalt	12.0	mg/kg	2.8E-07	mg/kg-day	NA	--	--	7.7E-07	mg/kg-day	3.0E-04	mg/kg-day	2.6E-03
				Lead	158	mg/kg	3.6E-06	mg/kg-day	NA	--	--	1.0E-05	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	4.6E-06	mg/kg-day	NA	--	--	1.3E-05	mg/kg-day	1.8E-06	mg/kg-day	**7.1E+00**
			Dermal Total								1.1E-06					**7.1E+00**
		Exposure Point Total									3.8E-06					**1.0E+01**
	Exposure Medium Total										3.8E-06					**1.0E+01**

TABLE 7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	3.5E-12	mg/m3	4.2E-03	1/(µg/m3)	1.5E-11	9.7E-12	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.2E-09	mg/m3	1.1E-04	1/(µg/m3)	1.3E-10	3.2E-09	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	2.8E-10	mg/m3	1.1E-03	1/(µg/m3)	3.0E-10	7.7E-10	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	3.1E-09	mg/m3	1.1E-04	1/(µg/m3)	3.4E-10	8.8E-09	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	2.6E-10	mg/m3	1.1E-04	1/(µg/m3)	2.9E-11	7.3E-10	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	9.1E-09	mg/m3	1.1E-05	1/(µg/m3)	1.0E-10	2.5E-08	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	4.0E-11	mg/m3	1.2E-03	1/(µg/m3)	4.8E-11	1.1E-10	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.4E-10	mg/m3	NA	--	--	3.9E-10	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	4.6E-10	mg/m3	1.1E-04	1/(µg/m3)	5.1E-11	1.3E-09	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	2.2E-10	mg/m3	4.3E-03	1/(µg/m3)	9.5E-10	6.2E-10	mg/m3	1.5E-05	mg/m3	4.1E-05
				Cadmium	18.6	mg/kg	1.1E-09	mg/m3	1.8E-03	1/(µg/m3)	2.0E-09	3.1E-09	mg/m3	1.0E-05	mg/m3	3.1E-04
				Cobalt	12.0	mg/kg	7.0E-10	mg/m3	9.0E-03	1/(µg/m3)	6.3E-09	2.0E-09	mg/m3	6.0E-06	mg/m3	3.3E-04
				Lead	158	mg/kg	9.3E-09	mg/m3	NA	--	--	2.6E-08	mg/m3	NA	--	--
				Vanadium	201	mg/kg	1.2E-08	mg/m3	NA	--	--	3.3E-08	mg/m3	1.0E-04	mg/m3	3.3E-04
			Inhalation Total								1.0E-08					1.0E-03
		Exposure Point Total									1.0E-08					1.0E-03
	Exposure Medium Total										1.0E-08					1.0E-03
Soil (2008) Total											3.8E-06					**1.0E+01**
										Total of Receptor Risks Across All Media	3.8E-06	Total of Receptor Hazards Across All Media				**1.0E+01**

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008)	Soil (2008)	Soil (2008)	Ingestion													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	2.7E-09	mg/kg-day	NA	--	--	1.9E-07	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	1.2E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	8.6E-09	8.2E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	5.4E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.9E-08	3.7E-07	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	3.7E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.7E-08	2.6E-06	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	6.5E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	4.7E-10	4.5E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	1.4E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.0E-10	9.8E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	1.8E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.4E-08	1.3E-07	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	1.2E-09	mg/kg-day	NA	--	--	8.4E-08	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	2.0E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.5E-08	1.4E-06	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	1.7E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.6E-07	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	4.1E-02
				Cadmium	18.6	mg/kg	8.6E-07	mg/kg-day	NA	--	--	6.0E-05	mg/kg-day	1.0E-03	mg/kg-day	6.0E-02
				Cobalt	12.0	mg/kg	5.5E-07	mg/kg-day	NA	--	--	3.9E-05	mg/kg-day	3.0E-04	mg/kg-day	1.3E-01
				Lead	158	mg/kg	7.3E-06	mg/kg-day	NA	--	--	5.1E-04	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	9.3E-06	mg/kg-day	NA	--	--	6.5E-04	mg/kg-day	7.0E-05	mg/kg-day	**9.3E+00**
			Ingestion Total								3.6E-07					**9.5E+00**
			Dermal													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	8.2E-10	mg/kg-day	NA	--	--	5.7E-08	mg/kg-day	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	4.6E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.3E-09	3.2E-07	mg/kg-day	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	2.1E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.5E-08	1.5E-07	mg/kg-day	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	1.4E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.0E-08	1.0E-06	mg/kg-day	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	2.5E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.8E-10	1.8E-07	mg/kg-day	NA	--	--
				Chrysene	0.303	mg/kg	5.5E-09	mg/kg-day	7.3E-03	1/(mg/kg-day)	4.0E-11	3.8E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	7.2E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.3E-09	5.0E-08	mg/kg-day	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	3.6E-09	mg/kg-day	NA	--	--	2.5E-07	mg/kg-day	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	7.9E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.8E-09	5.6E-07	mg/kg-day	NA	--	--
				Arsenic	3.78	mg/kg	1.6E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.4E-08	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	3.7E-03
				Cadmium	18.6	mg/kg	2.6E-09	mg/kg-day	NA	--	--	1.8E-07	mg/kg-day	3.0E-05	mg/kg-day	6.0E-03
				Cobalt	12.0	mg/kg	1.7E-08	mg/kg-day	NA	--	--	1.2E-06	mg/kg-day	3.0E-04	mg/kg-day	3.9E-03
				Lead	158	mg/kg	2.2E-07	mg/kg-day	NA	--	--	1.5E-05	mg/kg-day	NA	--	--
				Vanadium	201	mg/kg	2.8E-07	mg/kg-day	NA	--	--	1.9E-05	mg/kg-day	1.8E-06	mg/kg-day	**1.1E+01**
			Dermal Total								6.4E-08					**1.1E+01**
		Exposure Point Total									4.3E-07					**2.0E+01**
	Exposure Medium Total										4.3E-07					**2.0E+01**

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2008) (Cont)	Air	Fugative Dust	Inhalation													
				1,4-Dichloro-2-butene (trans)	0.0590	mg/kg	6.4E-11	mg/m3	4.2E-03	1/(µg/m3)	2.7E-10	4.5E-09	mg/m3	NA	--	--
				Benzo(a)anthracene	0.254	mg/kg	3.2E-10	mg/m3	1.1E-04	1/(µg/m3)	3.5E-11	2.3E-08	mg/m3	NA	--	--
				Benzo(a)pyrene (BaP)	0.116	mg/kg	1.4E-10	mg/m3	1.1E-03	1/(µg/m3)	1.5E-10	9.6E-09	mg/m3	NA	--	--
				Benzo(b)fluoranthene	0.799	mg/kg	9.9E-10	mg/m3	1.1E-04	1/(µg/m3)	1.1E-10	7.0E-08	mg/m3	NA	--	--
				Benzo(k)fluoranthene	0.140	mg/kg	1.6E-10	mg/m3	1.1E-04	1/(µg/m3)	1.8E-11	1.1E-08	mg/m3	NA	--	--
				Chrysene	0.303	mg/kg	6.9E-10	mg/m3	1.1E-05	1/(µg/m3)	7.6E-12	4.8E-08	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.0401	mg/kg	4.5E-11	mg/m3	1.2E-03	1/(µg/m3)	5.4E-11	3.2E-09	mg/m3	NA	--	--
				Di-n-octyl Phthalate	0.0260	mg/kg	3.4E-11	mg/m3	NA	--	--	2.4E-09	mg/m3	NA	--	--
				Indeno(1,2,3-cd)pyrene	0.441	mg/kg	5.0E-10	mg/m3	1.1E-04	1/(µg/m3)	5.5E-11	3.5E-08	mg/m3	NA	--	--
				Arsenic	3.78	mg/kg	4.1E-09	mg/m3	4.3E-03	1/(µg/m3)	1.8E-08	2.9E-07	mg/m3	1.5E-05	mg/m3	1.9E-02
				Cadmium	18.6	mg/kg	2.0E-08	mg/m3	1.8E-03	1/(µg/m3)	3.6E-08	1.4E-06	mg/m3	1.0E-05	mg/m3	1.4E-01
				Cobalt	12.0	mg/kg	1.3E-08	mg/m3	9.0E-03	1/(µg/m3)	1.2E-07	9.2E-07	mg/m3	6.0E-06	mg/m3	1.5E-01
				Lead	158	mg/kg	1.7E-07	mg/m3	NA	--	--	1.2E-05	mg/m3	NA	--	--
				Vanadium	201	mg/kg	2.2E-07	mg/m3	NA	--	--	1.5E-05	mg/m3	1.0E-04	mg/m3	1.5E-01
			Inhalation Total								1.7E-07					4.7E-01
		Exposure Point Total									1.7E-07					4.7E-01
	Exposure Medium Total										1.7E-07					4.7E-01
Soil (2008) Total											6.0E-07					**2.1E+01**
Groundwater (2008	Groundwater (2008)	Tap	Ingestion													
				Arsenic	0.00056	mg/L	3.1E-10	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.7E-10	2.2E-08	mg/kg-day	3.0E-04	mg/kg-day	7.3E-05
				Cobalt	0.0110	mg/L	6.2E-09	mg/kg-day	NA	--	--	4.3E-07	mg/kg-day	3.0E-04	mg/kg-day	1.4E-03
				Vanadium	0.00690	mg/L	3.9E-09	mg/kg-day	NA	--	--	2.7E-07	mg/kg-day	7.0E-05	mg/kg-day	3.9E-03
			Ingestion Total								4.7E-10					5.4E-03
			Dermal													
				Arsenic	0.00056	mg/L	1.0E-10	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.5E-10	7.2E-09	mg/kg-day	3.0E-04	mg/kg-day	2.4E-05
				Cobalt	0.0110	mg/L	8.1E-10	mg/kg-day	NA	--	--	5.7E-08	mg/kg-day	3.0E-04	mg/kg-day	1.9E-04
				Vanadium	0.00690	mg/L	1.3E-09	mg/kg-day	NA	--	--	8.9E-08	mg/kg-day	1.8E-06	mg/kg-day	4.9E-02
			Dermal Total								1.5E-10					4.9E-02
		Exposure Point Total									6.2E-10					5.5E-02
	Exposure Medium Total										6.2E-10					5.5E-02
Groundwater (2008) Total											6.2E-10					5.5E-02
										Total of Receptor Risks Across All Media	6.0E-07	Total of Receptor Hazards Across All Media				**2.1E+01**

TABLE 8.1.RME
CALCULATION OF RADIATION CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
			Total													
NOT APPLICABLE																
			Total													
		Exposure Point Total														
	Exposure Medium Total															
			Total													
		Exposure Point Total														
	Exposure Medium Total															
Total																
Total of Receptor Risks Across All Media												Total of Receptor Hazards Across All Media				

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	1.3E-08	--	6.7E-09	--	2.0E-08	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	5.9E-08	--	3.1E-08	--	9.0E-08	NA	--	--	--	--
			Benzo(b)fluoranthene	4.1E-08	--	2.1E-08	--	6.2E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	7.1E-10	--	3.7E-10	--	1.1E-09	NA	--	--	--	--
			Chrysene	1.5E-10	--	8.0E-11	--	2.3E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	2.0E-08	--	1.1E-08	--	3.1E-08	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	2.2E-08	--	1.2E-08	--	3.4E-08	NA	--	--	--	--
			Arsenic	4.0E-07	--	4.7E-08	--	4.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.58	--	0.90	**1.48**
			Chemical Total	5.5E-07	--	1.3E-07	--	6.8E-07		0.60	--	0.90	**1.50**
		Exposure Point Total						6.8E-07					**1.50**
	Exposure Medium Total							6.8E-07					**1.50**

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	7.3E-13	--	--	7.3E-13	NA	--	--	--	--
			Benzo(a)anthracene	--	6.4E-12	--	--	6.4E-12	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(b)fluoranthene	--	1.7E-11	--	--	1.7E-11	NA	--	--	--	--
			Benzo(k)fluoranthene	--	1.4E-12	--	--	1.4E-12	NA	--	--	--	--
			Chrysene	--	5.0E-12	--	--	5.0E-12	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	2.4E-12	--	--	2.4E-12	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	2.6E-12	--	--	2.6E-12	NA	--	--	--	--
			Arsenic	--	4.8E-11	--	--	4.8E-11	NA	--	<0.01	--	<0.01
			Cadmium	--	9.8E-11	--	--	9.8E-11	Kidney	--	<0.01	--	<0.01
			Cobalt	--	3.2E-10	--	--	3.2E-10	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	5.1E-10	--	--	5.1E-10		--	<0.01	--	<0.01
		Exposure Point Total						5.1E-10					<0.01
	Exposure Medium Total							5.1E-10					<0.01
Soil (2008) Total								**6.81E-07**					**1.50**
Adult Trespassers Total								**6.81E-07**					**1.50**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	6.8E-07	Total Hazard Index Across Soil (2008)	**1.5**
Total Risk Across All Media and All Exposure Routes	6.8E-07	azard Index Across All Media and All Exposure Routes	**1.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**1.5**	**1.5**
Cardiovascular System HI =		0.01	0.01
Skin HI =		<0.01	<0.01
Kidney HI =	<0.01	**1.5**	**1.5**
Respiratory System HI =	<0.01		<0.01

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	9.2E-09	--	7.7E-09	--	1.7E-08	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	4.2E-08	--	3.5E-08	--	7.7E-08	NA	--	--	--	--
			Benzo(b)fluoranthene	2.9E-08	--	2.4E-08	--	5.3E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	5.1E-10	--	4.2E-10	--	9.3E-10	NA	--	--	--	--
			Chrysene	1.1E-10	--	9.2E-11	--	2.0E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.5E-08	--	1.2E-08	--	2.7E-08	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.6E-08	--	1.3E-08	--	2.9E-08	NA	--	--	--	--
			Arsenic	2.8E-07	--	5.4E-08	--	3.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.91	--	2.24	**3.15**
			Chemical Total	3.9E-07	--	1.5E-07	--	5.4E-07		0.93	--	2.24	**3.17**
		Exposure Point Total						5.4E-07					**3.17**
	Exposure Medium Total							5.4E-07					**3.17**

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	3.3E-13	--	--	3.3E-13	NA	--	--	--	--
			Benzo(a)anthracene	--	2.9E-12	--	--	2.9E-12	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	6.9E-12	--	--	6.9E-12	NA	--	--	--	--
			Benzo(b)fluoranthene	--	7.9E-12	--	--	7.9E-12	NA	--	--	--	--
			Benzo(k)fluoranthene	--	6.6E-13	--	--	6.6E-13	NA	--	--	--	--
			Chrysene	--	2.3E-12	--	--	2.3E-12	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	1.1E-12	--	--	1.1E-12	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	1.2E-12	--	--	1.2E-12	NA	--	--	--	--
			Arsenic	--	2.2E-11	--	--	2.2E-11	NA	--	<0.01	--	<0.01
			Cadmium	--	4.5E-11	--	--	4.5E-11	Kidney	--	<0.01	--	<0.01
			Cobalt	--	1.4E-10	--	--	1.4E-10	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	2.3E-10	--	--	2.3E-10		--	<0.01	--	<0.01
		Exposure Point Total						2.3E-10					<0.01
	Exposure Medium Total							2.3E-10					<0.01
Soil (2008) Total								**5.41E-07**					**3.17**
Youth Trespassers Total								**5.41E-07**					**3.17**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	5.4E-07	Total Hazard Index Across Soil (2008)	**3.2**
Total Risk Across All Media and All Exposure Routes	5.4E-07	azard Index Across All Media and All Exposure Routes	**3.2**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**3.1**	**3.1**
Cardiovascular System HI =		0.02	0.02
Skin HI =		<0.01	<0.01
Kidney HI =	<0.01	**3.2**	**3.2**
Respiratory System HI =	<0.01		<0.01

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	6.5E-08	--	5.6E-08	--	1.2E-07	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	3.0E-07	--	2.5E-07	--	5.5E-07	NA	--	--	--	--
			Benzo(b)fluoranthene	2.0E-07	--	1.7E-07	--	3.8E-07	NA	--	--	--	--
			Benzo(k)fluoranthene	3.6E-09	--	3.1E-09	--	6.6E-09	NA	--	--	--	--
			Chrysene	7.7E-10	--	6.6E-10	--	1.4E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.0E-07	--	8.8E-08	--	1.9E-07	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.1E-07	--	9.7E-08	--	2.1E-07	NA	--	--	--	--
			Arsenic	2.0E-06	--	3.9E-07	--	2.4E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cadmium	--	--	--	--	--	Kidney	0.02	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.81	--	7.13	**9.94**
			Chemical Total	2.8E-06	--	1.1E-06	--	3.8E-06		2.88	--	7.14	**10.02**
		Exposure Point Total						3.8E-06					**10.02**
	Exposure Medium Total							3.8E-06					**10.02**

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	1.3E-10	--	--	1.3E-10	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	3.0E-10	--	--	3.0E-10	NA	--	--	--	--
			Benzo(b)fluoranthene	--	3.4E-10	--	--	3.4E-10	NA	--	--	--	--
			Benzo(k)fluoranthene	--	2.9E-11	--	--	2.9E-11	NA	--	--	--	--
			Chrysene	--	1.0E-10	--	--	1.0E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	4.8E-11	--	--	4.8E-11	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	5.1E-11	--	--	5.1E-11	NA	--	--	--	--
			Arsenic	--	9.5E-10	--	--	9.5E-10	NA	--	<0.01	--	<0.01
			Cadmium	--	2.0E-09	--	--	2.0E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	6.3E-09	--	--	6.3E-09	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.0E-08	--	--	1.0E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.0E-08					<0.01
	Exposure Medium Total							1.0E-08					<0.01
Soil (2008) Total								**3.84E-06**					**10.02**
On-Site Workers Total								**3.84E-06**					**10.02**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	3.8E-06	Total Hazard Index Across Soil (2008)	**10.0**
Total Risk Across All Media and All Exposure Routes	3.8E-06	azard Index Across All Media and All Exposure Routes	**10.0**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**9.9**	**9.9**
Cardiovascular System HI =		0.06	0.06
Skin HI =		0.01	0.01
Kidney HI =	<0.01	**10.0**	**10.0**
Respiratory System HI =	<0.01		<0.01

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	3.0E-06	--	1.1E-06	--	4.1E-06	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	1.4E-05	--	5.2E-06	--	1.9E-05	NA	--	--	--	--
			Benzo(b)fluoranthene	9.4E-06	--	3.6E-06	--	1.3E-05	NA	--	--	--	--
			Benzo(k)fluoranthene	1.6E-07	--	6.3E-08	--	2.3E-07	NA	--	--	--	--
			Chrysene	3.6E-08	--	1.4E-08	--	4.9E-08	NA	--	--	--	--
			Dibenz(a,h)anthracene	4.7E-06	--	1.8E-06	--	6.5E-06	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	5.2E-06	--	2.0E-06	--	7.2E-06	NA	--	--	--	--
			Arsenic	2.7E-06	--	3.2E-07	--	3.0E-06	Skin / CVS	0.02	--	<0.01	0.02
			Cadmium	--	--	--	--	--	Kidney	0.03	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.05	--	<0.01	0.06
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.93	--	6.04	**9.97**
			Chemical Total	3.9E-05	--	1.4E-05	--	5.3E-05		4.03	--	6.04	**10.07**
		Exposure Point Total						5.3E-05					**10.07**
	Exposure Medium Total							5.3E-05					**10.07**

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	5.9E-11	--	--	5.9E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	3.7E-09	--	--	3.7E-09	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	8.9E-09	--	--	8.9E-09	NA	--	--	--	--
			Benzo(b)fluoranthene	--	1.0E-08	--	--	1.0E-08	NA	--	--	--	--
			Benzo(k)fluoranthene	--	8.4E-10	--	--	8.4E-10	NA	--	--	--	--
			Chrysene	--	2.9E-09	--	--	2.9E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	1.4E-09	--	--	1.4E-09	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	1.5E-09	--	--	1.5E-09	NA	--	--	--	--
			Arsenic	--	3.8E-09	--	--	3.8E-09	NA	--	<0.01	--	<0.01
			Cadmium	--	7.9E-09	--	--	7.9E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	2.6E-08	--	--	2.6E-08	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	6.7E-08	--	--	6.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						6.7E-08					<0.01
	Exposure Medium Total							6.7E-08					<0.01
Soil (2008) Total								**5.30E-05**					**10.08**

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater (2008)	Groundwater (2008)	Tap	Arsenic	7.9E-06	--	4.1E-08	--	7.9E-06	Skin / CVS	0.05	--	<0.01	0.05
			Cobalt	--	--	--	--	--	CVS	1.00	--	<0.01	**1.01**
			Vanadium	--	--	--	--	--	GIS / Kidney	2.70	--	0.54	**3.24**
			Chemical Total	7.9E-06	--	4.1E-08	--	7.9E-06		3.76	--	0.54	**4.30**
		Exposure Point Total						7.9E-06					**4.30**
	Exposure Medium Total							7.9E-06					**4.30**
Groundwater (2008) Total								**7.93E-06**					**4.30**
Adult Residents Total								**6.10E-05**					**14.38**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	5.3E-05	Total Hazard Index Across Soil (2008)	**10.1**
Total Risk Across Groundwater (2008)	7.9E-06	Total Hazard Index Across Groundwater (2008)	**4.3**
Total Risk Across All Media and All Exposure Routes	6.1E-05	azard Index Across All Media and All Exposure Routes	**14.4**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**13.2**	**13.2**
Cardiovascular System HI =		**1.1**	**1.1**
Skin HI =		0.07	0.07
Kidney HI =	<0.01	**13.2**	**13.2**
Respiratory System HI =	<0.01		<0.01

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	2.6E-06	--	9.6E-07	--	3.6E-06	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	1.2E-05	--	4.4E-06	--	1.6E-05	NA	--	--	--	--
			Benzo(b)fluoranthene	8.3E-06	--	3.0E-06	--	1.1E-05	NA	--	--	--	--
			Benzo(k)fluoranthene	1.5E-07	--	5.3E-08	--	2.0E-07	NA	--	--	--	--
			Chrysene	3.2E-08	--	1.1E-08	--	4.3E-08	NA	--	--	--	--
			Dibenz(a,h)anthracene	4.2E-06	--	1.5E-06	--	5.7E-06	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	4.6E-06	--	1.7E-06	--	6.3E-06	NA	--	--	--	--
			Arsenic	6.2E-06	--	5.2E-07	--	6.7E-06	Skin / CVS	0.16	--	0.01	0.17
			Cadmium	--	--	--	--	--	Kidney	0.24	--	0.02	0.26
			Cobalt	--	--	--	--	--	CVS	0.51	--	0.01	0.53
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	36.71	--	39.54	**76.25**
			Chemical Total	3.8E-05	--	1.2E-05	--	5.0E-05		37.62	--	39.59	**77.21**
		Exposure Point Total						5.0E-05					**77.21**
	Exposure Medium Total							5.0E-05					**77.21**

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust											
			1,4-Dichloro-2-butene (trans)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	1.7E-09	--	--	1.7E-09	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	4.0E-09	--	--	4.0E-09	NA	--	--	--	--
			Benzo(b)fluoranthene	--	4.5E-09	--	--	4.5E-09	NA	--	--	--	--
			Benzo(k)fluoranthene	--	3.8E-10	--	--	3.8E-10	NA	--	--	--	--
			Chrysene	--	1.3E-09	--	--	1.3E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	6.3E-10	--	--	6.3E-10	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	6.7E-10	--	--	6.7E-10	NA	--	--	--	--
			Arsenic	--	9.6E-10	--	--	9.6E-10	NA	--	<0.01	--	<0.01
			Cadmium	--	2.0E-09	--	--	2.0E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	6.4E-09	--	--	6.4E-09	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	2.2E-08	--	--	2.2E-08		--	<0.01	--	<0.01
		Exposure Point Total						2.2E-08					<0.01
	Exposure Medium Total							2.2E-08					<0.01
Soil (2008) Total								**5.03E-05**					**77.21**

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater (2008)	Groundwater (2008)	Tap	Arsenic	4.6E-06	--	3.0E-08	--	4.6E-06	Skin / CVS	0.12	--	<0.01	0.12
			Cobalt	--	--	--	--	--	CVS	2.34	--	<0.01	**2.35**
			Vanadium	--	--	--	--	--	GIS / Kidney	6.30	--	1.60	**7.90**
			Chemical Total	4.6E-06	--	3.0E-08	--	4.6E-06		8.76	--	1.61	**10.37**
		Exposure Point Total						4.6E-06					**10.37**
	Exposure Medium Total							4.6E-06					**10.37**
Groundwater (2008) Total								**4.63E-06**					**10.37**
Young Child Residents Total								**5.50E-05**					**87.58**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	5.0E-05	Total Hazard Index Across Soil (2008)	**77.2**
Total Risk Across Groundwater (2008)	4.6E-06	Total Hazard Index Across Groundwater (2008)	**10.4**
Total Risk Across All Media and All Exposure Routes	5.5E-05	azard Index Across All Media and All Exposure Routes	**87.6**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**84.1**	**84.1**
Cardiovascular System HI =		**3.2**	**3.2**
Skin HI =		0.29	0.29
Kidney HI =	<0.01	**84.4**	**84.4**
Respiratory System HI =	<0.01		<0.01

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)											
			1,4-Dichloro-2-butene (trans)	--	--	--	--	--	NA	--	--	--	--
			Benzo(a)anthracene	6.5E-08	--	5.6E-08	--	1.2E-07	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	3.0E-07	--	2.5E-07	--	5.5E-07	NA	--	--	--	--
			Benzo(b)fluoranthene	2.0E-07	--	1.7E-07	--	3.8E-07	NA	--	--	--	--
			Benzo(k)fluoranthene	3.6E-09	--	3.1E-09	--	6.6E-09	NA	--	--	--	--
			Chrysene	7.7E-10	--	6.6E-10	--	1.4E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.0E-07	--	8.8E-08	--	1.9E-07	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	Kidney / Liver	--	--	--	--
			Indeno(1,2,3-cd)pyrene	1.1E-07	--	9.7E-08	--	2.1E-07	NA	--	--	--	--
			Arsenic	2.0E-06	--	3.9E-07	--	2.4E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cadmium	--	--	--	--	--	Kidney	0.02	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.81	--	7.13	**9.94**
			Chemical Total	2.8E-06	--	1.1E-06	--	3.8E-06		2.88	--	7.14	**10.02**
		Exposure Point Total						3.8E-06					**10.02**
	Exposure Medium Total							3.8E-06					**10.02**

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008) (Cont)	Air	Fugative Dust	1,4-Dichloro-2-butene (trans)	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo(a)anthracene	--	1.3E-10	--	--	1.3E-10	NA	--	--	--	--
			Benzo(a)pyrene (BaP)	--	3.0E-10	--	--	3.0E-10	NA	--	--	--	--
			Benzo(b)fluoranthene	--	3.4E-10	--	--	3.4E-10	NA	--	--	--	--
			Benzo(k)fluoranthene	--	2.9E-11	--	--	2.9E-11	NA	--	--	--	--
			Chrysene	--	1.0E-10	--	--	1.0E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	4.8E-11	--	--	4.8E-11	NA	--	--	--	--
			Di-n-octyl Phthalate	--	--	--	--	--	NA	--	--	--	--
			Indeno(1,2,3-cd)pyrene	--	5.1E-11	--	--	5.1E-11	NA	--	--	--	--
			Arsenic	--	9.5E-10	--	--	9.5E-10	NA	--	<0.01	--	<0.01
			Cadmium	--	2.0E-09	--	--	2.0E-09	Kidney	--	<0.01	--	<0.01
			Cobalt	--	6.3E-09	--	--	6.3E-09	RsS	--	<0.01	--	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.0E-08	--	--	1.0E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.0E-08					<0.01
	Exposure Medium Total							1.0E-08					<0.01
Soil (2008) Total								**3.84E-06**					**10.02**
Industrial / Commercial Workers Total								**3.84E-06**					**10.02**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Soil (2008)	3.8E-06	Total Hazard Index Across Soil (2008)	**10.0**
Total Risk Across All Media and All Exposure Routes	3.8E-06	azard Index Across All Media and All Exposure Routes	**10.0**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**9.9**	**9.9**
Cardiovascular System HI =		0.06	0.06
Skin HI =		0.01	0.01
Kidney HI =	<0.01	**10.0**	**10.0**
Respiratory System HI =	<0.01		<0.01

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	2.1E-07	--	1.9E-08	--	2.3E-07	Skin / CVS	0.03	--	<0.01	0.04
			Cobalt	--	--	--	--	--	CVS	0.13	--	<0.01	0.14
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.10	--	<0.01	0.11
			Vanadium	--	--	--	--	--	GIS / Kidney	0.14	--	<0.01	0.14
			Chemical Total	2.1E-07	--	1.9E-08	--	2.3E-07		0.41	--	0.01	0.42
		Exposure Point Total						2.3E-07					0.42
	Exposure Medium Total							2.3E-07					0.42
	Air	Fugative Dust											
			Arsenic	--	1.4E-08	--	--	1.4E-08	NA	--	0.02	--	0.02
			Cobalt	--	1.2E-07	--	--	1.2E-07	RsS	--	0.16	--	0.16
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	1.3E-07	--	--	1.3E-07		--	0.17	--	0.17
		Exposure Point Total						1.3E-07					0.17
	Exposure Medium Total							1.3E-07					0.17
Soil (2010) Total								**3.64E-07**					**0.59**

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Arsenic	4.7E-10	--	1.5E-10	--	6.2E-10	Skin / CVS	<0.01	--	<0.01	<0.01
			Barium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Chemical Total	4.7E-10	--	1.5E-10	--	6.2E-10		<0.01	--	<0.01	<0.01
		Exposure Point Total						6.2E-10					<0.01
	Exposure Medium Total							6.2E-10					<0.01
Groundwater Total								**6.25E-10**					**<0.01**
Construction Workers Total								**3.65E-07**					**0.60**

Total Risk Across Soil (2010)	3.6E-07	Total Hazard Index Across Soil (2010)	0.59
Total Risk Across Groundwater	6.2E-10	Total Hazard Index Across Groundwater	0.0
Total Risk Across All Media and All Exposure Routes	3.6E-07	Total Hazard Index Across All Media and All Exposure Routes	0.60

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.14	0.14
Cardiovascular System HI =		0.28	0.28
Skin HI =		0.14	0.14
Kidney HI =		0.14	0.14
Liver HI =		0.11	0.11
Respiratory System HI =	0.16		0.16

TABLE 10.1.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	0.58	--	0.90	**1.48**
			Chemical Total							0.58	--	0.90	**1.48**
		Exposure Point Total											**1.48**
	Exposure Medium Total												**1.48**
Soil (2008) Total													**1.48**
Adult Trespassers Total													**1.48**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**1.5**
Total Hazard Index Across All Media and All Exposure Routes	**1.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**1.5**	**1.5**
Kidney HI =		**1.5**	**1.5**

TABLE 10.2.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	0.91	--	2.24	**3.15**
			Chemical Total							0.91	--	2.24	**3.15**
		Exposure Point Total											**3.15**
	Exposure Medium Total												**3.15**
Soil (2008) Total													**3.15**
Youth Trespassers Total													**3.15**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**3.1**
Total Hazard Index Across All Media and All Exposure Routes	**3.1**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**3.1**	**3.1**
Kidney HI =		**3.1**	**3.1**

TABLE 10.3.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	2.81	--	7.13	**9.94**
			Chemical Total							2.81	--	7.13	**9.94**
		Exposure Point Total											**9.94**
	Exposure Medium Total												**9.94**
Soil (2008) Total													**9.94**
On-Site Workers Total													**9.94**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**9.9**
Total Hazard Index Across All Media and All Exposure Routes	**9.9**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**9.9**	**9.9**
Kidney HI =		**9.9**	**9.9**

TABLE 10.4.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	3.93	--	6.04	**9.97**
			Chemical Total							3.93	--	6.04	**9.97**
		Exposure Point Total											**9.97**
	Exposure Medium Total												**9.97**
Soil (2008) Total													**9.97**
roundwater (200	Groundwater	Tap	Cobalt						CVS	1.00	--	<0.01	**1.01**
			Vanadium						GIS / Kidney	2.70	--	0.54	**3.24**
			Chemical Total							3.71	--	0.54	**4.25**
		Exposure Point Total											**4.25**
	Exposure Medium Total												**4.25**
Groundwater (2008) Total													**4.25**
Adult Residents Total													**14.22**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**10.0**
Total Hazard Index Across Groundwater (2008)	**4.2**
Total Hazard Index Across All Media and All Exposure Routes	**14.2**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**13.2**	**13.2**
Cardiovascular System HI =		**1.0**	**1.0**
Kidney HI =		**13.2**	**13.2**

TABLE 10.5.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	36.71	--	39.54	**76.25**
			Chemical Total							36.71	--	39.54	**76.25**
		Exposure Point Total											**76.25**
	Exposure Medium Total												**76.25**
Soil (2008) Total													**76.25**
roundwater (200	Groundwater	Tap	Cobalt						CVS	2.34	--	<0.01	**2.35**
			Vanadium						GIS / Kidney	6.30	--	1.60	**7.90**
			Chemical Total							8.65	--	1.61	**10.25**
		Exposure Point Total											**10.25**
	Exposure Medium Total												**10.25**
Groundwater (2008) Total													**10.25**
Young Child Residents Total													**86.50**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**76.2**
Total Hazard Index Across Groundwater (2008)	**10.3**
Total Hazard Index Across All Media and All Exposure Routes	**86.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**84.1**	**84.1**
Cardiovascular System HI =		**2.4**	**2.4**
Kidney HI =		**84.1**	**84.1**

TABLE 10.6.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	2.81	--	7.13	**9.94**
			Chemical Total							2.81	--	7.13	**9.94**
		Exposure Point Total											**9.94**
	Exposure Medium Total												**9.94**
Soil (2008) Total													**9.94**
Industrial / Commercial Workers Total													**9.94**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**9.9**
Total Hazard Index Across All Media and All Exposure Routes	**9.9**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**9.9**	**9.9**
Kidney HI =		**9.9**	**9.9**

TABLE 10.7.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2008)	Soil (2008)	Soil (2008)	Vanadium						GIS / Kidney	9.27	--	10.70	**19.97**
			Chemical Total							9.27	--	10.70	**19.97**
		Exposure Point Total											**19.97**
	Exposure Medium Total												**19.97**
Soil (2008) Total													**19.97**
Construction Workers Total													**19.97**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil (2008)	**20.0**
Total Hazard Index Across All Media and All Exposure Routes	**20.0**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**20.0**	**20.0**
Kidney HI =		**20.0**	**20.0**

2010 DISTURBED SOIL SAMPLING INVESTIGATION HHRA

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil (2010)	Soil (2010)	Soil (2010)	On-Site Workers	Adult	Ingestion Dermal	Quantitative	Current landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adult and Youth	Ingestion Dermal	Quantitative	Current access of the site without permission
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
		Air	Fugitive Dusts	On-Site Workers	Adult	Inhalation	Quantitative	Current landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Inhalation	NA	Not a current receptor.
				Construction Workers	Adult	Inhalation	NA	Not a current receptor.
				Trespassers	Adult and Youth	Inhalation	Quantitative	Current access of the site without permission
				Residents	Adult and Young Child	Inhalation	NA	Not a current receptor.
	Groundwater	Groundwater	Groundwater	On-Site Workers	Adult	Ingestion Dermal	NA	Not currently exposed to this medium.
				Industrial / Commercial Workers	Adult	Ingestion	NA	Not a current receptor.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adult and Youth	Ingestion Dermal	NA	Not currently exposed to this medium.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
		Air	Volatile Emissions to Indoor Air	Industrial / Commercial Workers	Adult	Inhalation	NA	Not a current receptor.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (cont.)	Groundwater (2010)	Air	Volatile Emissions to Indoor Air	Residents	Adult	Inhalation	NA	Not a current receptor.
			Volatile Emissions to Trench Air	Construction Workers	Adult	Inhalation	NA	Not a current receptor.
	Sediment (2010)	Sediment (2010)	Sediment (2010)	On-Site Workers	Adult	Ingestion Dermal	Quantitative	Current landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adult and Youth	Ingestion Dermal	Quantitative	Current access of the site without permission
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
Future	Soil (2010)	Soil (2010)	Soil (2010)	On-Site Workers	Adult	Ingestion Dermal	Quantitative	Future potential landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	Quantitative	Future potential indoor workers walking around the site.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adult and Youth	Ingestion Dermal	Quantitative	Future potential access of the site without permission
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
		Air	Fugitive Dusts	On-Site Workers	Adult	Inhalation	Quantitative	Future potential landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Inhalation	Quantitative	Future potential indoor workers walking around the site.
				Construction Workers	Adult	Inhalation	Quantitative	Future potential excavation or construction activities for development.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Soil (2010)	Air	Fugitive Dusts	Trespassers	Adult and Youth	Inhalation	Quantitative	Future potential access of the site without permission
				Residents	Adult and Young Child	Inhalation	Quantitative	Future potential residential development.
	Groundwater	Groundwater	Groundwater	On-Site Workers	Adult	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				Industrial / Commercial Workers	Adult	Ingestion	Quantitative	Future potential indoor workers walking around the site.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adult and Youth	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
		Air	Volatile Emissions to Indoor Air	Industrial / Commercial Workers	Adult	Inhalation	Quantitative	Future potential vapor intrusion into building.
				Residents	Adult	Inhalation	Quantitative	Future potential vapor intrusion into building and exposure from shower vapors.
			Volatile Emissions to Trench Air	Construction Workers	Adult	Inhalation	Quantitative	Future potential excavation or construction activities for development.
	Sediment (2010)	Sediment (2010)	Sediment (2010)	On-Site Workers	Adult	Ingestion Dermal	Quantitative	Future potential landscaping, outdoor work-related activities for site.
				Industrial / Commercial Workers	Adult	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				Construction Workers	Adult	Ingestion Dermal	NA	Not expected to be exposed to this medium.
				Trespassers	Adult and Youth	Ingestion Dermal	Quantitative	Future potential access of the site without permission
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Soil (2010)
Exposure Medium: Surface Soil (2010)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil		**Inorganics (mg/kg)**													
	7440-38-2	Arsenic	0.65	6.2	mg/kg	69SB101	52/52	(6)	6.2	2.37	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	9 J	470 J	mg/kg	69SB126	52/52	(6)	470	233	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.056 J	0.29	mg/kg	69SB136	36/52	0.1U - 0.14U	0.29	0.717	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.044 J	5.3	mg/kg	69SB115	46/52	0.1U - 0.13U	5.3	0.655	7.00E+00	N/A	N/A	NO	BSL
	7440-47-3	Chromium	4.2	68	mg/kg	69SB123, 69SB145	52/52	(6)	68	87.6	1.20E+04 (7)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	0.61	64	mg/kg	69SB125	52/52	(6)	64	51.9	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	3	120	mg/kg	69SB128	52/52	(6)	120	225	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.25 J	71 J	mg/kg	69SB122	51/51	(6)	71	28.2	4.00E+02 (8)	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.0086 J	0.18	mg/kg	69SB125, 69SB130	36/46	0.02U - 0.034UJ	0.18	0.112	1.00E+00	N/A	N/A	NO	BSL
	7440-02-0	Nickel	1.2 J	19	mg/kg	69SB123, 69SB145	52/52	(6)	19	27.0	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.58 J	2.1	mg/kg	69SB126	12/52	1U - 1.6U	2.1	1.85	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.15 J	0.27	mg/kg	69SB125	4/52	0.2U - 0.32U	0.27	--	3.90E+01	N/A	N/A	NO	BSL
	7440-28-0	Thallium	0.054 J	0.32 J	mg/kg	69SB126	22/52	0.41U - 0.6U	0.32	0.775	7.80E-02	N/A	N/A	YES	ASL
	7440-62-2	Vanadium	9	550	mg/kg	69SB132	52/52	(6)	550	367	3.90E+01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	4.9	200	mg/kg	69SB115	51/52	4.3U - 4.3U	200	113	2.30E+03	N/A	N/A	NO	BSL

(1) J - Analyte present - Reported value is estimated
U - Not detected
UJ - Reported quantitation limit is qualified as estimated

mg/kg = milligrams per kilogram

Definitions: N/A = Not Applic
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemical
USEPA Regional Screening Levels, Residential Soil (November 2011)
(5) Rationale Codes
Selection Reason:
Above Screening Levels (ASL)
Deletion Reason:
Below Screening Level (BSL)
(6) No detection limits given; analyte detected in every sample
(7) Value for **chromium III** used as a surrogate.
(8) USEPA action level for lead.

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Total Soil (2010)
Exposure Medium: Total Soil (2010)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Total Soil (2010)		**Inorganics (mg/kg)**													
	7440-38-2	Arsenic	0.27 J	6.2	mg/kg	69SB101	161/161	(6)	6.2	2.37	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	7.1	470 J	mg/kg	69SB126	158/158	(6)	470	233	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.055 J	0.45	mg/kg	69SB150	132/161	0.1U - 0.16U	0.45	0.717	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.031 J	5.3	mg/kg	69SB115	108/161	0.034UJ - 0.14U	5.3	0.655	7.00E+00	N/A	N/A	NO	BSL
	7440-47-3	Chromium	3 J	68	mg/kg	69SB123	160/160	(6)	68	87.6	1.20E+04 (7)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	0.38	64	mg/kg	69SB125	160/160	(6)	64	51.9	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	3	280	mg/kg	69SB150	161/161	(6)	280	225	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.25 J	71 J	mg/kg	69SB122	154/154	(6)	71	28.2	4.00E+02 (8)	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.0081 J	0.18	mg/kg	B110, 69SB125, 69SB	122/143	0.0057U - 0.034UJ	0.18	0.112	1.00E+00	N/A	N/A	NO	BSL
	7440-02-0	Nickel	0.76 J	19	mg/kg	69SB123	159/161	1.3U - 1.4U	19	27.0	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.23 J	2.2	mg/kg	69SB129	50/161	1U - 1.6U	2.2	1.85	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.047 J	0.96	mg/kg	69SB118	12/161	0.04U - 0.32U	0.96	--	3.90E+01	N/A	N/A	NO	BSL
	7440-28-0	Thallium	0.054 J	0.32 J	mg/kg	69SB126	83/161	0.13U - 0.64U	0.32	0.775	7.80E-02	N/A	N/A	YES	ASL
	7440-62-2	Vanadium	9	580	mg/kg	69SB127, 69SB130	159/159	(6)	580	367	3.90E+01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	4.9	200	mg/kg	69SB115	149/156	4.3U - 5.6U	200	113	2.30E+03	N/A	N/A	NO	BSL

(1) J - Analyte present - Reported value is estimate
U - Not detected
UJ - Reported quantitation limit is qualified as estimate
mg/kg = milligrams per kilogran
Definitions: N/A = Not Applic
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considere
(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std De
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemical
USEPA Regional Screening Levels, Residential Soil (November 2011
(5) Rationale Codes
Selection Reason:
Above Screening Levels (ASL)
Deletion Reason:
Below Screening Level (BSL)
(6) No detection limits given; analyte detected in every sample
(7) Value for **chromium III** used as a surrogate.
(8) USEPA action level for lead.

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater (2010)
Exposure Medium: Groundwater (2010)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater															
		Dissolved Metals (ug/L)													
	d7440-38-2	Arsenic	0.32 J	0.38 J	µg/L	69GW27	3/7	0.28U - 1.5U	0.38	14.0	4.50E-02	10	MCL	YES	ASL
	d7440-39-3	Barium	12	570	µg/L	69GW12	7/7	(6)	570	260	2.90E+02	2000	MCL	YES	ASL
	d7440-43-9	Cadmium	0.14 J	0.16 J	µg/L	69GW12	2/7	0.12U - 0.12U	0.16	36.4	6.90E-01	5	MCL	NO	BSL
	d7440-48-4	Cobalt	0.71 J	12 J	µg/L	69GW12	5/7	0.41U - 0.43U	12	581	4.70E-01	N/A		YES	ASL
	d7440-02-0	Nickel	0.42 J	0.89 J	µg/L	69GW25	7/7	(6)	0.89	84.1	3.00E+01	N/A		NO	BSL
	d7440-62-2	Vanadium	2.4 J	6.6	µg/L	69GW11	7/7	(6)	6.6	21.0	7.80E+00	N/A		NO	BSL
	d7440-66-6	Zinc	7.2 J	16 J	µg/L	69GW26	4/7	6.5U - 6.5U	16	361	4.70E+02	N/A		NO	BSL
		Total Metals (ug/L)													
	7440-38-2	Arsenic	0.34 J	0.56 J	µg/L	69GW27	4/7	1.5U - 1.7U	0.56	18.9	4.50E-02	10	MCL	YES	ASL
	7440-39-3	Barium	12	580	µg/L	69GW12	7/7	(6)	580	686	2.90E+02	2000	MCL	YES	ASL
	7440-43-9	Cadmium	0.12 J	0.16 J	µg/L	69GW12	2/7	0.12UJ - 0.12UJ	0.16	16.6	6.90E-01	5	MCL	NO	BSL
	7440-48-4	Cobalt	0.81 J	11	µg/L	69GW11	4/7	0.24U - 0.32U	11	633	4.70E-01	N/A		YES	ASL
	7440-02-0	Nickel	0.44 J	0.9 J	µg/L	69GW25	7/7	(6)	0.9	95.7	3.00E+01	N/A		NO	BSL
	7440-62-2	Vanadium	2.7 J	6.9	µg/L	69GW07	7/7	(6)	6.9	485	7.80E+00	N/A		NO	BSL
	7440-66-6	Zinc	7.2 J	10 J	µg/L	69GW26	4/7	6.5U - 6.5U	10	548	4.70E+02	N/A		NO	BSL

(1) J - Analyte present - Reported value is estimated
U - Not detected
UJ - Reported quantitation limit is qualified as estimatec
µg/L = microgram per liter

Definitions: N/A = Not Applicable
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considerec
MCL = Medium Contaminant Level

(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemical
USEPA Regional Screening Levels, Tapwater (November 2011)
(5) Rationale Codes
Selection Reason:
Above Screening Levels (ASL)
Deletion Reason:
Below Screening Level (BSL)
(6) No detection limits given; analyte detected in every sample

TABLE 2.4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment (2010)
Exposure Medium: Sediment (2010)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Sediment (2010)		**Inorganics (mg/kg)**													
	7440-38-2	Arsenic	1	4.8 J	mg/kg	69SD09	14/14	(6)	4.8	2.88	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	24 J	140 J	mg/kg	69SD08	14/14	(6)	140	214	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.098 J	0.33 J	mg/kg	69SD07	14/14	(6)	0.33	0.355	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.38	24 J	mg/kg	69SD07	14/14	(6)	24	0.226	7.00E+00	N/A	N/A	YES	ASL
	7440-47-3	Chromium	10	99 J	mg/kg	69SD06	14/14	(6)	99	65.0	1.20E+04 (7)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	5.6 J	20 J	mg/kg	69SD09	14/14	(6)	20	46.5	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	38 J	160 J	mg/kg	69SD07	14/14	(6)	160	164	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	6.4	680 J	mg/kg	69SD07	14/14	(6)	680	20.0	4.00E+02 (8)	N/A	N/A	YES	ASL
	7439-97-6	Mercury	0.045	0.14 J	mg/kg	69SD10	14/14	(6)	0.14	0.167	1.00E+00	N/A	N/A	NO	BSL
	7440-02-0	Nickel	5.2	34 J	mg/kg	69SD06	14/14	(6)	34	18.4	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.85 J	1.3 J	mg/kg	69SD05, 69SD09	6/14	1.8U - 3.1UJ	1.3	3.72	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.25 J	0.7 J	mg/kg	69SD06	3/14	0.32U - 0.62UJ	0.7	ND	3.90E+01	N/A	N/A	NO	BSL
	7440-28-0	Thallium	0.11 J	0.11 J	mg/kg	69SD02	1/14	0.32U - 0.62UJ	0.11	4.36	7.80E-02	N/A	N/A	YES	ASL
	7440-62-2	Vanadium	67 J	370 J	mg/kg	69SD09	14/14	(6)	370	244	3.90E+01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	40	490 J	mg/kg	69SD07	14/14	(6)	490	152	2.30E+03	N/A	N/A	NO	BSL

(1) J - Analyte present - Reported value is e
U - Not detected
UJ - Reported quantitation limit is qualified as estimatec
(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010): Upper Limit of Mean (Mean+2 Std Dev
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemical
USEPA Regional Screening Levels, Residential Soil (November 2011)
(5) Rationale Codes
Selection Reason:
Above Screening Levels (ASL)
Deletion Reason:
Below Screening Level (BSL)
(6) No detection limits given; analyte detected in every sample
(7) Value for **chromium III** used as a surrogate.
(8) USEPA action level for lead.

mg/kg = milligrams per kilogram

Definitions: N/A = Not Applic
ND = Not Detected
COPC = Chemica
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Soil (2010)
Exposure Medium: Surface Soil (2010)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL)
Surface Soil (2010)	Arsenic	mg/kg	2.73	3.04 (N)	6.2	3.04	mg/kg	95% UCL (N)	95% Student's-t UCL
	Cobalt	mg/kg	10.0	12.2 (G)	64	12.2	mg/kg	95% UCL (G)	95% Approximate Gamma UCL
	Thallium	mg/kg	0.186	0.446 (NP)	0.32 J	0.320	mg/kg	Max	UCL>Max
	Vanadium	mg/kg	146	172 (G)	550	172	mg/kg	95% UCL (G)	95% Approximate Gamma UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(N) - Normal distribution and 95% UCL
(NP) - Non-parametric distribution and 95% UCL
(G) - Gamma distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 3.2.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Total Soil (2010)
Exposure Medium: Total Soil (2010)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL)
Total Soil (2010)									
	Arsenic	mg/kg	1.22	2.35 (NP)	6.2	2.35	mg/kg	95% UCL (NP)	95% Chebyshev (Mean, Sd) UCL
	Cobalt	mg/kg	17.3	12.3 (NP)	64	12.3	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
	Thallium	mg/kg	0.130	0.114 (NP)	0.32 J	0.114	mg/kg	95% UCL (NP)	95% KM (t) UCL
	Vanadium	mg/kg	0.164	216 (NP)	580	216	mg/kg	95% UCL (NP)	95% KM (BCA) UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(NP) - Non-parametric distribution and 95% UCL
(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 3.3.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
Exposure Medium: Soil

Exposure Point Soil	Chemical of Potential Concern	Exposure Point Concentration			
		Value	Units	Statistic (2)	Rationale (ProUCL)
SS	Arsenic	3.04	mg/kg	95% UCL (N)	95% Student's-t UCL
TS	Cobalt	12.3	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
SS	Thallium	0.320	mg/kg	Max	UCL>Max
TS	Vanadium	216	mg/kg	95% UCL (NP)	95% KM (BCA) UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detecti
(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 3.4.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater (2010)
Exposure Medium: Groundwater (2010)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater									
	Arsenic	µg/L	0.606	Not Determined	0.56 J	0.00056	mg/L	Max	Less than 8 samples
	Barium	µg/L	183	Not Determined	580	0.580	mg/L	Max	Less than 8 samples
	Cobalt	µg/L	3.40	Not Determined	11	0.0110	mg/L	Max	Less than 8 samples

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were not determined because data sets contained less than 8 samples or less than 4 detections.
(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 3.5.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment (2010)
Exposure Medium: Sediment (2010)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL)
Sediment (2010)									
	Arsenic	mg/kg	2.81	3.36 (N)	4.8 J	3.36	mg/kg	95% UCL (N)	95% Student's-t UCL
	Cadmium	mg/kg	5.08	13.4 (NP)	24 J	13.4	mg/kg	95% UCL (NP)	95% Chebyshev (Mean, Sd) UCL
	Cobalt	mg/kg	12.2	14.6 (N)	20 J	14.6	mg/kg	95% UCL (N)	95% Student's-t UCL
	Lead	mg/kg	116	353 (NP)	680 J	353	mg/kg	95% UCL (NP)	95% Chebyshev (Mean, Sd) UCL
	Thallium	mg/kg	0.199	Not Determined	0.11 J	0.110	mg/kg	Max	Less than 4 detections
	Vanadium	mg/kg	203	247 (N)	370 J	247	mg/kg	95% UCL (N)	95% Student's-t UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(N) - Normal distribution and 95% UCL
(NP) - Non-parametric distribution and 95% UCL
(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

TABLE 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2010)
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation									Exposure Concentration (EC) Equations
	Current and Future Trespassers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	
				ED	Exposure Duration	24	years	USEPA, 1991	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	210,240	hours	USEPA, 1989	
		Youth	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	
				ED	Exposure Duration	11	years	Prof Judge (4)	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	96,360	hours	USEPA, 1989	
	Current and Future On-Site Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	219,000	hours	USEPA, 1989	
	Future Industrial / Commercial Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	219,000	hours	USEPA, 1989	

TABLE 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil (2010)
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation									Exposure Concentration (EC) Equations
	Future Residents	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	24	hours/day	Prof Judge (8)	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	24	years	USEPA, 1991	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	210,240	hours	USEPA, 1989	
		Young Child	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	24	hours/day	Prof Judge (8)	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	6	years	USEPA, 1991	EC (mg/m3) =
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	52,560	hours	USEPA, 1989	
	Future Construction Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	1	years	Prof Judge (5)	EC (mg/m3) =
				PEF	Particulate Emission Factor	2.99E+06	m3/kg	USEPA, 2002 (14)	(Ca*ET*EF*ED)/AT
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	hours	USEPA, 1989	

Notes

Chemical Specific - See Table 3.3 Prof Judge - Professional Judgment

(3) Assumes individuals trespass on site 1 day/week.
(4) Represents youths from 6 to 16 years of age.
(5) Assumes a construction period of 1 year.
(6) Recommended outdoor activity factor for adults.
(7) Assumes an 8 hour work day.
(8) Conservatively assumes receptor remains at residence 24 hours/day.
(14) PEF calculated based on emissions from truck traffic on unpaved roads (refer to Appendix J)

Sources:

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002
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USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion									Chronic Daily Intake (CDI) Equations
	Future Residents	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	2	L/hour	USEPA, 1989	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	CDI (mg/kg-day) =
				ED	Exposure Duration	24	years	USEPA, 1991	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Young Child	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	1	L/hour	USEPA, 1989	
				EF	Exposure Frequency	350	days/year	USEPA, 2004	CDI (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
	Future Industrial / Commercial Workers	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	1	L/hour	USEPA, 1991	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	CDI (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2004	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	70	kg	USEPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	
	Future Construction Workers	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.02	L/hour	VDEQ, 2010	
				EF	Exposure Frequency	50	days/year	Prof Judge (12)	CDI (mg/kg-day) =
				ED	Exposure Duration	1	years	Prof Judge (5)	C x IR-W x EF x ED x 1/BW x 1/AT
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
Dermal									Dermally Adjusted Dose (DAD) Equations
	Future Residents	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	DAD (mg/kg-day) =
				SA	Surface Area Available for Contact	18,000	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	Inorganics
				tau	Lag Time	Chemical Specific	hour	USEPA, 2004	(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2004	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2004	Organics: ET <= t*
				ET	Exposure Time	0.58	hours/day	USEPA, 2004	(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	24	years	USEPA, 1991	Organics: ET > t*
				BW	Body Weight	70	kg	USEPA, 1997	(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B)))*SA*EF*ED)/(BW*AT)
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (cont.)	Future Residents	Young Child	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	DAD (mg/kg-day) =
				SA	Surface Area Available for Contact	6,600	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	Inorganics
				tau	Lag Time	Chemical Specific	hour	USEPA, 2004	(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2004	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2004	Organics: ET <= t*
				ET	Exposure Time	1	hours/day	USEPA, 2004	(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	6	years	USEPA, 1991	Organics: ET > t*
				BW	Body Weight	15	kg	USEPA, 1997	(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B)))*SA*EF*ED)/(BW*AT)
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
									Dermally Adjusted Dose (DAD) Equations
	Future Construction Workers	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	DAD (mg/kg-day) =
				SA	Surface Area Available for Contact	3,300	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	Inorganics
				tau	Lag Time	Chemical Specific	hour	USEPA, 2004	(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2004	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2004	Organics: ET <= t*
				ET	Exposure Time	2	hours/day	Prof Judge (13)	(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)
				EF	Exposure Frequency	50	days/year	Prof Judge (12)	
				ED	Exposure Duration	1	years	Prof Judge (5)	Organics: ET > t*
				BW	Body Weight	70	kg	USEPA, 1997	(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B)))*SA*EF*ED)/(BW*AT)
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

Notes

Chemical Specific - See Table 3.4
NA - Not Applicable
Prof Judge - Professional Judgment

(5) Assumes a construction period of 1 year.
(12) Assumes 20% of time spent in trench.
(13) Assumes 2 hours/event in trench.

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factors.
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
Arsenic	Chronic	3.00E-04	mg/kg/day	100%	3.00E-04	mg/kg/day	Skin / CVS	3/1	IRIS	4/3/2011
Barium	Chronic	2.00E-01	mg/kg/day	7%	1.40E-02	mg/kg/day	Kidney	300/1	IRIS	8/28/2010
Cadmium	Chronic	1.00E-03	mg/kg/day	3%	3.00E-05	mg/kg/day	Kidney	10/1	IRIS	11/22/2010
Cobalt	Chronic	3.00E-04	mg/kg/day	100%	3.00E-04	mg/kg/day	CVS	10/1	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	Chronic	1.00E-05	mg/kg/day	100%	1.00E-05	mg/kg/day	Liver / CVS / Skin	3000/1	PPRTV Appendix	3/29/1999
Vanadium	Chronic	5.00E-03	mg/kg/day	100%	5.00E-03	mg/kg/day	GIS / Kidney	100/1	IRIS	7/1/1997

Notes:

(1) Refer to RAGS, Part E
(2) Adjusted dermal RfD = Oral RfD * Adj Factor

NA = Not Applicable / Not Available

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Sources:
IRIS = Integrated Risk Information System
PPRTV = Provisional Peer Reviewed Toxicity Values

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s)
Arsenic	Chronic	1.50E-05	mg/m3	NA	NA	NA	NA	Cal EPA	NA
Barium	Chronic	5.00E-04	mg/m3	NA	NA	Fetus	100/1	HEAST	7/1/1997
Cadmium	Chronic	2.00E-05	mg/m3	NA	NA	Kidney	1/1	Cal EPA	3/4/1999
Cobalt	Chronic	6.00E-06	mg/m3	NA	NA	RsS	NA	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

NA = Not Applicable / Not Available

Target Organ Abbreviations:
RsS = Respiratory System

Sources:
PPRTV = Provisional Peer Reviewed Toxicity Values
Cal EPA = California Environmental Protection Agency
HEAST= Health Effects Assessment Summary Tables

TABLE 6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s)
Arsenic	1.50E+00	1 / (mg/kg/day)	100%	1.50E+00	1 / (mg/kg/day)	A	IRIS	4/3/2011
Barium	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

(1) Refer to RAGS, Part E
(2) Adjusted dermal CSF = Oral CSF / Adj Factor

NA = Not Applicable / Not Available

Sources:
IRIS = Integrated Risk Inforn

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Weight of Evidence:
Known/Likely (EPA classes A, B1, B2, C)
Cannot be Determined (EPA class D)
Not Likely (EPA class E)

TABLE 6.2
CANCER TOXICITY DATA -- INHALATION
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s)
Arsenic	4.30E-03	1/(µg/m3)	NA	NA	A	IRIS	4/3/2011
Barium	NA	NA	NA	NA	NA	NA	NA
Cadmium	1.80E-03	1/(µg/m3)	NA	NA	B1	IRIS	11/22/2010
Cobalt	9.00E-03	1/(µg/m3)	NA	NA	D	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA

Notes:

EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Sources:

IRIS = Integrated Risk Information System
PPRTV = Provisional Peer Reviewed Toxicity Values

NA = Not Applicable / Not Available

Weight of Evidence:
- Known/Likely (EPA classes A, B1, B2, C)
- Cannot be Determined (EPA class D)
- Not Likely (EPA class E)

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	2.1E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.2E-07	6.2E-07	mg/kg-day	3.0E-04	mg/kg-day	2.1E-03
				Cobalt	12.3	mg/kg	8.6E-07	mg/kg-day	NA	--	--	2.5E-06	mg/kg-day	3.0E-04	mg/kg-day	8.3E-03
				Thallium	0.320	mg/kg	2.2E-08	mg/kg-day	NA	--	--	6.5E-08	mg/kg-day	1.0E-05	mg/kg-day	6.5E-03
				Vanadium	216	mg/kg	1.5E-05	mg/kg-day	NA	--	--	4.4E-05	mg/kg-day	5.0E-03	mg/kg-day	8.8E-03
			Ingestion Total								3.2E-07					2.6E-02
			Dermal													
				Arsenic	3.04	mg/kg	2.5E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.8E-08	7.4E-08	mg/kg-day	3.0E-04	mg/kg-day	2.5E-04
				Cobalt	12.3	mg/kg	3.4E-08	mg/kg-day	NA	--	--	1.0E-07	mg/kg-day	3.0E-04	mg/kg-day	3.3E-04
				Thallium	0.320	mg/kg	8.9E-10	mg/kg-day	NA	--	--	2.6E-09	mg/kg-day	1.0E-05	mg/kg-day	2.6E-04
				Vanadium	216	mg/kg	6.0E-07	mg/kg-day	NA	--	--	1.8E-06	mg/kg-day	5.0E-03	mg/kg-day	3.5E-04
			Dermal Total								3.8E-08					1.2E-03
		Exposure Point Total									3.6E-07					2.7E-02
	Exposure Medium Total										3.6E-07					2.7E-02
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	9.1E-12	mg/m3	4.3E-03	1/(µg/m3)	3.9E-11	2.7E-11	mg/m3	1.5E-05	mg/m3	1.8E-06
				Cobalt	12.3	mg/kg	3.7E-11	mg/m3	9.0E-03	1/(µg/m3)	3.3E-10	1.1E-10	mg/m3	6.0E-06	mg/m3	1.8E-05
				Thallium	0.320	mg/kg	9.6E-13	mg/m3	NA	--	--	2.8E-12	mg/m3	NA	--	--
				Vanadium	216	mg/kg	6.5E-10	mg/m3	NA	--	--	1.9E-09	mg/m3	NA	--	--
			Inhalation Total								3.7E-10					2.0E-05
		Exposure Point Total									3.7E-10					2.0E-05
	Exposure Medium Total										3.7E-10					2.0E-05
Soil (2010) Total											3.6E-07					2.7E-02

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment (2010)	Sediment (2010)	Sediment (2010)	Ingestion													
				Arsenic	3.36	mg/kg	2.3E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.5E-07	6.8E-07	mg/kg-day	3.0E-04	mg/kg-day	2.3E-03
				Cadmium	13.4	mg/kg	9.4E-07	mg/kg-day	NA	--	--	2.7E-06	mg/kg-day	1.0E-03	mg/kg-day	2.7E-03
				Cobalt	14.6	mg/kg	1.0E-06	mg/kg-day	NA	--	--	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	9.9E-03
				Lead	353	mg/kg	2.5E-05	mg/kg-day	NA	--	--	7.2E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	7.7E-09	mg/kg-day	NA	--	--	2.2E-08	mg/kg-day	1.0E-05	mg/kg-day	2.2E-03
				Vanadium	247	mg/kg	1.7E-05	mg/kg-day	NA	--	--	5.0E-05	mg/kg-day	5.0E-03	mg/kg-day	1.0E-02
			Ingestion Total								3.5E-07					2.7E-02
			Dermal													
				Arsenic	3.36	mg/kg	1.2E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.8E-07	3.5E-07	mg/kg-day	3.0E-04	mg/kg-day	1.2E-03
				Cadmium	13.4	mg/kg	1.6E-08	mg/kg-day	NA	--	--	4.7E-08	mg/kg-day	3.0E-05	mg/kg-day	1.6E-03
				Cobalt	14.6	mg/kg	1.7E-07	mg/kg-day	NA	--	--	5.1E-07	mg/kg-day	3.0E-04	mg/kg-day	1.7E-03
				Lead	353	mg/kg	4.2E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	1.3E-09	mg/kg-day	NA	--	--	3.8E-09	mg/kg-day	1.0E-05	mg/kg-day	3.8E-04
				Vanadium	247	mg/kg	2.9E-06	mg/kg-day	NA	--	--	8.6E-06	mg/kg-day	5.0E-03	mg/kg-day	1.7E-03
			Dermal Total								1.8E-07					6.5E-03
		Exposure Point Total									5.3E-07					3.4E-02
	Exposure Medium Total										5.3E-07					3.4E-02
Sediment (2010) Total											5.3E-07					3.4E-02
										Total of Receptor Risks Across All Media	8.9E-07	Total of Receptor Hazards Across All Media				6.1E-02

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	1.5E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.3E-07	9.6E-07	mg/kg-day	3.0E-04	mg/kg-day	3.2E-03
				Cobalt	12.3	mg/kg	6.1E-07	mg/kg-day	NA	--	--	3.9E-06	mg/kg-day	3.0E-04	mg/kg-day	1.3E-02
				Thallium	0.320	mg/kg	1.6E-08	mg/kg-day	NA	--	--	1.0E-07	mg/kg-day	1.0E-05	mg/kg-day	1.0E-02
				Vanadium	216	mg/kg	1.1E-05	mg/kg-day	NA	--	--	6.8E-05	mg/kg-day	5.0E-03	mg/kg-day	1.4E-02
			Ingestion Total								2.3E-07					4.0E-02
			Dermal													
				Arsenic	3.04	mg/kg	2.9E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.4E-08	1.8E-07	mg/kg-day	3.0E-04	mg/kg-day	6.2E-04
				Cobalt	12.3	mg/kg	3.9E-08	mg/kg-day	NA	--	--	2.5E-07	mg/kg-day	3.0E-04	mg/kg-day	8.3E-04
				Thallium	0.320	mg/kg	1.0E-09	mg/kg-day	NA	--	--	6.5E-09	mg/kg-day	1.0E-05	mg/kg-day	6.5E-04
				Vanadium	216	mg/kg	6.9E-07	mg/kg-day	NA	--	--	4.4E-06	mg/kg-day	5.0E-03	mg/kg-day	8.8E-04
			Dermal Total								4.4E-08					3.0E-03
		Exposure Point Total									2.7E-07					4.3E-02
	Exposure Medium Total										2.7E-07					4.3E-02
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	4.2E-12	mg/m3	4.3E-03	1/(µg/m3)	1.8E-11	2.7E-11	mg/m3	1.5E-05	mg/m3	1.8E-06
				Cobalt	12.3	mg/kg	1.7E-11	mg/m3	9.0E-03	1/(µg/m3)	1.5E-10	1.1E-10	mg/m3	6.0E-06	mg/m3	1.8E-05
				Thallium	0.320	mg/kg	4.4E-13	mg/m3	NA	--	--	2.8E-12	mg/m3	NA	--	--
				Vanadium	216	mg/kg	3.0E-10	mg/m3	NA	--	--	1.9E-09	mg/m3	NA	--	--
			Inhalation Total								1.7E-10					2.0E-05
		Exposure Point Total									1.7E-10					2.0E-05
	Exposure Medium Total										1.7E-10					2.0E-05
Soil (2010) Total											2.7E-07					4.3E-02

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment (2010)	Sediment (2010)	Sediment (2010)	Ingestion													
				Arsenic	3.36	mg/kg	1.7E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.5E-07	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	3.5E-03
				Cadmium	13.4	mg/kg	6.7E-07	mg/kg-day	NA	--	--	4.2E-06	mg/kg-day	1.0E-03	mg/kg-day	4.2E-03
				Cobalt	14.6	mg/kg	7.3E-07	mg/kg-day	NA	--	--	4.6E-06	mg/kg-day	3.0E-04	mg/kg-day	1.5E-02
				Lead	353	mg/kg	1.8E-05	mg/kg-day	NA	--	--	1.1E-04	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	5.5E-09	mg/kg-day	NA	--	--	3.5E-08	mg/kg-day	1.0E-05	mg/kg-day	3.5E-03
				Vanadium	247	mg/kg	1.2E-05	mg/kg-day	NA	--	--	7.8E-05	mg/kg-day	5.0E-03	mg/kg-day	1.6E-02
			Ingestion Total								2.5E-07					4.2E-02
			Dermal													
				Arsenic	3.36	mg/kg	4.8E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	7.2E-08	3.1E-07	mg/kg-day	3.0E-04	mg/kg-day	1.0E-03
				Cadmium	13.4	mg/kg	6.4E-09	mg/kg-day	NA	--	--	4.1E-08	mg/kg-day	3.0E-05	mg/kg-day	1.4E-03
				Cobalt	14.6	mg/kg	7.0E-08	mg/kg-day	NA	--	--	4.4E-07	mg/kg-day	3.0E-04	mg/kg-day	1.5E-03
				Lead	353	mg/kg	1.7E-06	mg/kg-day	NA	--	--	1.1E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	5.3E-10	mg/kg-day	NA	--	--	3.3E-09	mg/kg-day	1.0E-05	mg/kg-day	3.3E-04
				Vanadium	247	mg/kg	1.2E-06	mg/kg-day	NA	--	--	7.5E-06	mg/kg-day	5.0E-03	mg/kg-day	1.5E-03
			Dermal Total								7.2E-08					5.7E-03
		Exposure Point Total									3.2E-07					4.8E-02
	Exposure Medium Total										3.2E-07					4.8E-02
Sediment (2010) Total											3.2E-07					4.8E-02
										Total of Receptor Risks Across All Media	5.9E-07	Total of Receptor Hazards Across All Media				9.1E-02

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	1.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.6E-06	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	9.9E-03
				Cobalt	12.3	mg/kg	4.3E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	4.0E-02
				Thallium	0.320	mg/kg	1.1E-07	mg/kg-day	NA	--	--	3.1E-07	mg/kg-day	1.0E-05	mg/kg-day	3.1E-02
				Vanadium	216	mg/kg	7.5E-05	mg/kg-day	NA	--	--	2.1E-04	mg/kg-day	5.0E-03	mg/kg-day	4.2E-02
			Ingestion Total								1.6E-06					1.2E-01
			Dermal													
				Arsenic	3.04	mg/kg	2.1E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.2E-07	5.9E-07	mg/kg-day	3.0E-04	mg/kg-day	2.0E-03
				Cobalt	12.3	mg/kg	2.8E-07	mg/kg-day	NA	--	--	7.9E-07	mg/kg-day	3.0E-04	mg/kg-day	2.6E-03
				Thallium	0.320	mg/kg	7.4E-09	mg/kg-day	NA	--	--	2.1E-08	mg/kg-day	1.0E-05	mg/kg-day	2.1E-03
				Vanadium	216	mg/kg	5.0E-06	mg/kg-day	NA	--	--	1.4E-05	mg/kg-day	5.0E-03	mg/kg-day	2.8E-03
			Dermal Total								3.2E-07					9.5E-03
		Exposure Point Total									1.9E-06					1.3E-01
	Exposure Medium Total										1.9E-06					1.3E-01
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	1.8E-10	mg/m3	4.3E-03	1/(µg/m3)	7.8E-10	5.1E-10	mg/m3	1.5E-05	mg/m3	3.4E-05
				Cobalt	12.3	mg/kg	7.4E-10	mg/m3	9.0E-03	1/(µg/m3)	6.6E-09	2.1E-09	mg/m3	6.0E-06	mg/m3	3.4E-04
				Thallium	0.320	mg/kg	1.9E-11	mg/m3	NA	--	--	5.4E-11	mg/m3	NA	--	--
				Vanadium	216	mg/kg	1.3E-08	mg/m3	NA	--	--	3.6E-08	mg/m3	NA	--	--
			Inhalation Total								7.4E-09					3.8E-04
		Exposure Point Total									7.4E-09					3.8E-04
	Exposure Medium Total										7.4E-09					3.8E-04
Soil (2010) Total											1.9E-06					1.3E-01

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment (2010)	Sediment (2010)	Sediment (2010)	Ingestion													
				Arsenic	3.36	mg/kg	1.2E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.8E-06	3.3E-06	mg/kg-day	3.0E-04	mg/kg-day	1.1E-02
				Cadmium	13.4	mg/kg	4.7E-06	mg/kg-day	NA	--	--	1.3E-05	mg/kg-day	1.0E-03	mg/kg-day	1.3E-02
				Cobalt	14.6	mg/kg	5.1E-06	mg/kg-day	NA	--	--	1.4E-05	mg/kg-day	3.0E-04	mg/kg-day	4.8E-02
				Lead	353	mg/kg	1.2E-04	mg/kg-day	NA	--	--	3.5E-04	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	3.8E-08	mg/kg-day	NA	--	--	1.1E-07	mg/kg-day	1.0E-05	mg/kg-day	1.1E-02
				Vanadium	247	mg/kg	8.6E-05	mg/kg-day	NA	--	--	2.4E-04	mg/kg-day	5.0E-03	mg/kg-day	4.8E-02
			Ingestion Total								1.8E-06					1.3E-01
			Dermal													
				Arsenic	3.36	mg/kg	3.5E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	5.2E-07	9.8E-07	mg/kg-day	3.0E-04	mg/kg-day	3.3E-03
				Cadmium	13.4	mg/kg	4.6E-08	mg/kg-day	NA	--	--	1.3E-07	mg/kg-day	3.0E-05	mg/kg-day	4.3E-03
				Cobalt	14.6	mg/kg	5.1E-07	mg/kg-day	NA	--	--	1.4E-06	mg/kg-day	3.0E-04	mg/kg-day	4.7E-03
				Lead	353	mg/kg	1.2E-05	mg/kg-day	NA	--	--	3.4E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	3.8E-09	mg/kg-day	NA	--	--	1.1E-08	mg/kg-day	1.0E-05	mg/kg-day	1.1E-03
				Vanadium	247	mg/kg	8.5E-06	mg/kg-day	NA	--	--	2.4E-05	mg/kg-day	5.0E-03	mg/kg-day	4.8E-03
			Dermal Total								5.2E-07					1.8E-02
		Exposure Point Total									2.3E-06					1.5E-01
	Exposure Medium Total										2.3E-06					1.5E-01
Sediment (2010) Total											2.3E-06					1.5E-01
										Total of Receptor Risks Across All Media	4.2E-06	Total of Receptor Hazards Across All Media				2.8E-01

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	1.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.6E-06	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	9.9E-03
				Cobalt	12.3	mg/kg	4.3E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	4.0E-02
				Thallium	0.320	mg/kg	1.1E-07	mg/kg-day	NA	--	--	3.1E-07	mg/kg-day	1.0E-05	mg/kg-day	3.1E-02
				Vanadium	216	mg/kg	7.5E-05	mg/kg-day	NA	--	--	2.1E-04	mg/kg-day	5.0E-03	mg/kg-day	4.2E-02
			Ingestion Total								1.6E-06					1.2E-01
			Dermal													
				Arsenic	3.04	mg/kg	2.1E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.2E-07	5.9E-07	mg/kg-day	3.0E-04	mg/kg-day	2.0E-03
				Cobalt	12.3	mg/kg	2.8E-07	mg/kg-day	NA	--	--	7.9E-07	mg/kg-day	3.0E-04	mg/kg-day	2.6E-03
				Thallium	0.320	mg/kg	7.4E-09	mg/kg-day	NA	--	--	2.1E-08	mg/kg-day	1.0E-05	mg/kg-day	2.1E-03
				Vanadium	216	mg/kg	5.0E-06	mg/kg-day	NA	--	--	1.4E-05	mg/kg-day	5.0E-03	mg/kg-day	2.8E-03
			Dermal Total								3.2E-07					9.5E-03
		Exposure Point Total									1.9E-06					1.3E-01
	Exposure Medium Total										1.9E-06					1.3E-01
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	1.8E-10	mg/m3	4.3E-03	1/(µg/m3)	7.8E-10	5.1E-10	mg/m3	1.5E-05	mg/m3	3.4E-05
				Cobalt	12.3	mg/kg	7.4E-10	mg/m3	9.0E-03	1/(µg/m3)	6.6E-09	2.1E-09	mg/m3	6.0E-06	mg/m3	3.4E-04
				Thallium	0.320	mg/kg	1.9E-11	mg/m3	NA	--	--	5.4E-11	mg/m3	NA	--	--
				Vanadium	216	mg/kg	1.3E-08	mg/m3	NA	--	--	3.6E-08	mg/m3	NA	--	--
			Inhalation Total								7.4E-09					3.8E-04
		Exposure Point Total									7.4E-09					3.8E-04
	Exposure Medium Total										7.4E-09					3.8E-04
Soil (2010) Total											1.9E-06					1.3E-01
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00056	mg/L	2.0E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.9E-06	5.5E-06	mg/kg-day	3.0E-04	mg/kg-day	1.8E-02
				Barium	0.580	mg/L	2.0E-03	mg/kg-day	NA	--	--	5.7E-03	mg/kg-day	2.0E-01	mg/kg-day	2.8E-02
				Cobalt	0.0110	mg/L	3.8E-05	mg/kg-day	NA	--	--	1.1E-04	mg/kg-day	3.0E-04	mg/kg-day	3.6E-01
			Ingestion Total								2.9E-06					4.1E-01
	Exposure Medium Total										2.9E-06					4.1E-01
Groundwater Total											2.9E-06					4.1E-01
										Total of Receptor Risks Across All Media	4.9E-06	Total of Receptor Hazards Across All Media				5.4E-01

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	1.4E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.1E-06	4.2E-06	mg/kg-day	3.0E-04	mg/kg-day	1.4E-02
				Cobalt	12.3	mg/kg	5.8E-06	mg/kg-day	NA	--	--	1.7E-05	mg/kg-day	3.0E-04	mg/kg-day	5.6E-02
				Thallium	0.320	mg/kg	1.5E-07	mg/kg-day	NA	--	--	4.4E-07	mg/kg-day	1.0E-05	mg/kg-day	4.4E-02
				Vanadium	216	mg/kg	1.0E-04	mg/kg-day	NA	--	--	3.0E-04	mg/kg-day	5.0E-03	mg/kg-day	5.9E-02
			Ingestion Total								2.1E-06					1.7E-01
			Dermal													
				Arsenic	3.04	mg/kg	1.7E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.6E-07	5.0E-07	mg/kg-day	3.0E-04	mg/kg-day	1.7E-03
				Cobalt	12.3	mg/kg	2.3E-07	mg/kg-day	NA	--	--	6.7E-07	mg/kg-day	3.0E-04	mg/kg-day	2.2E-03
				Thallium	0.320	mg/kg	6.0E-09	mg/kg-day	NA	--	--	1.7E-08	mg/kg-day	1.0E-05	mg/kg-day	1.7E-03
				Vanadium	216	mg/kg	4.0E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	5.0E-03	mg/kg-day	2.4E-03
			Dermal Total								2.6E-07					8.0E-03
		Exposure Point Total									2.4E-06					1.8E-01
	Exposure Medium Total										2.4E-06					1.8E-01
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	7.3E-10	mg/m3	4.3E-03	1/(µg/m3)	3.2E-09	2.1E-09	mg/m3	1.5E-05	mg/m3	1.4E-04
				Cobalt	12.3	mg/kg	3.0E-09	mg/m3	9.0E-03	1/(µg/m3)	2.7E-08	8.7E-09	mg/m3	6.0E-06	mg/m3	1.4E-03
				Thallium	0.320	mg/kg	7.7E-11	mg/m3	NA	--	--	2.3E-10	mg/m3	NA	--	--
				Vanadium	216	mg/kg	5.2E-08	mg/m3	NA	--	--	1.5E-07	mg/m3	NA	--	--
			Inhalation Total								3.0E-08					1.6E-03
		Exposure Point Total									3.0E-08					1.6E-03
	Exposure Medium Total										3.0E-08					1.6E-03
Soil (2010) Total											2.4E-06					1.8E-01

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00056	mg/L	5.3E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	7.9E-06	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	5.1E-02
				Barium	0.580	mg/L	5.4E-03	mg/kg-day	NA	--	--	1.6E-02	mg/kg-day	2.0E-01	mg/kg-day	7.9E-02
				Cobalt	0.0110	mg/L	1.0E-04	mg/kg-day	NA	--	--	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	**1.0E+00**
			Ingestion Total								7.9E-06					**1.1E+00**
			Dermal													
				Arsenic	0.00056	mg/L	2.7E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.1E-08	8.0E-08	mg/kg-day	3.0E-04	mg/kg-day	2.7E-04
				Barium	0.580	mg/L	2.8E-05	mg/kg-day	NA	--	--	8.3E-05	mg/kg-day	1.4E-02	mg/kg-day	5.9E-03
				Cobalt	0.0110	mg/L	2.2E-07	mg/kg-day	NA	--	--	6.3E-07	mg/kg-day	3.0E-04	mg/kg-day	2.1E-03
			Dermal Total								4.1E-08					8.3E-03
		Exposure Point Total									7.9E-06					**1.1E+00**
	Exposure Medium Total										7.9E-06					**1.1E+00**
Groundwater Total											7.9E-06					**1.1E+00**
Sediment (2010)	Sediment (2010)	Sediment (2010)	Ingestion													
				Arsenic	3.36	mg/kg	2.3E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.5E-07	6.8E-07	mg/kg-day	3.0E-04	mg/kg-day	2.3E-03
				Cadmium	13.4	mg/kg	9.4E-07	mg/kg-day	NA	--	--	2.7E-06	mg/kg-day	1.0E-03	mg/kg-day	2.7E-03
				Cobalt	14.6	mg/kg	1.0E-06	mg/kg-day	NA	--	--	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	9.9E-03
				Lead	353	mg/kg	2.5E-05	mg/kg-day	NA	--	--	7.2E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	7.7E-09	mg/kg-day	NA	--	--	2.2E-08	mg/kg-day	1.0E-05	mg/kg-day	2.2E-03
				Vanadium	247	mg/kg	1.7E-05	mg/kg-day	NA	--	--	5.0E-05	mg/kg-day	5.0E-03	mg/kg-day	1.0E-02
			Ingestion Total								3.5E-07					2.7E-02
			Dermal													
				Arsenic	3.36	mg/kg	1.2E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.8E-07	3.5E-07	mg/kg-day	3.0E-04	mg/kg-day	1.2E-03
				Cadmium	13.4	mg/kg	1.6E-08	mg/kg-day	NA	--	--	4.7E-08	mg/kg-day	3.0E-05	mg/kg-day	1.6E-03
				Cobalt	14.6	mg/kg	1.7E-07	mg/kg-day	NA	--	--	5.1E-07	mg/kg-day	3.0E-04	mg/kg-day	1.7E-03
				Lead	353	mg/kg	4.2E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	1.3E-09	mg/kg-day	NA	--	--	3.8E-09	mg/kg-day	1.0E-05	mg/kg-day	3.8E-04
				Vanadium	247	mg/kg	2.9E-06	mg/kg-day	NA	--	--	8.6E-06	mg/kg-day	5.0E-03	mg/kg-day	1.7E-03
			Dermal Total								1.8E-07					6.5E-03
		Exposure Point Total									5.3E-07					3.4E-02
	Exposure Medium Total										5.3E-07					3.4E-02
Total of Receptor Risks Across All Media											1.0E-05	Total of Receptor Hazards Across All Media				**1.3E+00**

TABLE 7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	3.3E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	5.0E-06	3.9E-05	mg/kg-day	3.0E-04	mg/kg-day	1.3E-01
				Cobalt	12.3	mg/kg	1.3E-05	mg/kg-day	NA	--	--	1.6E-04	mg/kg-day	3.0E-04	mg/kg-day	5.2E-01
				Thallium	0.320	mg/kg	3.5E-07	mg/kg-day	NA	--	--	4.1E-06	mg/kg-day	1.0E-05	mg/kg-day	4.1E-01
				Vanadium	216	mg/kg	2.4E-04	mg/kg-day	NA	--	--	2.8E-03	mg/kg-day	5.0E-03	mg/kg-day	5.5E-01
			Ingestion Total								5.0E-06					**1.6E+00**
			Dermal													
				Arsenic	3.04	mg/kg	2.8E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.2E-07	3.3E-06	mg/kg-day	3.0E-04	mg/kg-day	1.1E-02
				Cobalt	12.3	mg/kg	3.8E-07	mg/kg-day	NA	--	--	4.4E-06	mg/kg-day	3.0E-04	mg/kg-day	1.5E-02
				Thallium	0.320	mg/kg	9.8E-09	mg/kg-day	NA	--	--	1.1E-07	mg/kg-day	1.0E-05	mg/kg-day	1.1E-02
				Vanadium	216	mg/kg	6.6E-06	mg/kg-day	NA	--	--	7.7E-05	mg/kg-day	5.0E-03	mg/kg-day	1.5E-02
			Dermal Total								4.2E-07					5.2E-02
		Exposure Point Total									5.4E-06					**1.7E+00**
	Exposure Medium Total										5.4E-06					**1.7E+00**
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	1.8E-10	mg/m3	4.3E-03	1/(µg/m3)	7.9E-10	2.1E-09	mg/m3	1.5E-05	mg/m3	1.4E-04
				Cobalt	12.3	mg/kg	7.4E-10	mg/m3	9.0E-03	1/(µg/m3)	6.7E-09	8.7E-09	mg/m3	6.0E-06	mg/m3	1.4E-03
				Thallium	0.320	mg/kg	1.9E-11	mg/m3	NA	--	--	2.3E-10	mg/m3	NA	--	--
				Vanadium	216	mg/kg	1.3E-08	mg/m3	NA	--	--	1.5E-07	mg/m3	NA	--	--
			Inhalation Total								7.5E-09					1.6E-03
		Exposure Point Total									7.5E-09					1.6E-03
	Exposure Medium Total										7.5E-09					1.6E-03
Soil (2010) Total											5.4E-06					**1.7E+00**

TABLE 7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00056	mg/L	3.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.6E-06	3.6E-05	mg/kg-day	3.0E-04	mg/kg-day	1.2E-01
				Barium	0.580	mg/L	3.2E-03	mg/kg-day	NA	--	--	3.7E-02	mg/kg-day	2.0E-01	mg/kg-day	1.9E-01
				Cobalt	0.0110	mg/L	6.0E-05	mg/kg-day	NA	--	--	7.0E-04	mg/kg-day	3.0E-04	mg/kg-day	**2.3E+00**
			Ingestion Total								4.6E-06					**2.6E+00**
			Dermal													
				Arsenic	0.00056	mg/L	2.0E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.0E-08	2.4E-07	mg/kg-day	3.0E-04	mg/kg-day	7.9E-04
				Barium	0.580	mg/L	2.1E-05	mg/kg-day	NA	--	--	2.4E-04	mg/kg-day	1.4E-02	mg/kg-day	1.7E-02
				Cobalt	0.0110	mg/L	1.6E-07	mg/kg-day	NA	--	--	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.2E-03
			Dermal Total								3.0E-08					2.4E-02
		Exposure Point Total									4.6E-06					**2.7E+00**
	Exposure Medium Total										4.6E-06					**2.7E+00**
Groundwater Total											4.6E-06					**2.7E+00**
Sediment (2010)	Sediment (2010)	Sediment (2010)	Ingestion													
				Arsenic	3.36	mg/kg	5.5E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	8.2E-07	6.4E-06	mg/kg-day	3.0E-04	mg/kg-day	2.1E-02
				Cadmium	13.4	mg/kg	2.2E-06	mg/kg-day	NA	--	--	2.5E-05	mg/kg-day	1.0E-03	mg/kg-day	2.5E-02
				Cobalt	14.6	mg/kg	2.4E-06	mg/kg-day	NA	--	--	2.8E-05	mg/kg-day	3.0E-04	mg/kg-day	9.2E-02
				Lead	353	mg/kg	5.7E-05	mg/kg-day	NA	--	--	6.7E-04	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	1.8E-08	mg/kg-day	NA	--	--	2.1E-07	mg/kg-day	1.0E-05	mg/kg-day	2.1E-02
				Vanadium	247	mg/kg	4.0E-05	mg/kg-day	NA	--	--	4.7E-04	mg/kg-day	5.0E-03	mg/kg-day	9.4E-02
			Ingestion Total								8.2E-07					2.5E-01
			Dermal													
				Arsenic	3.36	mg/kg	6.9E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.0E-07	8.0E-07	mg/kg-day	3.0E-04	mg/kg-day	2.7E-03
				Cadmium	13.4	mg/kg	9.2E-09	mg/kg-day	NA	--	--	1.1E-07	mg/kg-day	3.0E-05	mg/kg-day	3.6E-03
				Cobalt	14.6	mg/kg	1.0E-07	mg/kg-day	NA	--	--	1.2E-06	mg/kg-day	3.0E-04	mg/kg-day	3.9E-03
				Lead	353	mg/kg	2.4E-06	mg/kg-day	NA	--	--	2.8E-05	mg/kg-day	NA	--	--
				Thallium	0.110	mg/kg	7.5E-10	mg/kg-day	NA	--	--	8.8E-09	mg/kg-day	1.0E-05	mg/kg-day	8.8E-04
				Vanadium	247	mg/kg	1.7E-06	mg/kg-day	NA	--	--	2.0E-05	mg/kg-day	5.0E-03	mg/kg-day	3.9E-03
			Dermal Total								1.0E-07					1.5E-02
		Exposure Point Total									9.2E-07					2.7E-01
	Exposure Medium Total										9.2E-07					2.7E-01
Sediment (2010) Total											9.2E-07					2.7E-01
Total of Receptor Risks Across All Media											1.1E-05	Total of Receptor Hazards Across All Media				**4.6E+00**

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (2010)	Soil (2010)	Soil (2010)	Ingestion													
				Arsenic	3.04	mg/kg	1.4E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.1E-07	9.8E-06	mg/kg-day	3.0E-04	mg/kg-day	3.3E-02
				Cobalt	12.3	mg/kg	5.7E-07	mg/kg-day	NA	--	--	4.0E-05	mg/kg-day	3.0E-04	mg/kg-day	1.3E-01
				Thallium	0.320	mg/kg	1.5E-08	mg/kg-day	NA	--	--	1.0E-06	mg/kg-day	1.0E-05	mg/kg-day	1.0E-01
				Vanadium	216	mg/kg	1.0E-05	mg/kg-day	NA	--	--	7.0E-04	mg/kg-day	5.0E-03	mg/kg-day	1.4E-01
			Ingestion Total								2.1E-07					4.1E-01
			Dermal													
				Arsenic	3.04	mg/kg	1.3E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.9E-08	8.8E-07	mg/kg-day	3.0E-04	mg/kg-day	2.9E-03
				Cobalt	12.3	mg/kg	1.7E-08	mg/kg-day	NA	--	--	1.2E-06	mg/kg-day	3.0E-04	mg/kg-day	4.0E-03
				Thallium	0.320	mg/kg	4.4E-10	mg/kg-day	NA	--	--	3.1E-08	mg/kg-day	1.0E-05	mg/kg-day	3.1E-03
				Vanadium	216	mg/kg	3.0E-07	mg/kg-day	NA	--	--	2.1E-05	mg/kg-day	5.0E-03	mg/kg-day	4.2E-03
			Dermal Total								1.9E-08					1.4E-02
		Exposure Point Total									2.3E-07					4.2E-01
	Exposure Medium Total										2.3E-07					4.2E-01
	Air	Fugative Dust	Inhalation													
				Arsenic	3.04	mg/kg	3.3E-09	mg/m3	4.3E-03	1/(µg/m3)	1.4E-08	2.3E-07	mg/m3	1.5E-05	mg/m3	1.5E-02
				Cobalt	12.3	mg/kg	1.3E-08	mg/m3	9.0E-03	1/(µg/m3)	1.2E-07	9.4E-07	mg/m3	6.0E-06	mg/m3	1.6E-01
				Thallium	0.320	mg/kg	3.5E-10	mg/m3	NA	--	--	2.4E-08	mg/m3	NA	--	--
				Vanadium	216	mg/kg	2.4E-07	mg/m3	NA	--	--	1.6E-05	mg/m3	NA	--	--
			Inhalation Total								1.3E-07					1.7E-01
		Exposure Point Total									1.3E-07					1.7E-01
	Exposure Medium Total										1.3E-07					1.7E-01
Soil (2010) Total											3.6E-07					5.9E-01

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00056	mg/L	3.1E-10	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.7E-10	2.2E-08	mg/kg-day	3.0E-04	mg/kg-day	7.3E-05
				Barium	0.580	mg/L	3.2E-07	mg/kg-day	NA	--	--	2.3E-05	mg/kg-day	2.0E-01	mg/kg-day	1.1E-04
				Cobalt	0.0110	mg/L	6.2E-09	mg/kg-day	NA	--	--	4.3E-07	mg/kg-day	3.0E-04	mg/kg-day	1.4E-03
			Ingestion Total								4.7E-10					1.6E-03
			Dermal													
				Arsenic	0.00056	mg/L	1.0E-10	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.5E-10	7.2E-09	mg/kg-day	3.0E-04	mg/kg-day	2.4E-05
				Barium	0.580	mg/L	1.1E-07	mg/kg-day	NA	--	--	7.5E-06	mg/kg-day	1.4E-02	mg/kg-day	5.4E-04
				Cobalt	0.0110	mg/L	8.1E-10	mg/kg-day	NA	--	--	5.7E-08	mg/kg-day	3.0E-04	mg/kg-day	1.9E-04
			Dermal Total								1.5E-10					7.5E-04
		Exposure Point Total									6.2E-10					2.4E-03
	Exposure Medium Total										6.2E-10					2.4E-03
Groundwater Total											6.2E-10					2.4E-03
Total of Receptor Risks Across All Media											3.6E-07	Total of Receptor Hazards Across All Media				6.0E-01

TABLE 8.1.RME
CALCULATION OF RADIATION CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
			Total													
NOT APPLICABLE																
			Total													
		Exposure Point Total														
	Exposure Medium Total															
			Total													
		Exposure Point Total														
	Exposure Medium Total															
Total																
Total of Receptor Risks Across All Media												Total of Receptor Hazards Across All Media				

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	3.2E-07	--	3.8E-08	--	3.6E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	<0.01	--	<0.01	<0.01
			Chemical Total	3.2E-07	--	3.8E-08	--	3.6E-07		0.03	--	<0.01	0.03
		Exposure Point Total						3.6E-07					0.03
	Exposure Medium Total							3.6E-07					0.03
	Air	Fugative Dust											
			Arsenic	--	3.8E-11	--	--	3.8E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	3.2E-10	--	--	3.2E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	3.6E-10	--	--	3.6E-10		--	<0.01	--	<0.01
		Exposure Point Total						3.6E-10					<0.01
	Exposure Medium Total							3.6E-10					<0.01
Soil (2010) Total								**3.57E-07**					**0.03**

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Sediment (2010)	Sediment	Sediment	Arsenic	3.5E-07	--	1.8E-07	--	5.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.01	--	<0.01	0.01
			Chemical Total	3.5E-07	--	1.8E-07	--	5.3E-07		0.03	--	<0.01	0.03
		Exposure Point Total						5.3E-07					0.03
	Exposure Medium Total							5.3E-07					0.03
Sediment (2010) Total								**5.32E-07**					**0.03**
Adult Trespassers Total								**8.89E-07**					**0.06**

Total Risk Across Soil (2010)	3.6E-07	Total Hazard Index Across Soil (2010)	0.03
Total Risk Across Sediment (2010)	5.3E-07	Total Hazard Index Across Sediment (2010)	0.03
Total Risk Across All Media and All Exposure Routes	8.9E-07	Total Hazard Index Across All Media and All Exposure Routes	0.06

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.02	0.02
Cardiovascular System HI =		0.04	0.04
Skin HI =		0.02	0.02
Kidney HI =		0.03	0.03
Liver HI =		<0.01	<0.01
Respiratory System HI =	<0.01		<0.01

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	2.3E-07	--	4.4E-08	--	2.7E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.01	--	<0.01	0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.01	--	<0.01	0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.01	--	<0.01	0.01
			Chemical Total	2.3E-07	--	4.4E-08	--	2.7E-07		0.04	--	<0.01	0.04
		Exposure Point Total						2.7E-07					0.04
	Exposure Medium Total							2.7E-07					0.04
	Air	Fugative Dust											
			Arsenic	--	1.8E-11	--	--	1.8E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	1.5E-10	--	--	1.5E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	1.7E-10	--	--	1.7E-10		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-10					<0.01
	Exposure Medium Total							1.7E-10					<0.01
Soil (2010) Total								**2.71E-07**					**0.04**

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adolescent

Sediment (2010)	Sediment	Sediment	Arsenic	2.5E-07	--	7.2E-08	--	3.2E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.02	--	<0.01	0.02
			Chemical Total	2.5E-07	--	7.2E-08	--	3.2E-07		0.04	--	<0.01	0.05
		Exposure Point Total						3.2E-07					0.05
	Exposure Medium Total							3.2E-07					0.05
Sediment (2010) Total								**3.23E-07**					**0.05**
Youth Trespassers Total								**5.94E-07**					**0.09**

Total Risk Across Soil (2010)	2.7E-07	Total Hazard Index Across Soil (2010)	0.04
Total Risk Across Sediment (2010)	3.2E-07	Total Hazard Index Across Sediment (2010)	0.05
Total Risk Across All Media and All Exposure Routes	5.9E-07	Total Hazard Index Across All Media and All Exposure Routes	0.09

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.03	0.03
Cardiovascular System HI =		0.05	0.05
Skin HI =		0.02	0.02
Kidney HI =		0.04	0.04
Liver HI =		0.01	0.01
Respiratory System HI =	<0.01		<0.01

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	1.6E-06	--	3.2E-07	--	1.9E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.03	--	<0.01	0.03
			Vanadium	--	--	--	--	--	GIS / Kidney	0.04	--	<0.01	0.05
			Chemical Total	1.6E-06	--	3.2E-07	--	1.9E-06		0.12	--	<0.01	0.13
		Exposure Point Total						1.9E-06					0.13
	Exposure Medium Total							1.9E-06					0.13
	Air	Fugative Dust	Arsenic	--	7.7E-10	--	--	7.7E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	6.5E-09	--	--	6.5E-09	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	7.3E-09	--	--	7.3E-09		--	<0.01	--	<0.01
		Exposure Point Total						7.3E-09					<0.01
	Exposure Medium Total							7.3E-09					<0.01
Soil (2010) Total								**1.92E-06**					**0.13**

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Sediment (2010)	Sediment (2010)	Sediment (2010)	Arsenic	1.8E-06	--	5.2E-07	--	2.3E-06		Skin / CVS	0.01	--	<0.01	0.01
			Cadmium	--	--	--	--	--		Kidney	0.01	--	<0.01	0.02
			Cobalt	--	--	--	--	--		CVS	0.05	--	<0.01	0.05
			Lead	--	--	--	--	--		NA	--	--	--	--
			Thallium	--	--	--	--	--		Liver / CVS / Skin	0.01	--	<0.01	0.01
			Vanadium	--	--	--	--	--		GIS / Kidney	0.05	--	<0.01	0.05
			Chemical Total	1.8E-06	--	5.2E-07	--	2.3E-06			0.13	--	0.02	0.15
		Exposure Point Total						2.3E-06						0.15
	Exposure Medium Total							2.3E-06						0.15
Sediment (2010) Total								**2.28E-06**						**0.15**
On-Site Workers Total								**4.20E-06**						**0.28**

Total Risk Across Soil (2010)	1.9E-06	Total Hazard Index Across Soil (2010)	0.13
Total Risk Across Sediment (2010)	2.3E-06	Total Hazard Index Across Sediment (2010)	0.15
Total Risk Across All Media and All Exposure Routes	4.2E-06	Total Hazard Index Across All Media and All Exposure Routes	0.28

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.10	0.10
Cardiovascular System HI =		0.17	0.17
Skin HI =		0.07	0.07
Kidney HI =		0.12	0.12
Liver HI =		0.05	0.05
Respiratory System HI =	<0.01		<0.01

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)											
			Arsenic	1.6E-06	--	3.2E-07	--	1.9E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.03	--	<0.01	0.03
			Vanadium	--	--	--	--	--	GIS / Kidney	0.04	--	<0.01	0.05
			Chemical Total	1.6E-06	--	3.2E-07	--	1.9E-06		0.12	--	<0.01	0.13
		Exposure Point Total						1.9E-06					0.13
	Exposure Medium Total							1.9E-06					0.13
	Air	Fugative Dust											
			Arsenic	--	7.8E-10	--	--	7.8E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	6.6E-09	--	--	6.6E-09	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	7.4E-09	--	--	7.4E-09		--	<0.01	--	<0.01
		Exposure Point Total						7.4E-09					<0.01
	Exposure Medium Total							7.4E-09					<0.01
Soil (2010) Total								**1.92E-06**					**0.13**

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Groundwater	Groundwater	Tap	Arsenic	2.9E-06	--	--	--	2.9E-06	Skin / CVS	0.02	--	--	0.02
			Barium	--	--	--	--	--	Kidney	0.03	--	--	0.03
			Cobalt	--	--	--	--	--	CVS	0.36	--	--	0.36
			Chemical Total	2.9E-06	--	--	--	2.9E-06		0.41	--	--	0.41
		Exposure Point Total						2.9E-06					0.41
	Exposure Medium Total							2.9E-06					0.41
Groundwater Total								**2.94E-06**					**0.41**
Industrial / Commercial Workers Total								**4.85E-06**					**0.54**

Total Risk Across Soil (2010)	1.9E-06	Total Hazard Index Across Soil (2010)	0.13
Total Risk Across Groundwater	2.9E-06	Total Hazard Index Across Groundwater	0.41
Total Risk Across All Media and All Exposure Routes	4.9E-06	Total Hazard Index Across All Media and All Exposure Routes	0.54

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.05	0.05
Cardiovascular System HI =		0.47	0.47
Skin HI =		0.06	0.06
Kidney HI =		0.07	0.07
Liver HI =		0.03	0.03
Respiratory System HI =	<0.01		<0.01

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	2.1E-06	--	2.6E-07	--	2.4E-06	Skin / CVS	0.01	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.06	--	<0.01	0.06
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.04	--	<0.01	0.05
			Vanadium	--	--	--	--	--	GIS / Kidney	0.06	--	<0.01	0.06
			Chemical Total	2.1E-06	--	2.6E-07	--	2.4E-06		0.17	--	<0.01	0.18
		Exposure Point Total						2.4E-06					0.18
	Exposure Medium Total							2.4E-06					0.18
	Air	Fugative Dust	Arsenic	--	3.1E-09	--	--	3.1E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	2.6E-08	--	--	2.6E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	2.9E-08	--	--	2.9E-08		--	<0.01	--	<0.01
		Exposure Point Total						2.9E-08					<0.01
	Exposure Medium Total							2.9E-08					<0.01
Soil (2010) Total								**2.43E-06**					**0.18**
Groundwater	Groundwater	Tap	Arsenic	7.9E-06	--	4.1E-08	--	7.9E-06	Skin / CVS	0.05	--	<0.01	0.05
			Barium	--	--	--	--	--	Kidney	0.08	--	<0.01	0.09
			Cobalt	--	--	--	--	--	CVS	1.00	--	<0.01	**1.01**
			Chemical Total	7.9E-06	--	4.1E-08	--	7.9E-06		1.14	--	<0.01	**1.14**
		Exposure Point Total						7.9E-06					**1.14**
	Exposure Medium Total							7.9E-06					**1.14**
Groundwater (2010) Total								**7.93E-06**					**1.14**

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment (2010)	Sediment	Sediment	Arsenic	3.5E-07	--	1.8E-07	--	5.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.01	--	<0.01	0.01
			Chemical Total	3.5E-07	--	1.8E-07	--	5.3E-07		0.03	--	<0.01	0.03
		Exposure Point Total						5.3E-07					0.03
	Exposure Medium Total							5.3E-07					0.03
Sediment (2010) Total								**5.32E-07**					**0.03**
Adult Residents Total								**1.09E-05**					**1.36**

Total Risk Across Soil (2010)	2.4E-06	Total Hazard Index Across Soil (2010)	0.18
Total Risk Across Groundwater	7.9E-06	Total Hazard Index Across Groundwater	**1.1**
Total Risk Across Sediment (2010)	5.3E-07	Total Hazard Index Across Sediment (2010)	0.03
Total Risk Across All Media and All Exposure Routes	1.1E-05	Total Hazard Index Across All Media and All Exposure Routes	**1.4**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.07	0.07
Cardiovascular System HI =		**1.2**	**1.2**
Skin HI =		0.12	0.12
Kidney HI =		0.16	0.16
Liver HI =		0.05	0.05
Respiratory System HI =	<0.01		<0.01

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	5.0E-06	--	4.2E-07	--	5.4E-06	Skin / CVS	0.13	--	0.01	0.14
			Cobalt	--	--	--	--	--	CVS	0.52	--	0.01	0.54
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.41	--	0.01	0.42
			Vanadium	--	--	--	--	--	GIS / Kidney	0.55	--	0.02	0.57
			Chemical Total	5.0E-06	--	4.2E-07	--	5.4E-06		1.62	--	0.05	**1.67**
		Exposure Point Total						5.4E-06					**1.67**
	Exposure Medium Total							5.4E-06					**1.67**
	Air	Fugative Dust	Arsenic	--	7.7E-10	--	--	7.7E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	6.5E-09	--	--	6.5E-09	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	7.3E-09	--	--	7.3E-09		--	<0.01	--	<0.01
		Exposure Point Total						7.3E-09					<0.01
	Exposure Medium Total							7.3E-09					<0.01
Soil (2010) Total								**5.42E-06**					**1.67**
Groundwater	Groundwater	Tap	Arsenic	4.6E-06	--	3.0E-08	--	4.6E-06	Skin / CVS	0.12	--	<0.01	0.12
			Barium	--	--	--	--	--	Kidney	0.19	--	0.02	0.20
			Cobalt	--	--	--	--	--	CVS	2.34	--	<0.01	**2.35**
			Chemical Total	4.6E-06	--	3.0E-08	--	4.6E-06		2.65	--	0.02	**2.67**
		Exposure Point Total						4.6E-06					**2.67**
	Exposure Medium Total							4.6E-06					**2.67**
Groundwater Total								**4.63E-06**					**2.67**

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment (2010)	Sediment	Sediment	Arsenic	8.2E-07	--	1.0E-07	--	9.2E-07	Skin / CVS	0.02	--	<0.01	0.02
			Cadmium	--	--	--	--	--	Kidney	0.03	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.09	--	<0.01	0.10
			Lead	--	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.02	--	<0.01	0.02
			Vanadium	--	--	--	--	--	GIS / Kidney	0.09	--	<0.01	0.10
			Chemical Total	8.2E-07	--	1.0E-07	--	9.2E-07		0.25	--	0.01	0.27
		Exposure Point Total						9.2E-07					0.27
	Exposure Medium Total							9.2E-07					0.27
Sediment (2010) Total								**9.24E-07**					**0.27**
Young Child Residents Total								**1.10E-05**					**4.61**

Total Risk Across Soil (2010)	5.4E-06	Total Hazard Index Across Soil (2010)	**1.7**
Total Risk Across Groundwater	4.6E-06	Total Hazard Index Across Groundwater	**2.7**
Total Risk Across Sediment (2010)	9.2E-07	Total Hazard Index Across Sediment (2010)	0.27
Total Risk Across All Media and All Exposure Routes	1.1E-05	Total Hazard Index Across All Media and All Exposure Routes	**4.6**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.67	0.67
Cardiovascular System HI =		**3.7**	**3.7**
Skin HI =		0.73	0.73
Kidney HI =		0.90	0.90
Liver HI =		0.44	0.44
Respiratory System HI =	<0.01		<0.01

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	2.1E-07	--	1.9E-08	--	2.3E-07	Skin / CVS	0.03	--	<0.01	0.04
			Cobalt	--	--	--	--	--	CVS	0.13	--	<0.01	0.14
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.10	--	<0.01	0.11
			Vanadium	--	--	--	--	--	GIS / Kidney	0.14	--	<0.01	0.14
			Chemical Total	2.1E-07	--	1.9E-08	--	2.3E-07		0.41	--	0.01	0.42
		Exposure Point Total						2.3E-07					0.42
	Exposure Medium Total							2.3E-07					0.42
	Air	Fugative Dust	Arsenic	--	1.4E-08	--	--	1.4E-08	NA	--	0.02	--	0.02
			Cobalt	--	1.2E-07	--	--	1.2E-07	RsS	--	0.16	--	0.16
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	1.3E-07	--	--	1.3E-07		--	0.17	--	0.17
		Exposure Point Total						1.3E-07					0.17
	Exposure Medium Total							1.3E-07					0.17
Soil (2010) Total								**3.64E-07**					**0.59**

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Groundwater	Groundwater	Tap	Arsenic	4.7E-10	--	1.5E-10	--	6.2E-10	Skin / CVS	<0.01	--	<0.01	<0.01
			Barium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Chemical Total	4.7E-10	--	1.5E-10	--	6.2E-10		<0.01	--	<0.01	<0.01
		Exposure Point Total						6.2E-10					<0.01
	Exposure Medium Total							6.2E-10					<0.01
Groundwater Total								**6.25E-10**					**<0.01**
Construction Workers Total								**3.65E-07**					**0.60**

Total Risk Across Soil (2010)	3.6E-07	Total Hazard Index Across Soil (2010)	0.59
Total Risk Across Groundwater	6.2E-10	Total Hazard Index Across Groundwater	0.0
Total Risk Across All Media and All Exposure Routes	3.6E-07	Total Hazard Index Across All Media and All Exposure Routes	0.60

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.14	0.14
Cardiovascular System HI =		0.28	0.28
Skin HI =		0.14	0.14
Kidney HI =		0.14	0.14
Liver HI =		0.11	0.11
Respiratory System HI =	0.16		0.16

TABLE 10.1.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Arsenic	7.9E-06	--	4.1E-08	--	7.9E-06	Skin / CVS	0.05	--	<0.01	0.05
			Barium	--	--	--	--	--	Kidney	0.08	--	<0.01	0.09
			Cobalt	--	--	--	--	--	CVS	1.00	--	<0.01	**1.01**
			Chemical Total	7.9E-06	--	4.1E-08	--	7.9E-06		1.14	--	<0.01	**1.14**
		Exposure Point Total						7.9E-06					**1.14**
	Exposure Medium Total							7.9E-06					**1.14**
Groundwater Total								**7.93E-06**					**1.14**
Adult Residents Total								**7.93E-06**					**1.14**

Total Risk Across Groundwater	7.9E-06	Total Hazard Index Across Groundwater	**1.1**
Total Risk Across All Media and All Exposure Routes	7.9E-06	Total Hazard Index Across All Media and All Exposure Routes	**1.1**

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Cardiovascular System HI =		**1.1**	**1.1**
Skin HI =		0.05	0.05
Kidney HI =		0.09	0.09

TABLE 10.2.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 69 (AIRCRAFT PARKING AREA)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (2010)	Soil (2010)	Soil (2010)	Arsenic	5.0E-06	--	4.2E-07	--	5.4E-06	Skin / CVS	0.13	--	0.01	0.14
			Cobalt	--	--	--	--	--	CVS	0.52	--	0.01	0.54
			Thallium	--	--	--	--	--	Liver / CVS / Skin	0.41	--	0.01	0.42
			Vanadium	--	--	--	--	--	GIS / Kidney	0.55	--	0.02	0.57
			Chemical Total	5.0E-06	--	4.2E-07	--	5.4E-06		1.62	--	0.05	**1.67**
		Exposure Point Total						5.4E-06					**1.67**
	Exposure Medium Total							5.4E-06					**1.67**
Soil (2010) Total								**5.42E-06**					**1.67**
Groundwater	Groundwater	Tap	Arsenic	4.6E-06	--	3.0E-08	--	4.6E-06	Skin / CVS	0.12	--	<0.01	0.12
			Barium	--	--	--	--	--	Kidney	0.19	--	0.02	0.20
			Cobalt	--	--	--	--	--	CVS	2.34	--	<0.01	**2.35**
			Chemical Total	4.6E-06	--	3.0E-08	--	4.6E-06		2.65	--	0.02	**2.67**
		Exposure Point Total						4.6E-06					**2.67**
	Exposure Medium Total							4.6E-06					**2.67**
Groundwater Total								**4.63E-06**					**2.67**
Young Child Residents Total								**1.01E-05**					**4.34**

Total Risk Across Soil (2010)	5.4E-06	Total Hazard Index Across Soil (2010)	**1.7**
Total Risk Across Groundwater	4.6E-06	Total Hazard Index Across Groundwater	**2.7**
Total Risk Across All Media and All Exposure Routes	1.0E-05	Total Hazard Index Across All Media and All Exposure Routes	**4.3**

Notes:

Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		0.57	0.57
Cardiovascular System HI =		**3.6**	**3.6**
Skin HI =		0.68	0.68
Kidney HI =		0.77	0.77
Liver HI =		0.42	0.42

APPENDIX L
BACKGROUND RISK

2008 CORRECTIVE MEASURES STUDY INVESTIGATION HHRA

APPENDIX L
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL)
Surface Soil									
	Arsenic	mg/kg	1.18	1.49 (NP)	2.5 J	1.49	mg/kg	95% UCL (NP)	95% KM (t) UCL
	Cobalt	mg/kg	22.8	27.3 (NP)	50.2 J	27.3	mg/kg	95% UCL (NP)	95% KM (BCA) UCL
	Thallium	mg/kg	0.186	Not Determined	0.1 J	0.10	mg/kg	Max	Less than 4 detections
	Vanadium	mg/kg	142	166 (NP)	230	166	mg/kg	95% UCL (NP)	95% KM (t) UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(NP) - Non-parametric distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

APPENDIX L
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Total Soil (Airfield)
Exposure Medium: Total Soil (Airfield)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL)
Total Soil (Airfield)	Arsenic	mg/kg	0.996	1.18 (NP)	2.5 J	1.18	mg/kg	95% UCL (NP)	95% KM (t) UCL
	Cobalt	mg/kg	18.2	30.1 (NP)	78	30.1	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
	Thallium	mg/kg	0.244	Not Determined	0.29 J	0.290	mg/kg	Max	Less than 4 detections
	Vanadium	mg/kg	176	200 (NP)	410	200	mg/kg	95% UCL (NP)	95% KM (BCA) UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(NP) - Non-parametric distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

APPENDIX L
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater									
	Antimony	µg/L	11.0	9.20 (NP)	14.2 J	0.00920	mg/L	95% UCL (NP)	95% KM (t) UCL
	Arsenic	µg/L	4.99	9.10 (NP)	22.4 J	0.00910	mg/L	95% UCL (NP)	95% KM (t) UCL
	Cadmium	µg/L	9.0	18.6 (NP)	53.1	0.0186	mg/L	95% UCL (NP)	95% KM (t) UCL
	Cobalt	µg/L	152	586 (NP)	778	0.586	mg/L	95% UCL (NP)	97.5% KM (Chebyshev) UCL
	Copper	µg/L	114	172 (NP)	352	0.172	mg/L	95% UCL (NP)	95% KM (t) UCL
	Lead	µg/L	7.49	15.0 (NP)	32.5 J	0.0150	mg/L	95% UCL (NP)	95% KM (BCA) UCL
	Mercury	µg/L	0.0677	Not Determined	0.21	0.00021	mg/L	Max	Less than 4 detections
	Nickel	µg/L	40.3	55.6 (NP)	86.9	0.0556	mg/L	95% UCL (NP)	95% KM (t) UCL
	Selenium	µg/L	6.87	Not Determined	42.7 J	0.0427	mg/L	Max	Less than 4 detections
	Silver	µg/L	3.76	Not Determined	30.1	0.0301	mg/L	Max	Less than 4 detections
	Vanadium	µg/L	161	249 (NP)	549	0.249	mg/L	95% UCL (NP)	95% KM (t) UCL

Notes:

UCL = Upper Confidence Level

(1) Distribution and 95% UCL were calculated by ProUCL for data sets with greater than 8 samples and greater than 4 detections.
(NP) - Non-parametric distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL) or the maximum detected.

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil											
			Arsenic	1.6E-07	--	1.9E-08	--	1.7E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.48	--	0.74	**1.22**
			Chemical Total	1.6E-07	--	1.9E-08	--	1.7E-07		0.50	--	0.74	**1.24**
		Exposure Point Total						1.7E-07					**1.24**
	Exposure Medium Total							1.7E-07					**1.24**
	Air	Fugative Dust											
			Arsenic	--	1.9E-11	--	--	1.9E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	7.2E-10	--	--	7.2E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	7.4E-10	--	--	7.4E-10		--	<0.01	--	<0.01
		Exposure Point Total						7.4E-10					<0.01
	Exposure Medium Total							7.4E-10					<0.01
Surface Soil Total								**1.75E-07**					**1.24**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	1.2E-07	--	1.5E-08	--	1.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.58	--	0.89	**1.47**
			Chemical Total	1.2E-07	--	1.5E-08	--	1.4E-07		0.60	--	0.89	**1.50**
		Exposure Point Total						1.4E-07					**1.50**
	Exposure Medium Total							1.4E-07					**1.50**
	Air	Fugative Dust	Arsenic	--	1.5E-11	--	--	1.5E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	7.9E-10	--	--	7.9E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	8.1E-10	--	--	8.1E-10		--	<0.01	--	<0.01
		Exposure Point Total						8.1E-10					<0.01
	Exposure Medium Total							8.1E-10					<0.01
Total Soil (Airfield) Total								**1.39E-07**					**1.50**
Adult Trespassers Total								**3.14E-07**					**2.74**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Surface Soil	1.8E-07	Total Hazard Index Across Surface Soil	**1.2**
Total Risk Across Total Soil (Airfield)	1.4E-07	Total Hazard Index Across Total Soil (Airfield)	**1.5**
Total Risk Across All Media and All Exposure Routes	3.1E-07	Total Hazard Index Across All Media and All Exposure Routes	**2.7**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**2.7**	**2.7**
Cardiovascular System HI =		0.04	0.04
Skin HI =		<0.01	<0.01
Kidney HI =		**2.7**	**2.7**
Respiratory System HI =	<0.01		<0.01

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil											
			Arsenic	1.1E-07	--	2.1E-08	--	1.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.03	--	<0.01	0.03
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.75	--	1.85	**2.60**
			Chemical Total	1.1E-07	--	2.1E-08	--	1.3E-07		0.78	--	1.85	**2.63**
		Exposure Point Total						1.3E-07					**2.63**
	Exposure Medium Total							1.3E-07					**2.63**
	Air	Fugative Dust											
			Arsenic	--	8.6E-12	--	--	8.6E-12	NA	--	<0.01	--	<0.01
			Cobalt	--	3.3E-10	--	--	3.3E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	3.4E-10	--	--	3.4E-10		--	<0.01	--	<0.01
		Exposure Point Total						3.4E-10					<0.01
	Exposure Medium Total							3.4E-10					<0.01
Surface Soil Total								**1.33E-07**					**2.63**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: Trespassers
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	8.8E-08	--	1.7E-08	--	1.0E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.03	--	<0.01	0.03
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.90	--	2.23	**3.13**
			Chemical Total	8.8E-08	--	1.7E-08	--	1.0E-07		0.94	--	2.23	**3.17**
		Exposure Point Total						1.0E-07					**3.17**
	Exposure Medium Total							1.0E-07					**3.17**
	Air	Fugative Dust	Arsenic	--	6.8E-12	--	--	6.8E-12	NA	--	<0.01	--	<0.01
			Cobalt	--	3.6E-10	--	--	3.6E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	3.7E-10	--	--	3.7E-10		--	<0.01	--	<0.01
		Exposure Point Total						3.7E-10					<0.01
	Exposure Medium Total							3.7E-10					<0.01
Total Soil (Airfield) Total								**1.05E-07**					**3.17**
Youth Trespassers Total								**2.38E-07**					**5.80**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Surface Soil	1.3E-07	Total Hazard Index Across Surface Soil	**2.6**
Total Risk Across Total Soil (Airfield)	1.1E-07	Total Hazard Index Across Total Soil (Airfield)	**3.2**
Total Risk Across All Media and All Exposure Routes	2.4E-07	Total Hazard Index Across All Media and All Exposure Routes	**5.8**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**5.7**	**5.7**
Cardiovascular System HI =		0.07	0.07
Skin HI =		<0.01	<0.01
Kidney HI =		**5.7**	**5.7**
Respiratory System HI =	<0.01		<0.01

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil											
			Arsenic	7.8E-07	--	1.5E-07	--	9.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.09	--	<0.01	0.09
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.32	--	5.89	**8.21**
			Chemical Total	7.8E-07	--	1.5E-07	--	9.4E-07		2.41	--	5.90	**8.31**
		Exposure Point Total						9.4E-07					**8.31**
	Exposure Medium Total							9.4E-07					**8.31**
	Air	Fugative Dust											
			Arsenic	--	3.8E-10	--	--	3.8E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.4E-08	--	--	1.4E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.5E-08	--	--	1.5E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.5E-08					<0.01
	Exposure Medium Total							1.5E-08					<0.01
Surface Soil Total								**9.50E-07**					**8.31**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Current, Future
Receptor Population: On-Site Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	6.2E-07	--	1.2E-07	--	7.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.10
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.80	--	7.10	**9.89**
			Chemical Total	6.2E-07	--	1.2E-07	--	7.4E-07		2.90	--	7.10	**10.00**
		Exposure Point Total						7.4E-07					**10.00**
	Exposure Medium Total							7.4E-07					**10.00**
	Air	Fugative Dust	Arsenic	--	3.0E-10	--	--	3.0E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.6E-08	--	--	1.6E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.6E-08					<0.01
	Exposure Medium Total							1.6E-08					<0.01
Total Soil (Airfield) Total								**7.57E-07**					**10.00**
On-Site Workers Total								**1.71E-06**					**18.32**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Surface Soil	9.5E-07	Total Hazard Index Across Surface Soil	**8.3**
Total Risk Across Total Soil (Airfield)	7.6E-07	Total Hazard Index Across Total Soil (Airfield)	**10.0**
Total Risk Across All Media and All Exposure Routes	1.7E-06	Total Hazard Index Across All Media and All Exposure Routes	**18.3**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**18.1**	**18.1**
Cardiovascular System HI =		0.21	0.21
Skin HI =		0.01	0.01
Kidney HI =		**18.1**	**18.1**
Respiratory System HI =	<0.01		<0.01

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Arsenic	1.0E-06	--	1.3E-07	--	1.2E-06	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.12	--	<0.01	0.13
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.25	--	4.99	**8.23**
			Chemical Total	1.0E-06	--	1.3E-07	--	1.2E-06		3.38	--	4.99	**8.37**
		Exposure Point Total						1.2E-06					**8.37**
	Exposure Medium Total							1.2E-06					**8.37**
	Air	Fugative Dust	Arsenic	--	1.5E-09	--	--	1.5E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	5.8E-08	--	--	5.8E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	6.0E-08	--	--	6.0E-08		--	<0.01	--	<0.01
		Exposure Point Total						6.0E-08					<0.01
	Exposure Medium Total							6.0E-08					<0.01
Surface Soil Total								**1.23E-06**					**8.38**
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	8.3E-07	--	1.0E-07	--	9.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.14	--	<0.01	0.14
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.91	--	6.01	**9.92**
			Chemical Total	8.3E-07	--	1.0E-07	--	9.3E-07		4.06	--	6.01	**10.07**
		Exposure Point Total						9.3E-07					**10.07**
	Exposure Medium Total							9.3E-07					**10.07**
	Air	Fugative Dust	Arsenic	--	1.2E-09	--	--	1.2E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	6.4E-08	--	--	6.4E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	6.5E-08	--	--	6.5E-08		--	<0.01	--	<0.01
		Exposure Point Total						6.5E-08					<0.01
	Exposure Medium Total							6.5E-08					<0.01
Total Soil (Airfield) Total								**9.96E-07**					**10.07**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap											
			Antimony	--	--	--	--	--	Whole Body, CVS	0.63	--	0.02	0.65
			Arsenic	1.3E-04	--	6.7E-07	--	**1.3E-04**	Skin / CVS	0.83	--	<0.01	0.84
			Cadmium	--	--	--	--	--	Kidney	1.02	--	0.18	**1.20**
			Cobalt	--	--	--	--	--	CVS	53.52	--	0.11	**53.63**
			Copper	--	--	--	--	--	GIS	0.12	--	<0.01	0.12
			Lead	--	--	--	--	--	NA	--	--	--	--
			Mercury	--	--	--	--	--	ImS	0.04	--	<0.01	0.04
			Nickel	--	--	--	--	--	Whole Body	0.08	--	<0.01	0.08
			Selenium	--	--	--	--	--	Skin	0.23	--	<0.01	0.24
			Silver	--	--	--	--	--	Skin	0.16	--	0.01	0.18
			Vanadium	--	--	--	--	--	GIS / Kidney	97.46	--	19.57	**117.02**
			Chemical Total	1.3E-04	--	6.7E-07	--	**1.3E-04**		154.08	--	19.90	**173.98**
		Exposure Point Total						**1.3E-04**					**173.98**
	Exposure Medium Total							**1.3E-04**					**173.98**
Groundwater Total								**1.29E-04**					**173.98**
Adult Residents Total								**1.31E-04**					**192.43**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Surface Soil	1.2E-06	Total Hazard Index Across Surface Soil	**8.4**
Total Risk Across Total Soil (Airfield)	1.0E-06	Total Hazard Index Across Total Soil (Airfield)	**10.1**
Total Risk Across Groundwater	**1.3E-04**	Total Hazard Index Across Groundwater	**174.0**
Total Risk Across All Media and All Exposure Routes	**1.3E-04**	Total Hazard Index Across All Media and All Exposure Routes	**192.4**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		0.73	0.73
Immune System HI =		0.04	0.04
Gastrointestinal System HI =		**135.3**	**135.3**
Cardiovascular System HI =		**55.4**	**55.4**
Skin HI =		**1.3**	**1.3**
Kidney HI =		**136.4**	**136.4**
Respiratory System HI =	<0.01		<0.01

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Arsenic	2.4E-06	--	2.1E-07	--	2.7E-06	Skin / CVS	0.06	--	<0.01	0.07
			Cobalt	--	--	--	--	--	CVS	1.16	--	0.03	**1.20**
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	30.32	--	32.65	**62.97**
			Chemical Total	2.4E-06	--	2.1E-07	--	2.7E-06		31.55	--	32.69	**64.24**
		Exposure Point Total						2.7E-06					**64.24**
	Exposure Medium Total							2.7E-06					**64.24**
	Air	Fugative Dust	Arsenic	--	3.8E-10	--	--	3.8E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.5E-08	--	--	1.5E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.5E-08	--	--	1.5E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.5E-08					<0.01
	Exposure Medium Total							1.5E-08					<0.01
Surface Soil Total								**2.67E-06**					**64.24**
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	1.9E-06	--	1.6E-07	--	2.1E-06	Skin / CVS	0.05	--	<0.01	0.05
			Cobalt	--	--	--	--	--	CVS	1.28	--	0.04	**1.32**
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	36.53	--	39.34	**75.87**
			Chemical Total	1.9E-06	--	1.6E-07	--	2.1E-06		37.86	--	39.38	**77.24**
		Exposure Point Total						2.1E-06					**77.24**
	Exposure Medium Total							2.1E-06					**77.24**
	Air	Fugative Dust	Arsenic	--	3.0E-10	--	--	3.0E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.6E-08	--	--	1.6E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.6E-08					<0.01
	Exposure Medium Total							1.6E-08					<0.01
Total Soil (Airfield) Total								**2.12E-06**					**77.25**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap											
			Antimony	--	--	--	--	--	Whole Body, CVS	1.47	--	0.06	**1.54**
			Arsenic	7.5E-05	--	4.9E-07	--	7.5E-05	Skin / CVS	1.94	--	0.01	**1.95**
			Cadmium	--	--	--	--	--	Kidney	2.38	--	0.52	**2.90**
			Cobalt	--	--	--	--	--	CVS	124.87	--	0.33	**125.20**
			Copper	--	--	--	--	--	GIS	0.27	--	<0.01	0.28
			Lead	--	--	--	--	--	NA	--	--	--	--
			Mercury	--	--	--	--	--	ImS	0.08	--	<0.01	0.09
			Nickel	--	--	--	--	--	Whole Body	0.18	--	<0.01	0.18
			Selenium	--	--	--	--	--	Skin	0.55	--	<0.01	0.55
			Silver	--	--	--	--	--	Skin	0.38	--	0.04	0.42
			Vanadium	--	--	--	--	--	GIS / Kidney	227.40	--	57.72	**285.12**
			Chemical Total	7.5E-05	--	4.9E-07	--	7.5E-05		359.52	--	58.71	**418.23**
		Exposure Point Total						7.5E-05					**418.23**
	Exposure Medium Total							7.5E-05					**418.23**
Groundwater Total								**7.53E-05**					**418.23**
Young Child Residents Total								**8.01E-05**					**559.72**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Surface Soil	2.7E-06	Total Hazard Index Across Surface Soil	**64.2**
Total Risk Across Total Soil (Airfield)	2.1E-06	Total Hazard Index Across Total Soil (Airfield)	**77.2**
Total Risk Across Groundwater	7.5E-05	Total Hazard Index Across Groundwater	**418.2**
Total Risk Across All Media and All Exposure Routes	8.0E-05	Total Hazard Index Across All Media and All Exposure Routes	**559.7**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		**1.7**	**1.7**
Immune System HI =		0.09	0.09
Gastrointestinal System HI =		**424.2**	**424.2**
Cardiovascular System HI =		**131.3**	**131.3**
Skin HI =		**3.0**	**3.0**
Kidney HI =		**426.9**	**426.9**
Respiratory System HI =	<0.01		<0.01

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil											
			Arsenic	7.8E-07	--	1.5E-07	--	9.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.09	--	<0.01	0.09
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.32	--	5.89	**8.21**
			Chemical Total	7.8E-07	--	1.5E-07	--	9.4E-07		2.41	--	5.90	**8.31**
		Exposure Point Total						9.4E-07					**8.31**
	Exposure Medium Total							9.4E-07					**8.31**
	Air	Fugative Dust											
			Arsenic	--	3.8E-10	--	--	3.8E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.4E-08	--	--	1.4E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.5E-08	--	--	1.5E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.5E-08					<0.01
	Exposure Medium Total							1.5E-08					<0.01
Surface Soil Total								**9.50E-07**					**8.31**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Industrial / Commercial Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	6.2E-07	--	1.2E-07	--	7.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.10
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.80	--	7.10	**9.89**
			Chemical Total	6.2E-07	--	1.2E-07	--	7.4E-07		2.90	--	7.10	**10.00**
		Exposure Point Total						7.4E-07					**10.00**
	Exposure Medium Total							7.4E-07					**10.00**
	Air	Fugative Dust	Arsenic	--	3.0E-10	--	--	3.0E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.6E-08	--	--	1.6E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.6E-08					<0.01
	Exposure Medium Total							1.6E-08					<0.01
Total Soil (Airfield) Total								**7.57E-07**					**10.00**
Industrial / Commercial Workers Total								**1.71E-06**					**18.32**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Surface Soil	9.5E-07	Total Hazard Index Across Surface Soil	**8.3**
Total Risk Across Total Soil (Airfield)	7.6E-07	Total Hazard Index Across Total Soil (Airfield)	**10.0**
Total Risk Across All Media and All Exposure Routes	1.7E-06	Total Hazard Index Across All Media and All Exposure Routes	**18.3**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**18.1**	**18.1**
Cardiovascular System HI =		0.21	0.21
Skin HI =		0.01	0.01
Kidney HI =		**18.1**	**18.1**
Respiratory System HI =	<0.01		<0.01

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Arsenic	1.0E-07	--	9.3E-09	--	1.1E-07	Skin / CVS	0.02	--	<0.01	0.02
			Cobalt	--	--	--	--	--	CVS	0.29	--	<0.01	0.30
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	7.66	--	8.84	**16.49**
			Chemical Total	1.0E-07	--	9.3E-09	--	1.1E-07		7.97	--	8.85	**16.81**
		Exposure Point Total						1.1E-07					**16.81**
	Exposure Medium Total							1.1E-07					**16.81**
	Air	Fugative Dust	Arsenic	--	7.0E-09	--	--	7.0E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	2.7E-07	--	--	2.7E-07	RsS	--	0.35	--	0.35
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	0.13	--	0.13
			Chemical Total	--	2.7E-07	--	--	2.7E-07		--	0.48	--	0.48
		Exposure Point Total						2.7E-07					0.48
	Exposure Medium Total							2.7E-07					0.48
Surface Soil Total								**3.87E-07**					**17.29**
Total Soil (Airfield)	Total Soil (Airfield)	Total Soil (Airfield)	Arsenic	8.2E-08	--	7.3E-09	--	8.9E-08	Skin / CVS	0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.32	--	<0.01	0.33
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	9.23	--	10.64	**19.87**
			Chemical Total	8.2E-08	--	7.3E-09	--	8.9E-08		9.56	--	10.66	**20.22**
		Exposure Point Total						8.9E-08					**20.22**
	Exposure Medium Total							8.9E-08					**20.22**
	Air	Fugative Dust	Arsenic	--	5.5E-09	--	--	5.5E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	3.0E-07	--	--	3.0E-07	RsS	--	0.38	--	0.38
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	0.15	--	0.15
			Chemical Total	--	3.0E-07	--	--	3.0E-07		--	0.54	--	0.54
		Exposure Point Total						3.0E-07					0.54
	Exposure Medium Total							3.0E-07					0.54
Total Soil (Airfield) Total								**3.90E-07**					**20.76**

APPENDIX L
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICC

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

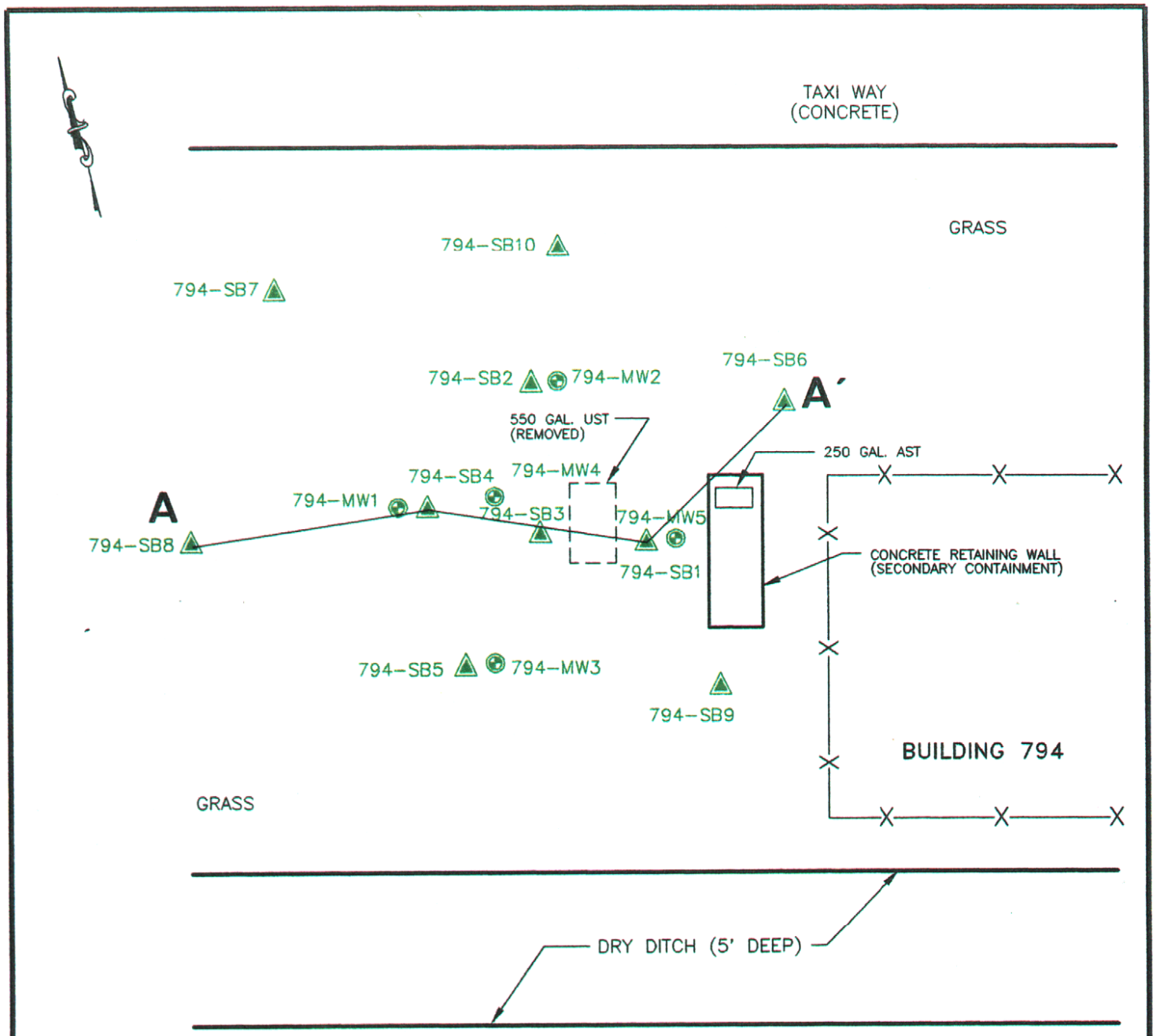
Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap											
			Antimony	--	--	--	--	--	Whole Body, CVS	<0.01	--	<0.01	<0.01
			Arsenic	7.6E-09	--	2.5E-09	--	1.0E-08	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	0.02	0.02
			Cobalt	--	--	--	--	--	CVS	0.08	--	0.01	0.09
			Copper	--	--	--	--	--	GIS	<0.01	--	<0.01	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Nickel	--	--	--	--	--	Whole Body	<0.01	--	<0.01	<0.01
			Selenium	--	--	--	--	--	Skin	<0.01	--	<0.01	<0.01
			Silver	--	--	--	--	--	Skin	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	0.14	--	1.77	**1.91**
			Chemical Total	7.6E-09	--	2.5E-09	--	1.0E-08		0.22	--	1.80	**2.02**
		Exposure Point Total						1.0E-08					**2.02**
	Exposure Medium Total							1.0E-08					**2.02**
Groundwater Total								**1.02E-08**					**2.02**
Construction Workers Total								**7.87E-07**					**40.07**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Surface Soil	3.9E-07	Total Hazard Index Across Surface Soil	**17.3**
Total Risk Across Total Soil (Airfield)	3.9E-07	Total Hazard Index Across Total Soil (Airfield)	**20.8**
Total Risk Across Groundwater	1.0E-08	Total Hazard Index Across Groundwater	**2.0**
Total Risk Across All Media and All Exposure Routes	7.9E-07	Total Hazard Index Across All Media and All Exposure Routes	**40.1**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		<0.01	<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**38.3**	**38.3**
Cardiovascular System HI =		0.76	0.76
Skin HI =		0.03	0.03
Kidney HI =		**38.3**	**38.3**
Respiratory System HI =	0.73		0.73

ATTACHMENT 1
UST 794 SITE CHARACTERIZATION SAMPLE LOCATIONS



LEGEND

794-MW3 MONITOR WELL INSTALLED BY BB&L (1994)

794-SB5 SOIL BORING INSTALLED BY BB&L (1994)

AST ABOVE GROUND STORAGE TANK

A ____ A' CROSS-SECTION LOCATION (SEE FIGURE 2-1)

GRASS

20 10 0 20

(IN FEET)
1 INCH = 20 FT.

MW-SB-LOC
8/24/94 27-JHD
3991015R/39910G01.DWG

SOURCE: BB&L 1994

BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

SITE 794

SOIL BORING AND MONITOR WELL LOCATIONS

FIGURE **3-1**