Baker

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

September 29, 2011

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

Attn: Mr. Adolph Everett, P.E.
Chief, RCRA Programs Branch

Re: Contract N62470-07-D-0502
IQC for A/E Services for Multi-Media
Environmental Compliance Engineering Support
Delivery Order (DO) 0002
U.S. Naval Activity Puerto Rico (NAPR)
EPA I.D. No. PR2170027203
Final Corrective Measures Study Report for SWMU 56

Dear Mr. Everett:

Michael Baker Jr., Inc. (Baker), on behalf of the Navy, is pleased to provide you with one hard copy of the replacement pages and one electronic copy provided on CD of the Final Corrective Measures Study Report for SWMU 56. Directions for inserting these replacement pages into your copy of the Revised Draft Corrective Measures Study Report are provided for your use. This document has been revised to address EPA comments dated March 11, 2011. The Navy 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. Mark E. Davidson at (843) 743-2135.

Sincerely,
MICHAEL BAKER JR., INC.

Mark E. Kimes

Mark E. Kimes, P.E.
Activity Coordinator

MEK
Attachments

cc: Ms. Debra Evans-Ripley, BRAC PMO SE (letter only)
Mr. Tim Gordon, US EPA Region II (1 hard copy and 1 CD)
Mr. Mark E. Davidson, BRAC PMO SE (1 hard copy and 1 CD)
Mr. David Criswell, BRAC PMO SE (letter only)
Mr. Pedro Ruiz, NAPR (1 hard copy and 1 CD)
Ms. Bonnie Capito, NAVFAC Atlantic – Code EV42 (1 hard copy for Admin. Record)
Mr. Carl Soderberg, US EPA Caribbean Office (1 hard copy and 1 CD)
Mr. Gloria Toro, PR EQB (1 hard copy and 1 CD)
Ms. Wilmarie Rivera, PREQB (1CD)
Mr. Felix Lopez, US F&WS (1CD)
Ms. Brenda Smith, TechLaw, Inc. (1 CD)

NAVY RESPONSE TO EPA COMMENTS (DATED MARCH 11, 2011) ON THE REVISED DRAFT CORRECTIVE MEASURES STUDY REPORT FOR SWMU 56 DATED OCTOBER 29, 2010

The following comments were generated based on review of the *Revised Draft Corrective Measures Study Report SWMU 56* (Revised Draft CMS Report), Naval Activity Puerto Rico (NAPR) Ceiba, Puerto Rico originally submitted to EPA on October 29, 2010 and on a review of the October 29, 2010 Navy Response to EPA's January 15, 2009 Comments on the *Draft Corrective Measures Study Report – SWMU 56*, dated September 26, 2008. EPA comments are provided in italics and the Navy response is provided in regular print.

EPA COMMENTS

GENERAL COMMENTS

EPA General Comment 1[from EPA's January 15, 2009 Comment Letter]: *Surface soil samples collected along the drainage ditch at soil borings 56SB06 and 56SB07 contained metals in excess of the corrective action objectives (CAOs) established for surface soils. These were the only surface soil samples collected over an approximate 1,200-foot stretch of the ditch (between drainage ditch segments C-D, D-E, and nearly all of E-F). According to Section 4.1, Surface and Subsurface Soil Sampling, these borings were installed to determine if contamination in the drainage ditch had migrated to the subsurface soil or groundwater. The potential source(s) of the detected metals is not discussed in the Draft CMS Report. Therefore, it is not clear that NAPR considers the drainage ditch as the source of the surface soil contamination at 56SB06 and 56SB07. Furthermore, it is not clear whether surface soil has been impacted in other areas along the course of the drainage ditch or not. Revise the Draft CMS Report to discuss potential source(s) of the metals present in the surface soil at 56SB06 and 56SB07. Based on this discussion, provide for additional characterization of the surface soils adjacent to the drainage ditch, or explain why additional characterization of the surface soils is not warranted.*

Navy Response: The metals detected in surface soil at soil boring locations 56SB06 and 56SB07 in excess of corrective action objectives (CAOs) were selenium and vanadium. Since submittal of the draft CMS report for SWMU 56, a background airfield soil data set has been established and incorporated into the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010) as Addendum B. Statistical evaluations performed on the SWMU 56 surface soil and background airfield soil data sets, which will be summarized within Table 7-27 of the revised CMA report, show that these two metals were not detected in SWMU 56 surface soil at concentrations statistically elevated above background levels. Based on the above mentioned statistical evaluations, CAOs will not be developed for these two metals within the revised CMS report and, therefore, additional characterization of surface soils adjacent to the drainage ditch is not warranted.

Evaluation of the Response to EPA General Comment 1: *The response is partially adequate. The response states that the additional characterization of the surface soils adjacent to the drainage ditch is not warranted because selenium and vanadium were not detected in SWMU 56 surface soil at concentrations statistically elevated above background levels. The background airfield soil data set was established and incorporated into the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010), which was developed after the Draft Corrective Measures Study Report for SWMU 56, dated September 26, 2008, was initially submitted. The response does not indicate that the background study information will be incorporated into the CMS. Revise Section 4.1, Surface and Subsurface Soil Sampling, to include a discussion of the statistical evaluations of* *background levels of selenium and vanadium with respect to the detected concentrations in samples collected from soil boring locations 56SB06 and 56SB07.*

Navy Response: As indicated in the original response, "Statistical evaluations performed on the SWMU 56 surface soil and background airfield soil data sets, which [are] summarized within Table 7-27 of the revised CMS report, show that these two metals were not detected in SWMU 56 surface soil at concentrations statistically elevated above background levels." The statistical evaluation presented in Table 7-27 (Section 7.9.1) reflects the incorporation of the background study information into the CMS. In addition, background data are incorporated into the human health risk evaluation (Sections 8.3.1 and 8.3.5).

As Section 4.1, Surface and Subsurface Soil Sampling, is intended to present data collected at SWMU 56, and not intended compare that data to regulatory or background values, a discussion of the statistical evaluation of background levels of selenium and vanadium with respect to the detected concentrations in samples collected from soil boring locations 56SB06 and 56SB07 is not appropriate for this section. Comparisons of SWMU metals concentrations to background levels are provided in Section 6.0 (Analytical Results), Section 7.0 (Ecological Risk Assessment), and Section 8.0 (Human Health Risk Assessment).

It is recognized that Section 4.0 does include the discussion of the collection of sediment samples 56SD06 and 56SD07, which were incorporated into the background data set for drainage ditch sediment. As a result, the background data set is mentioned within Section 4.0. Details regarding the background data set for airfield soil and airfield drainage ditch sediment are provided in Addendum B and Addendum C of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010). Reference to this background report will be made in Section 4.0.

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

EPA General Comment 3 [from EPA's January 15, 2009 Comment Letter]: *Risk and hazard to future residential populations were not evaluated in the site-specific human health risk assessment (HHRA). While this is consistent with the Final Corrective Measures Study Work Plan SWMU 56 dated December 6, 2007 (CMS 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. While Section 10.0, Justification and Recommendation of the Corrective Measure, recommends that institutional controls be put in place to prevent future residential exposure, specific land use controls are not discussed. Revise the HHRA to provide a thorough discussion of specific institutional controls that will be enacted.*

Navy Response: Future residential land use will conservatively be assumed for SWMU 56, 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 evaluated to provide the most conservatively protective risk estimation and for conservative comparison with other exposure scenarios. Section 8.0 text and associated tables, figures, and appendices will be revised accordingly.

Evaluation of the Response to EPA General Comment 3: *The response is partially adequate. The CMS was revised to evaluate risk and hazard to future hypothetical residents; however, some of the exposure factors used in the quantitative evaluation do not appear appropriate. Table 8-5, Summary of*

Exposure Parameters, indicates that an exposure duration (ED) of 24 years and an averaging time for non-carcinogens (AT_{NC}) of 8,760 days were used to evaluate site media exposures. Revise the HHRA to use an ED of 30 years to evaluate risk and hazard to future hypothetical adult residents (and thus an AT_{NC} of 10,950 days as AT_{NC}=EDx365 days/year), and update Table 8-5 and Section 8.3.2, Exposure Assessment accordingly.

Additionally, it appears that residential soil exposures were also evaluated using total soil data (i.e., data from 0-10 feet below ground surface [bgs]). If this approach is followed, the exposure point concentrations (EPCs) for future hypothetical residents (at a minimum) should be the maximum detected concentrations (MDC) at each sampling location rather than the 95% upper confidence limit (UCL) on the mean to be protective and ensure overestimation of the risk and hazards. Revise the HHRA accordingly, or provide sufficient justification for not following this approach. If the MDC is not used as the EPC when evaluating soil exposures, clarify why it is not necessary to resample at SWMU 56 in order to use the 95% UCL.

Navy Response: The ED value used in the HHRA for the future residential adult receptor was agreed upon in the January 9, 2009 conference call between the Navy, USEPA, and PREQB. The rationale for this value is as follows. The total lifetime ED of 30 years for the future residential receptor is divided into two parts. First, an ED of 6 years is evaluated for young children, which accounts for the period of lowest weight (and highest soil ingestion). Second, an ED of 24 years is assessed for older children and adults and uses an adult body weight (and lower soil ingestion rate). For the purpose of determining a total lifetime cancer risk for the future residential receptor, the cancer risk totals for the adult (24 year ED) and the young child (6 year ED) are summed and included in the HHRA as part of the discussion of potential human health effects. No revisions to Table 8-5 or Section 8.3.2 are proposed.

Regarding the evaluation of the soil exposure pathway, the Navy partially agrees with this comment. However, rather than using the MDC as the EPC, the approach used in the SWMU 56 HHRA will be revised as follows. Although the airfield surface and subsurface soil were reworked and the top layer of soil was removed and replaced with fill, it is recognized that there is still potential for exposure to the top layer of soil. Therefore, in order to conservatively account for potential exposure to surface soil (0 to 1 foot bgs) and total soil (0 to 10 feet bgs), COPCs will be selected from both surface soil and total soil. ProUCL will be used to calculate 95% UCLs (in the "with NDs" mode, as applicable) 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.

EPA General Comment 4 [from EPA's January 15, 2009 Comment Letter]: *The HHRA evaluated exposure to industrial workers based on surface and subsurface soil (0-10 ft below ground surface [bgs]) according to Section 8.2, Land Use and Potentially Exposed Receptors. However, page 6-1 of the CMS Work Plan indicates that industrial workers are only expected to encounter surface soil. Revise the HHRA to correct this deviation from the CMS Work Plan. Specifically, the HHRA should calculate risk and hazard to industrial workers based on surface soil (0-2 ft bgs).*

Navy Response: The deviation from the CMS Work Plan is acknowledged. However, after further evaluation of site conditions, it is noted that the surface soil and shallow subsurface soil have been extensively reworked at the airfield, and fill material has been emplaced during development of the airfield causing the loss of loamy, organic topsoil and mixing of surface and shallow subsurface soil. Construction of the airfield resulted in removal of the top layer of the land surface, subsequent replacement of soil with fill, and grading following final construction. As such, the assumption of a distinct layer of surface soil does not appear to be a valid application for the airfield. Therefore, surface soil and subsurface soil samples collected from SWMU 56 will be combined to create a total soil data set (0 to 10 feet bgs) for the purpose of evaluating potential human exposure. Section 8.0 text and associated tables, figures, and appendices will be revised accordingly.

Evaluation of the Response to EPA General Comment 4: *The response is partially adequate. Given that during the construction of the airfield surface and subsurface soil were extensively reworked causing complete removal of the top layer and the top layer was subsequently replaced with fill, combining the surface and subsurface soil data sets to create a total soil (0-10 feet bgs) data set may be appropriate to evaluate soil exposures to industrial workers. However, if this approach is followed, the EPCs for industrial workers (as with future hypothetical residents) should be the MDC at each sampling location rather than the 95% UCL on the mean to be protective and ensure overestimation of the risk and hazards. Revise the HHRA accordingly, or provide sufficient justification for not following this approach. If the MDC is not used as the EPC when evaluating soil exposures, clarify why it is not necessary to resample at SWMU 56 in order to use the 95% UCL.*

Navy Response: Refer to the Navy's response to Evaluation of the Response to EPA General Comment 3.

EPA General Comment 5 [from EPA's January 15, 2009 Comment Letter]: *It is unclear from the HHRA whether method detection limits (MDLs) were sufficiently sensitive to justify site 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. However, for SWMU 56, only two chemicals exceeded their detection limits. Arsenic in all media and vanadium in groundwater and surface water have maximum detection limits in excess of the screening levels. A discussion of these exceedances and associated uncertainties will be included in the uncertainties section (specifically, Section 8.3.5.2).

Evaluation of the Response to EPA General Comment 5: *The response is partially adequate. The report has been revised to indicate that reporting limits (RLs) exceed the human health screening levels for two compounds (i.e., arsenic and vanadium). However, the report does not include a table that compares the RLs [or preferably the sample quantitation limits (SQLs)] to human health risk-based screening criteria. Revise the CMS to include such a table.*

Additionally, the subsections of Section 8.3.5, Comparison to Background Levels, and 8.3.6, Sources of Uncertainty should be re-numbered and/or re-organized. The subsections of Section 8.3.5 are numbered "8.3.6.1" and the subsections of Section 8.3.6 are numbered "8.3.5.1." Revise these sections to correct subsection numbers and ensure references to these sections in the text are updated.

Navy Response: The RLs as well as the human health risk-based screening criteria can be found in Tables 2.1 through 2.6 found in Appendix L. The following sentence will be added to the third paragraph of Section 8.3.6.2:

> "For SWMU 56, arsenic in all media and vanadium in groundwater and surface water have maximum detection limits in excess of the RSLs (refer to Tables 2.1 through 2.5 found in Appendix L)."

Additionally, subsections of Section 8.3.5 and 8.3.6 will be revised to correct subsection numbers, and references to these sections in the text will be verified.

EPA General Comment 8 [from EPA's January 15, 2009 Comment Letter]: *The conceptual site model (CSM) discussed in the HHRA and depicted in Figure 8-1, Conceptual Site Model, indicates that surface water and sediment exposures to site workers (e.g., industrial/commercial workers, construction workers) were not considered complete exposure pathways. Please clarify why exposures to surface water and sediment to site workers are not considered to be associated with complete exposure pathways, or evaluate risk and hazard to site workers based on all relevant exposures to sediment and surface water.*

Navy Response: The Navy partially agrees with this comment. Industrial/commercial worker and construction worker exposures to surface water and sediment at SWMU 56 are potentially complete pathways. However, they are considered insignificant in relationship to total soil exposures. The source of surface water and sediment at SWMU 56 is a series of drainage ditches, and it is assumed that the amount of time spent in the ditches for these receptors would be minimal. Figure 8-1 will be revised to reflect that these exposure pathways are complete but insignificant. Also, as indicated in Navy response to EPA General Comment 3, future residential receptors will be added to the HHRA and will include evaluation of surface water/sediment exposure pathways as a conservative upper bound estimate of site risks from these media.

Evaluation of the Response to EPA General Comment 8: *The response is partially adequate. Section 8.3.6, Sources of Uncertainty, should present a comprehensive qualitative uncertainty analysis that justifies not quantitatively evaluating risk and hazard to industrial workers resulting from surface water and sediment exposures. While exposures are anticipated to be minimal, the lack of quantitatively evaluating surface water and sediment exposure pathways for industrial workers introduces uncertainty to the risk assessment.*

Navy Response: The following text will be added to Section 8.3.6:

> "It is acknowledged that industrial/commercial worker and construction worker exposures to surface water and sediment at SWMU 56 are potentially complete pathways. However, they are considered insignificant in relationship to soil exposures. The source of surface water and sediment at SWMU 56 is a series of drainage ditches, and it is assumed that the amount of time spent in the ditches for these receptors would be minimal. Also, future residential receptor exposures are evaluated in the HHRA and include evaluation of surface water/sediment exposure pathways as a conservative upper bound estimate of site risks from these media. As such, it is not expected that the lack of quantitative evaluation of risk and hazard to industrial workers resulting from surface water and sediment exposures significantly underestimates potential human health risks."

SPECIFIC COMMENTS

EPA Specific Comment 5: ***Section 7.4.1.2, Groundwater Screening Values, Page 7-18*** **[from EPA's January 15, 2009 Comment Letter]:** *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 effect (EC_{50}). The uncertainty factors noted in the CMS 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 CMS Work Plan. While an uncertainty factor of 30 is more protective, provide the rationale for this deviation from the CMS Work Plan in the revised Draft 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 LD_{50}, LC_{50}, and EC_{50} values and chronic-based LOAEL, LOEL, and LOEC values to chronic-based NOAEL, NOEC, or NOEL values (100 and 10, respectively [USEPA, 1997]), uncertainty factors were arbitrarily selected. Because Wentsel et al. (1996) provide uncertainty factors for converting a variety of acute toxicity values, including NOEL, NOEC, LOEL, and LOEC values to a chronic-based screening value, these uncertainty factors were in place of arbitrarily selected values within the draft CMS report.

Evaluation of the Response to EPA Specific Comment 5: *The Navy response is somewhat unclear. The response seems to indicate that arbitrary uncertainty factors were applied in the CMS work plan, but were then replaced in the Screening Level Ecological Risk Assessment (SLERA) by the Wentsel et al. (1996) uncertainty factors. The response is acceptable if this interpretation is correct. The response should be further clarified if this interpretation is incorrect.*

Navy Response: The above interpretation is correct.

EPA Specific Comment 9: ***Section 10.1.2, Sediment, Page 10-3*** **[from EPA's January 15, 2009 Comment Letter]:** *Section 10.1.2 indicates that in areas of the drainage ditch underlain by soil, sediments will be excavated to a depth of one foot. However, it is not clear why this approach will be protective of ecological receptors, since soil sampling in areas surrounding the drainage ditch showed some elevated concentrations of metals, including concentrations above sediment CAOs. For example, Table 6-2, Summary of Detected Laboratory Results – Subsurface Soil, shows concentrations of chromium, selenium and vanadium in subsurface soils at concentrations exceeding sediment CAOs. Based on these results, there is a concern that the sediments will be removed but soil may remain in place above the sediment CAOs. Thus the drainage channel will still contain metals at unacceptable levels. Revise the Draft CMS Report to propose confirmatory sampling as part of the sediment removal, or provide additional justification that future ecological receptors will be protected.*

Navy Response: The risk assessment model evaluates how ecological receptors may be exposed to chemicals originating from the site soils. 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. Removal of upper one foot strata of drainage ditch sediment eliminates the contaminant exposure pathway resulting in negligible risk to ecological receptor groups; terrestrial plants, avian and invertebrates. The excavated soil will be replaced to original ground surface with approved contaminant free soil.

Based on refined risk evaluation no detected chemicals were defined as ecological contaminants of concern for subsurface soils. If present, contaminants in the subsurface soils (one foot below ground surface) would not enter the terrestrial ecological food web.

Evaluation of the Response to EPA Specific Comment 9: *The response does not address the comment. It is problematic to excavate the impacted sediment from the unlined portions of the drainage ditch without confirmatory sampling of the side walls and the bottom to prove that the sediment Corrective Action Objectives (CAOs) have been attained throughout. Backfilling the excavated portions of the ditch with compacted, low-permeability soil may temporarily eliminate exposure to contaminants exceeding their CAOs at depth. The concern is that some of the backfilled areas may be washed away over time due to high rainfall events (e.g., tropical downpours associated with hurricanes), thereby re-exposing the potentially contaminated excavated side walls and the bottom of the drainage ditch. Revise the CMS to develop a post-excavation confirmatory sampling plan for the drainage ditch to address this issue.*

Navy Response: Post-excavation confirmatory sampling of the drainage ditch is not necessary to meet the sediment CAOs. The ecologically active zone is contained within the upper 6 inches of sediment. Sediment excavation in unlined portions of the drainage ditch (segments C-D and E-F) will extend to one foot below ground surface (i.e., excavation will be deeper than the biologically active zone as a conservative measure). To ensure the excavated sidewalls and bottom are not re-exposed by erosion, the implementation of the sediment excavation and disposal portion of the corrective measure has been revised to include installation of geotextile liner prior to backfill activities. Excavated sediments will then be replaced with one foot of clean fill in the form of compacted low permeability soil. As such, there will be no complete exposure pathway to any residual contamination that may be present below one foot. Moreover, additional engineering controls will be in place to protect the drainage ditch from erosion (e.g., the ditch invert will be armored with riprap). This will protect ecological receptors from future exposure to deeper sediments.

The following text will be added to the last paragraph in Section 10.1.2:

> "Following excavation, ditch segments C-D and E-F will be lined with geotextile to prevent re-exposure of the excavated sidewalls and bottom. Ditch segments C-D and E-F will then be backfilled with one foot of compacted low permeability soil to eliminate the ecological exposure pathway and graded to promote positive drainage. The ditch invert will be armored with riprap to prevent future erosion."

The third paragraph in Section 11.1 will be revised as follows:

> "Any contamination in excess of the CAOs that remain below the one foot excavation will not pose a risk to ecological receptors because the excavation will be lined with geotextile, backfilled with one foot of compacted low permeability soil, and armored with riprap."

The following bullet points were revised as follows:

- Line excavated area in segments C-D and E-F with geotextile and secure in place with stakes
- Backfill excavated area in segments C-D and E-F with one foot compacted low permeability soil and grade to promote positive drainage
- Backfill ditch segments C-D and E-F with clean aggregate riprap to provide future erosion resistance and simplify backfill installation

The following text will be added to the last paragraph in Section 11.1:

> "Lining the drainage ditch with geotextile, backfilling with compacted low permeability soil, and stabilizing with rip rap will remove the ecological exposure pathway to the remaining sediments and protect the drainage ditch from erosion."

Table 11-2 has been revised to include installation cost of geotextile liner.

EPA Specific Comment 10: *Section 11.1.1, Required Planning Documents, Page 11-3 3* [from EPA's January 15, 2009 Comment Letter]: *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. Typically, this information is documented in a stand-alone, 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).

Evaluation of the Response to EPA Specific Comment 10: *The response partially addresses the comment. The Navy states that EPA-approved "Master Project Plans" are available which cover the Project Management Plan (PMP), Data Collection Quality Assurance Plan (DCQAP), Data Management Plan (DMP), and the Health and Safety Plan (HSP). However, these Master Project Plans are not referenced in Section 11.1.1. Instead, several bullets outline elements to be included as part of a Corrective Active Project Plan. It is unclear how the Corrective Active Project Plan will reference the Master Project Plans, if at all. Revise the CMS to reference the Master Project Plans as the source for DCQAP, DMP, and HSP if these plans will not be specified in the individual site-specific project plans.*

Navy Response: Reference to the Master Project Plans will be added to the end of Section 11.1.1 as follows:

> "The corrective action will be conducted in accordance with Master Project Plans for Naval Station Roosevelt Roads, which includes the Project Management Plan (PMP), Data Collection Quality Assurance Plan (DCQAP), Data Management Plan (DMP), and the Health and Safety Plan (HSP) (Baker 1995 a-d, respectively)."

The references listed in Section 11.5 include:

> Baker. 1995a. Final Project Management Plan, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995
>
> Baker. 1995b. Final Data Collection Quality Assurance Plan, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995
>
> Baker. 1995c. Draft Data Management Plan, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995
>
> Baker. 1995d. Final Health and Safety Plan Addendum, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995

MINOR COMMENTS

EPA Minor Comment 2: ***Section 6.1, Surface Soils, Page 6-2*****[from EPA's January 15, 2009 Comment Letter]:** *The last paragraph in Section 6.1 states "Arsenic exceeded the background screening value in three samples and vanadium exceeded the screening value in two samples. Cadmium, chromium, cobalt, lead and vanadium exceeded the background screening value in one sample." The first sentence is correct per the data presented in Table 6-1, Summary of Detected Laboratory Results –*

Surface Soil. The second sentence incorrectly lists vanadium. Revise the Draft CMS Report to address this apparent discrepancy.

Navy Response: The third sentence of the last paragraph in Section 6.1 will be edited as such "Cadmium, chromium, cobalt and lead exceeded the background screening value in one sample". The reference to vanadium exceeding background in one sample will be deleted as vanadium exceeded background in two samples as mentioned in the prior sentence.

Evaluation of the Response to EPA Minor Comment 2: *The response is partially adequate. The original comment stated that "Arsenic exceeded the background screening value in three samples and vanadium exceeded the screening value in two samples. Cadmium, chromium, cobalt, lead and vanadium exceeded the background screening value in one sample." The response indicates that the last paragraph in Section 6.1, Surface Soils, was edited to state that "Cadmium, chromium, cobalt and lead exceeded the background screening value in one sample." The text presented in the revised CMS states that "Arsenic exceeded the background screening value in four samples (and one duplicate sample); lead exceeded background in two samples; cadmium, cobalt and vanadium exceeded the screening value in one sample." The previous comment indicated that the other exceedances in the section appeared correct as originally referenced; however, the number of screening value exceedances for arsenic, chromium and lead have been changed in addition to vanadium. Clarify why the number of noted screening value exceedances were revised and ensure that other values were not inadvertently changed.*

Navy Response: The text was checked against Table 6-1 and is correct as written. The numbers of screening value exceedances were revised between the Draft and Revised Draft CMS reports to reflect the inclusion of September 2008 data in the Revised Draft CMS (the Draft CMS only included April and May 2008 data). In addition, background values were changed from the basewide background surface soil values (used in the Draft CMS) to the airfield background soil values used in the Revised Draft CMS.

EPA Minor Comment 3: *Section 6.6.1, Summary of Detected Compounds in Field QA/QC Samples, Page 6-7* [from EPA's January 15, 2009 Comment Letter]: *The last paragraph in this section states "Six SVOCs (1,4-Dichlorobenzene, acetophenone, bis(2-ethylhexyl)phthalate, diethyl phthalate di-nbutyl phthalate, and phenol) were detected in ER01 (from a macro core liner), ER02 (stainless steel spoon) and ER05 and ER06 (groundwater sample tubing). Note that SVOCs were not analyzed for in ER06, ER07 and ER10." The second sentence is correct per Table 6-6, Summary of Detected Laboratory Results – Field QA/QC Summary. However, the first sentence should clarify that QA/QC samples from the groundwater sample tubing were designated ER04 and ER05, not ER05 and ER06. Revise the Draft CMS Report to address this apparent discrepancy.*

Navy Response: The last paragraph of Section 6.6.1 on Page 6-7 will be revised to state that QA/QC samples from the groundwater sample tubing were designated as ER04 and ER05 (not ER05 and ER06).

Evaluations of the Response to EPA Minor Comment 3: *The response is partially adequate. The original comment requested clarification on the analysis and naming of quality acceptance/quality control (QA/QC) samples in Table 6-6, Summary of Detected Laboratory Results - Field QA/QC Summary. The naming of the QA/QC samples has been clarified; however, additional changes within the text were made regarding the number of detections in samples. For example, in Table 6-6, acetone does not appear to have been detected in samples ER04 and ER05, though it is noted to have been detected in these samples in the text. Review and revise Section 6.6.1, Summary of Detected Compounds in Field QA/QC Samples, and Table 6-6, as necessary, to address these and other potential discrepancies.*

Navy Response: Section 6.6.1 will be reviewed and corrections to the text will be made to accurately describe the QA/QC results. The last paragraph of Section 6.6.1 will be revised to read as follows:

> "Eight equipment rinsate samples were collected as indicated on Table 6-6. The VOC acetone was detected in JUNE09-ER02, which was collected from a stainless steel spoon. The VOC toluene was detected in ER04 and ER05, which were collected from groundwater sampling tubing. Eight SVOCs (as shown on Table 6-6) were detected in ER01 (from a macro core liner), ER02 (stainless steel spoon), ER04 and ER05 (groundwater sample tubing) and/or JUNE09-ER02 (stainless steel spoon). Note that SVOCs were not analyzed for in ER06, ER07 and ER10. Five metals (arsenic, copper, lead, tin and vanadium) were detected in the equipment rinsate samples. There were no detections of metals in ER04, ER05, or JUNE09-ER10."

PREQB COMMENTS

GENERAL COMMENTS

PREQB Comment 1: *Please note that in addition to review the Navy's response to PREQB comments on the Draft Corrective Measures Study Report dated September 2008, a review of the Revised Draft Corrective Measures Study Report dated October 2010 was conducted due to the inclusion of new data and evaluation in the revised report. The responses to PREQB comments were evaluated in the context of reviewing the revised draft report. Where applicable, comments below indicate where the responses require additional clarification or revision, based on the information and data presented in the revised draft report.*

Navy Response: Comment is noted.

PREQB Comment 2: *A Pre-excavation Investigation was conducted in 2008 and a Supplemental Investigation was conducted in 2009. Please clarify the purpose and scope of the excavation activity and identify the location of where the excavation activities took place on relevant figures.*

Navy Response: Excavation activities were planned as part of an Interim Corrective Measure based on the results of the Draft CMS Report for SWMU 56 (Baker, September 26, 2008). Because of potentially changed site conditions, the Draft CMS Report for SWMU 56 was retracted on December 3, 2008 and the planned ICM (excavation of surface soil and sediment) was not implemented. The original intent of the Pre-Excavation Investigation conducted in September 2008 was to further delineate the extent of COCs identified in the Draft CMS in surface soil and sediment in support of the planned ICM. The purpose of the Supplemental Field Investigation conducted in June 2009 was to further delineate the distribution of potential COCs in the drainage ditch sediment, specifically from drainage ditch segments E-F and G-H. The location of samples associated with these investigations is shown on Figure 4-2.

The first paragraph of the Pre-Excavation Investigation subsection of Section 4.0 – CMS Investigation Activities will be revised to read as follows**:**

> This investigation was conducted in support of a planned (albeit not implemented) Interim Corrective Measure (ICM) and consisted of further delineation of the distribution of COCs identified in the Draft CMS Report for SWMU 56 in surface soil and sediment, The pre-excavation field investigation was conducted from September 24, 2008 to September 25, 2008 and involved the collection of surface soil and drainage ditch sediment. As shown on Figure 4-2

> a total of twelve surface soil samples (designated 56SS01 through 56SS12; collected from the 0.0 to 1.0-foot depth interval) and three drainage ditch sediment samples (designated 56SD12 through 56SD14) were collected. Also as depicted on Figure 4-2, sediment was collected from Drainage Ditch Segment E-F. Surface soil samples 56SS01 through 56SS06 were analyzed for lead and selenium and surface soil samples 56SS07 through 56SS12 were analyzed for selenium and vanadium, while each drainage ditch sediment sample was analyzed for Appendix IX metals.

The first paragraph of the Supplemental Field Investigation subsection of Section 4.0 – CMS Investigation Activities will be revised to read as follows:

> The purpose of the supplemental field investigation conducted on June 27, 2009 was to further delineate the distribution of potential COCs in the drainage ditch sediment. The Supplemental Field investigation involved the collection of eight sediment samples (designated 56SD15 through 56SD22), as shown on Figure 4-2. Sediment samples 56SD15, 56SD16, 56SD17, 56SD18, 56SD19, and 56SD20 were collected from Drainage Ditch Segment E-F, while sediment samples 56SD21 and 56SD22 were collected from Drainage Ditch Segment G-H (see Figure 4-2). Each sediment sample was analyzed for Appendix IX metals, acid volatile sulfide (AVS), and simultaneously extracted metals (SEM).

PREQB Comment 3: *There are notations throughout the report that the laboratory reported nondetect results down to the method detection limit (MDL) for all matrices. Tables 6-1 thru 6-6 and Appendix B show the laboratory data reported down to the MDL. As included on the comments for the September 2008 draft report, 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). EPA guidance states that "Because [sample quantitation limits (SQLs)] take into account sample characteristics, sample preparation and analytical adjustments, these values are the most relevant [quantitation limits] for evaluating non-detected chemicals (EPA, 1989)." Both of these documents ensure the use of the quantitation limit (or reporting limit) in all data evaluations. The Navy's response to comments indicated the use of the MDL was acceptable based on the laboratory's process for performing MDL studies. However, regardless of the procedure used by the laboratory, the MDL is a statistically derived value. The quantitation limits are accurately verified by laboratory analyses of standards at the unadjusted reporting limit with every initial calibration. Table 3-2 of the approved CMS Work Plan presented the quantitation limits that the laboratory was required to achieve, and not the MDLs. In addition, other sections of the approved CMS Work Plan (listed below) clearly indicated that reporting limits (not MDLs) would be used for the evaluation of the data during the ecological risk assessment.*

- *a. Section 5.1.2, Existing Analytical Data, of the approved CMS Work Plan discusses the use of reporting limits.*
- *b. Section 5.3.1 (Selection Criteria for Analytical Data) of the approved CMS Work Plan states that maximum reporting limits will be conservatively used to estimate exposure for non-detected chemicals. Note that several sections of the CMS Report state that maximum MDLs were conservatively used, and not reporting limits.*
- *c. Section 5.3.2 (Exposure Point Concentration – Abiotic Media) of the approved CMS Work Plan states that for conservatism, the maximum reporting limit for chemicals that were analyzed for but not detected also will be compared to medium-specific screening values and (where applicable) used for food web exposure modeling. This will be done to ensure that reporting limits are similar to, or less than, chemical concentrations at which potential adverse effects to ecological receptors may occur. Note that the CMS Report states that maximum MDLs were used for this comparison, and not reporting limits.*
- *d. Section 5.4.1 (Selection of Ecological Chemicals of Potential Concern) of the approved CMS Work Plan states that for chemicals not detected in any samples of a particular medium, the*

maximum reporting limit will be used to calculate media-specific HQs. For a given medium, nondetected chemicals with HQs greater than 1.0 based on maximum reporting limits will be identified as ecological COPCs for that medium. The CMS Report states that maximum MDLs were used for these calculations and COPC identifications, and not reporting limits.

e. Section 5.7.1 (General Methodology for Step 3a) of the approved CMS Work Plan states that chemicals not identified as ecological COPCs because maximum detected concentrations (or maximum reporting limits in the case of non-detected chemicals) are less than medium-specific screening values will not be evaluated in Step 3a of the baseline ERA since a conclusion of no unacceptable risk can be made with high confidence. The CMS Report states that MDLs were used for this evaluation, and not reporting limits.

It should be noted that reporting limits are typically 3-5 times higher than the MDLs prior to adjustment for sample-specific parameters, etc. It should be noted that the ECP Phase II data presented in Tables 6-7 through 6-10 reported nondetect results down to the reporting limit, not the MDL. Please revise the report according to the requirements set forth in the approved CMS Work Plan.

Navy Response: 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.

PREQB Evaluation of Response (June 27, 2011 email from Gloria, Toto Agrait, PREQB): PREQB defers to EPA, noting that for current and future projects, PREQB requests that the Navy follow their current DoD Quality Systems Manual version 4.1 and report to the level of quantitation or level of detection. Please revise the report to be consistent with the agency-approved work plan.

Navy Response: This issue of reporting non-detects to the MDL on the existing documents has been resolved with the Navy's July 22, 2011 submission and the EPA approval dated July 28, 2011. The Navy is currently preparing a letter to document this resolution. Moving forward, analytical data will be reported as follows: non-detects will be reported down to the LOD, estimated values will be reported below the LOQ, and positive values are above the LOQ (this procedure was first implemented for analytical data generated for the April 2011 field sampling events). Existing analytical data (where non-detects are reported to the MDL) that has already been submitted to EPA will not be revised

PREQB Comment 4: *For all validation reports in Appendix C, it appears that when blank qualification occurred in all analyses, the validator qualified the associated samples as nondetect (U) at the reported concentration. In many cases, the reported concentrations were below the reporting limit. Therefore, the new nondetect result at this "reported concentration" is not an accurate reflection of the actual nondetect value. As per the EPA Region 2 validation guidelines, sample results below the reporting limit should be raised to the reporting limit if affected by the blank contamination. Please revisit all validation memos and apply qualifications in accordance with EPA Region 2* procedures.

Navy Response: As indicated in the data validation narratives in Appendix C, the validator modified the blank flagging actions in response to a laboratory modification in how the non-detect results were reported. The Region II validation SOPs were written based on the assumption that non-detect results would be reported to the reporting limit. However, for this project the laboratory reported all non-detect results to the MDL Raising a few results to the reporting limit because of blank contamination would introduce an inconsistency in the manner of reporting non-detects. The laboratory practice of reporting results to the MDL was accommodated by the validator by modifying the validation guidance as noted in the validation reports. The blank-qualified non-detect results do not have lower reporting limits. The reporting limits are not changed. The U flag is stating that the qualified result should be considered non-detect at the reported value due to blank contamination (consider the value as a raised MDL) rather than positive at the reported value. Reporting limits are present on all validated EDD files for these SDGs.

As noted in the previous response, the issue of data having been reported to the MDL rather than to the RL is awaiting resolution. 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.

PREQB Evaluation of Response (June 27, 2011 email from Gloria, Toto Agrait, PREQB): Please refer to PREQB's Evaluation of Response to General Comment 3.

Navy Response: Refer to the Navy's Response to PREQB General Comment 3.

PAGE-SPECIFIC COMMENTS

PREQB Comment 1: *Page 1-1, Section 1.0: Please note the location of the soil disturbance activities mentioned in this section on relevant figures.*

Navy Response: Figures 4-1 and 4-2 will be revised to show the location of the areas of disturbed soil.

PREQB Comment 2: *Page 4-2, Section 4.0, Supplemental Field Investigation: The text refers to Segment G-H, shown on Figure 4-2. However, this segment is not depicted on the figure. Please clarify.*

Navy Response: Figure 4-2 will be revised to include drainage ditch segment G-H.

PREQB Comment 3: *Page 4-4, Section 4.1, Paragraphs 1 & 2: Please provide an explanation for the lack of sample homogenization, as is standard sampling protocol, for the aliquots other than VOCs.*

Navy Response: Samples were homogenized for aliquots other than VOCs. The fifth and sixth paragraphs of the 2008 CMS Investigation subsection of Section 4.1 – Surface and Subsurface Soil Sampling will be revised to read as follows:

> [surface soil] "…Surface soil samples were collected after removing any vegetation and topsoil/root zones. VOC samples were collected immediately after the sample was liner was cut and the sample was screened with the PID. VOCs samples 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. Following VOC sampling, soil was homogenized and soil samples for Appendix IX SVOCs (including LLPAHs) and metals were transferred directly into pre-labeled sample jars and placed on ice…"
>
> [subsurface soil] "…Soil boring logs are presented in Appendix A. Sampling was conducted as described for surface soil, with VOC samples collected using Terra Core kits immediately after cutting the liner and screening the soil with the PID, followed by soil homogenization, and then the collection of SVOC (including LLPAHs) and metals samples. The samples were transferred into pre-labeled sample jars and placed on ice. A total of 17 samples (16 primary environmental samples plus one duplicate sample) were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs) and metals. A sampling summary is provided on Table 4-1."

PREQB Comment 4: *<u>Page 4-4, Section 4.1, Paragraph 2:</u> Please confirm that the subsurface soil samples collected for VOCs were also collected using the Method 5035 preservation techniques.*

Navy Response: Subsurface soil samples collected for VOCs were also collected using Method 5035 preservation techniques. The text will be edited as specified in the response to PREQB Comment 3 (above).

PREQB Comment 5: *<u>Page 4-4, Section 4.1, 2008 CMS Investigation:</u>*

a. *Paragraph 1: The text states that surface soil samples were transferred directly into pre-labeled sample jars. Please clarify if these samples were first homogenized.*
b. *Paragraph 2, please clarify the following passage, "The presence of groundwater was not apparent; therefore the field geologist's discretion was used to indicate the water-bearing zone. The sampling depths were selected based on the field geologist's discretion to represent the variability in the predominantly clayey soil type in the shallower depths and observations of moisture, dampness or saturated soil in the deeper depths." The wording with respect to groundwater not being apparent and the mention of saturated soils appears contradictory.*
c. *Paragraph 2: For the subsurface soil samples, please clarify if each depth interval was preserved for VOCs immediately after cutting the liner and screening the sample or if samples were preserved after the desired depth interval for analysis was selected.*

Navy Response:

a. Please see response to PREQB Comments 3 and 4. VOC samples were collected first, soils were then homogenized, and finally SVOC and metals samples were collected.

b. When using direct push technology (DPT) in some matrices (e.g., clay soil), water can be driven from the sample during the sampling process such that a saturated zone may not readily apparent. This situation can occur when using Macro-Core samplers or traditional split spoon samplers. In such cases, the discretion of the field geologist must be used to select sampling intervals and to select screen intervals for monitoring well installation. The appropriate portion of the sixth paragraph of the 2008 CMS Investigation subsection of Section 4.1 – Surface and Subsurface Soil Sampling has been revised to clarify this issue:

> "Field observations and Photoionization Detector (PID) readings did not indicate the presence of specific zones of contamination. Because of the clayey soil type, the presence of groundwater was not apparent; therefore sampling depths were selected based on the field geologist's discretion, including observations of changes in soil types and moisture content. Soil boring logs are presented in Appendix A."

c. Subsurface VOC samples were preserved immediately after cutting the liner and screening the sample with the PID. The text will be clarified as presented in the response to PREQB Comment 3.

PREQB Comment 6: *<u>Page 4-4, Section 4.2:</u> It was observed that the well development and groundwater sampling activities were conducted between one and two days apart. It is a common practice to wait for a period of one to two weeks following well development before sampling is conducted (refer to the December 1995 USEPA OSWER article EPA/540/S-95/504 by Puls and Barcelona) to allow for physical and chemical equilibration in the area of newly-installed wells. Please provide an explanation as to the short timeframe between well development and sampling.*

Navy Response: The purpose of monitoring well development is to ensure removal of fine grained sediments (fines) from the vicinity of the well screen. This allows the water to flow freely from the formation into the well and also reduces the turbidity of the water during sampling. (USEPA ERT SOP 2044; October 23, 2001). Environmental industry standard and Baker's SOP is to conduct well development a minimum of 24 hours after well installation (setting of the cement/bentonite grout). The purpose of this wait time primarily is to ensure that the bentonite well seal is fully hydrated and that the cement-bentonite grout has set sufficiently so that they will not be eroded by the development process. If gentle development methods are used it is even acceptable to develop the well shortly after installation as long as the method does not interfere with the setting of the well seal (USEPA ERT SOP 2044; October 23, 2001).

The timing of groundwater sampling with respect to well installation/development is typically controlled be the fieldwork logistics and the overall project schedule. As a general practice, the groundwater monitoring well installation and development task is usually initiated as one of the first tasks during a field event and sampling of those wells is typically one of the last tasks initiated to maximize the time between development and sampling. For longer field programs, this could mean a week or more between installation/development and sampling. However, for shorter field programs, a minimum time period between installation /development and sampling of 24 hours is usually used as a rule. More important than the stand-time between well installation/development and groundwater sampling is the equilibration of the groundwater within the well with the surrounding aquifer. This equilibration is evaluated by monitoring the water level in the well (i.e., is the water level static?) and by measuring groundwater quality parameters during purging. Stabilization of the water quality parameters is a strong indicator that the water being purged (and ultimately sampled) is representative of the groundwater quality in the aquifer being sampled. During purging and sampling, pH, specific conductance, temperature, reduction/oxidation (redox) potential, dissolved oxygen (DO), and turbidity are monitored every five minutes. If the water quality parameters are stabilized, and other low flow sampling procedures are properly followed then the resulting groundwater sample will be representative of the aquifer groundwater quality.

USEPA Environmental Response Team (ERT) Standard Operating Procedures (SOPs), SOP 2044 Monitor Well Development. October 23, 2001 as on the ERT website http://www.ert.org/mainContent.asp?section=Products&subsection=List

PREQB Comment 7: *Page 4-5, Section 4.2, Paragraph 4: Please indicate the time and/or turbidity goals (or other parameter goals) for the well development process in this discussion.*

Navy Response: The following text will be added to the fifth paragraph of Section 4.2 – Monitoring Well Installation and Groundwater Sampling:

> "In most cases, more than three well volumes of water were removed in an effort to reduce turbidity and improve clarity to ensure successful low flow sampling parameter equilibrium. An attempt was made to reduce turbidity to less than 20 Nephelometric Turbidity Unit (NTUs), as specified in the work plan."

PREQB Comment 8: *Page 4-6, Section 4.3, Paragraph 1: A synoptic set of water level measurements is typically collected prior to sampling a group of wells in order to ensure that the levels are at equilibrium and have not been influenced by pumping activities, etc. The sampling dates presented in Table 4-1 versus the May 7, 2008 water level measurement date presented in this section of the text indicate that water levels were measured following the sampling. Please provide some clarification in the text as to why water levels were collected following the sampling.*

Navy Response: Water levels were measured in each well prior to sampling to provide a static water level baseline from which drawdown in the well could be calculated during sampling. These values are presented in the field logs in Appendix A. Additionally, water level measurements were collected from wells at both SWMUs 56 and 69 on May 7, 2008 to provide a consistent set of measurements across the airfield. These levels are presented on Table 5-2 and were measured approximately four days after sample collection to allow for equilibration (note that 56GW08 was measured prior to groundwater sample collection on May 7, 2008). Synoptic water levels for SWMU 56 were again measured on July 22, 2008 in conjunction with wells at SWMUs 61, 69, 71 and 74. This data for SWMU 56 is also shown on Table 5-2 and illustrated in Figure 5-6 - Regional Groundwater Contour Map.

PREQB Comment 9: *Page 4-7, Section 4.4.2, Paragraph 3: The text indicates that sediment samples 56SD15 through 56SD22 were collected on June 27, 2009, however the dates presented in Table 4-1 reflect that they were collected on June 24, 2009. Please clarify.*

Navy Response: The first sentence of the Supplemental Field investigation subsection in Section 4.4.2 – Sediment Sampling will be corrected to reflect that sediment samples were collected on June 24, 2009 rather than on June 29, 2009.

PREQB Comment 10: *Page 4-8, Section 4.4.3, Paragraph 1: Please change "OPR" to "ORP" in the first sentence.*

Navy Response: "OPR" has been changed to "ORP" as indicated by this comment.

PREQB Comment 11: *Page 4-8, Section 4.5 / Appendix A: Please provide the IDW characterization and disposal information as supporting documentation.*

Navy Response: IDW characterization and disposal documentation will be added to Appendix A. The following sentence will be added to the end of the paragraph in Section 4.5 – Investigation Derived Waste:

> "IDW characterization and disposal documentation is provided in Appendix A."

PREQB Comment 12: *Page 4-9, Section 4.7, Paragraph 2: Please provide an indication as to whether a particular spot on each PVC riser was marked for survey to allow for water level measurements to be taken from a consistent location.*

Navy Response: The PVC was not marked for survey as it is standard procedure to take water level measurements from the highest point on the PVC. The third paragraph of Section 4.7 – Surveying will be revised as follows:

> "Each monitoring well at SWMU 56 was surveyed using the RTK GPS method on May 6, 2008. An elevation was obtained from the top of PVC riser (highest point) for water level elevation calculations and a spot ground surface elevation was also obtained…."

PREQB Comment 13: *Page 4-10, Section 4.8.3: Please explain why there were no MS/MSD samples collected during the Pre-excavation Investigation in September 2008 or the Supplemental Field Investigation in June 2009.*

Navy Response: As documented in data validation narratives (Appendix C), MS/MSD samples were collected from sample locations 56SS09 in September 2008, 56SD14 in September 2008, and 56SD22 in June 2009. This information will be added to Table 4-1 and Section 4.8.3. Section 4.8.3 will be revised to read as follows:

"Matrix spike/matrix spike duplicates were collected at the rate of approximately 5 percent of primary environmental samples from soil, sediment, and groundwater. Two sets of MS/MSDs (56SB05-03MS/MSD and 56SB06-03MS/MSD) were collected corresponding to 24 soil samples for the 2008 CMS Investigation. One MS/MSD (56SS09MS/MSD) was collected corresponding to 12 soil samples for the Pre-excavation Investigation. One MS/MSD (56SD04MS/MSD) was collected corresponding to four sediment samples for the 2008 CMS Investigation. One MS/MSD (56SD14MS/MSD) was collected corresponding to four sediment samples for the Pre-excavation Investigation. One MS/MSD (56SD22MS/MSD) was collected corresponding to nine sediment samples for the Supplemental Field Investigation. One MS/MSD (56GW03 MS/MSD) was collected corresponding to eight groundwater and five surface water samples for the 2008 CMS Investigation. The MS/MSD samples were analyzed for the same parameters as the primary samples (with the exception of TOC for the sediment sample), and the results were used to evaluate the effect of each type of matrix on the analytical method."

PREQB Comment 14: *Page 4-10, Section 4.8.5, Paragraph 1:*

a. *Please explain why there was no equipment rinsate collected during the Pre-excavation Investigation in September 2008.*
b. *Please complete the fourth sentence.*

Navy Response:

a. The lack of an equipment rinsate sample for the Pre-excavation Investigation was a field team oversight.

b. The fourth sentence of Section 4.8.5 will be revised to read as follows:

ER02 was collected from a stainless steel spoon representing the tool used for soil and sediment sample collection.

PREQB Comment 15: *Page 4-11, Section 4.9, Paragraph 1:The text states that CompuChem Laboratories conducted the analyses for the Supplemental Field Investigation. However, as per Section 6.6.15 and the Data Validation Reports in Appendix C, Columbia Analytical Services performed these analyses. Please revise accordingly.*

Navy Response: The text will be corrected to indicate that Columbia Analytical Services, Rochester, New York conducted the analyses for the Supplemental Field Investigation.

PREQB Comment 16: *Page 5-2, Section 5.3.1, Paragraph 1: It is noted in this section that boring 56SB01 was advanced deeper than the rest in order to identify a significant water-bearing zone, but was then back-filled to sixteen feet to better accommodate the installation of a monitoring well. Please reference this in Section 4 of the report and provide an indication as to the procedures and material used to backfill the borehole to sixteen feet.*

Navy Response: Boring 56SB01 was advanced to a total depth of 28 feet below ground surface in –order to identify a significant water bearing zone. This boring was subsequently backfilled with drill cuttings to a total depth of 16 feet below the ground surface. Drill cuttings last out of the hole were replaced first thereby approximating the original stratigraphy at this location. Note that PID monitoring and visual/olfactory observations did not indicate the presence of contamination at this boring location. This information has been added to Section 4.1 – Surface and Subsurface Soil Sampling.

PREQB Comment 17: *Page 5-3, Section 5.3.3, Paragraph 1: Please note in the text why wells at locations 56SB04 and 56SB05 were not subjected to slug testing.*

Navy Response: Slug testing was not included in the Final Corrective Measures Study Work Plan for SWMU 56 (Baker, 2007). Slug testing was completed on a number of wells to provide additional characterization information, as time permitted in the field schedule.

PREQB Comment 18: *Page 5-3, Section 5.3.3, Paragraph 2: In addition to acknowledging a comment made previously about clarifying the large difference in the hydraulic conductivity values for 56SB02 and 56SB03 by simply stating that this difference exists, please hypothesize (based on geologic observations made during the investigation or by re-analyzing the test data) as to why these values are so much lower than the others.*

Navy Response: A high degree of variability in the water producing capacity of shallow wells has been noted throughout NAPR. The boring logs indicated clay and silty clay at 56SB02 and 56SB03, which is similar to the other wells at SWMU 56. A hypothesis to explain the differences in hydraulic conducitivty would be related to the degree of fracturing of the clay in some wells versus other wells. Small microfracturing of the clay can occur both horizontally and vertically. Although this can be difficult to observe during drilling, microfracturing can have an impact on the hydraulic conductivity of a monitoring well. The following will be added to the end of the second paragraph of Section 5.3.3 – Aquifer Characterization Testing:

> … All wells were similarly logged as containing clay and silty clay; however, the degree of microfracturing present at a location can have an impact on the magnitude of the hydraulic conductivity.

PREQB Comment 19: *Page 6-1, Section 6.0:*

> *The opening paragraph should include a note that the Phase II ECP data were not validated, as per Section 4.0. Otherwise, the second sentence in the opening paragraph could be misleading.*
>
> *Paragraph 2: Please add the words "and Table 6-8" after the reference to Table 6-7 in the second sentence.*

Navy Response: The text will be revised to indicate that Phase II ECP data were not validated. Reference to Table 6-8 will be added to the second paragraph.

PREQB Comment 20: *Page 6-2, Section 6.1: The text refers to two duplicates associated with samples 56SS01 through 56SS12. Please revise to one duplicate.*

Navy Response: The text is correct as written. Two duplicate samples were collected. The text will be revised to clarify that one duplicate sample was collected from sample location 56SB03 and the other was collected from location 56SS11.

PREQB Comment 21: *Page 6-4, Section 6.3, Paragraph 3: The last sentence of this paragraph states that the remaining SVOCs were detected in 56GW07. However, this is not accurate as 1,4-dichlorobenzene was not previously discussed in this paragraph and was detected in sample 56GW02, not 56GW07. Please revise.*

Navy Response: The text will be revised to reflect the findings in Table 6-3, as follows:

Eight SVOCs were detected in the groundwater samples including 1,4-dichlorobenzene, 3&4 methylphenol, anthracene, bis(2-ethylhexyl)phthalate, diethyl phthalate, fluoranthene, fluorene and phenanthrene. Phenanthrene was detected in two samples, while the remaining SVOCs were detected in one sample each. Similar to the VOC detections, the detected concentrations of SVOCs are considered low (i.e., near detection limits).

PREQB Comment 22: <u>Page 6-7, Section 6.6.1:</u>

a. *Paragraph 2: The one VOC detected in the field blanks was 2-butanone, not acetone. Please revise the text accordingly.*

Navy Response: The text will be corrected as requested by this comment.

b. *Paragraph 3: The text states that five trip blanks were collected. However, according to Table 4-2, there were six trip blanks collected. In addition, Table 6-6 only presents results for five trip blanks. Please clarify and revise, as necessary.*

Navy Response: Six trip blanks were collected. However, data from 56TB01 were rejected during data validation. The text will be edited to indicate that because data from 56TB01 were rejected during data validation, these data are presented in Appendix B but are not shown on Table 6-6. The third paragraph of Section 6.6.1 will be revised to read as follows:

> Six trip blanks were collected. Data from 56TB01 were rejected during data validation, and are presented in Appendix B but not shown on Table 6-6. Chloromethane (0.38J ug/L) was detected in one of the trip blanks (56TB03). No other VOCs were detected in the trip blank samples.

c. *Paragraph 4: The text of the first sentence indicates that acetone and toluene were detected in equipment blanks ER04 and ER05, yet the data in Table 6-6 do not reflect this. Please clarify.*

Navy Response: The text will be corrected to reflect the data in Table 6-6, as follows:

> Eight equipment rinsate samples were collected as indicated on Table 6-6. The VOC acetone was detected in JUNE09-ER02, which was collected from a stainless steel spoon. The VOC toluene was detected in ER04 and ER05, which were collected from groundwater sampling tubing. Eight SVOCs (as shown on Table 6-6) were detected in ER01 (from a macro core liner), ER02 (stainless steel spoon), ER04 and ER05 (groundwater sample tubing) and/or JUNE09-ER02 (stainless steel spoon). Note that SVOCs were not analyzed for in ER06, ER07 and ER10. Five metals (arsenic, copper, lead, tin and vanadium) were detected in the equipment rinsate samples. There were no detections of metals in ER04, ER05, or JUNE09-ER10.

d. *Please correct the spelling of the word "stainless" in the third sentence.*

Navy Response: The spelling of "stainless steel" will be corrected as requested.

PREQB Comment 23: <u>Page 6-10, Section 6.6.3.2, SDG SWMU36289-4:</u> *Samples were reextracted outside of holding time for low-level PAHs due to an LCS recovery issue. The results of the reextraction were reported due to acceptable LCS results, although the extractions were performed outside of holding time. Further justification was requested in the comments for the September 2008 draft report as to why the results of the reextractions were reported. The justification provided in the Navy's response to comments stated that the recovery of dibenz(a,h)anthracene (121%) was high in the LCS associated with the original extractions within holding time. However, it is unclear why the validator chose to report the* *results of the potentially low-biased data outside of holding time versus the more accurate results of the original analysis within holding time especially when dibenz(a,h)anthracene was not even detected in any of the associated samples (56SW01 through 56SW05). Since this compound was not detected in the samples, there was no adverse effect from the slightly high recovery in the associated LCS. Please clarify.*

Navy Response: In the initial analysis, the method blank and LCS exhibited non-compliant surrogate recoveries at 142% and 144% (QC limit 44-123%). In the re-analysis all surrogates were within criteria. In the initial analysis, the associated LCS also exhibited non-compliant recoveries for 10 of the 18 spiked compounds. In the re-analysis only one compound was non-compliant, dibenzo (a,h)anthracene at 121% (QC limit 42-112%). In the initial analysis internal standards were non-compliant for the method blank and the LCS, the re-analysis had compliant recoveries. Due to these non-compliances in the method blank and LCS associated with the initial analysis samples the re-analysis of the samples was used.

PREQB Comment 24: *Page 6-12, Section 6.6.4.2, SDG SWMU36360-6: Samples were reextracted outside of holding time due to surrogate and internal standards in the initial analyses. Further justification was requested in the comments for the September 2008 draft report as to why the results of the reextractions were not reported. The justification provided in the Navy's response to comments stated that the internal standards and surrogates were still outside of the control limits in the reextractions and the results of both analyses were not comparable. Please provide information on which analysis had higher recoveries of surrogates and internal standards in the explanation so it can be justified that the proper analysis was reported.*

Navy Response: The results of the reextractions were not reported because internal standards and surrogates were still outside of control limits. In addition, the reextractions were conducted more than 14 days out of holding time (re-extracted samples were collected on 4/29 and analyzed on 5/30, which exceeds the 14 day holding time by 17 days). As such, the validator would have been required to reject non-detected results from the reanalysis. For this reason, the original analysis results were reported.

PREQB Comment 25: *Page 6-15, Section 6.6.6.2, SDG SWMU36419-1: Samples were reextracted outside of holding time due to an LCS and MS/MSD recovery issue. The results of the reextraction were reported due to acceptable LCS and MS/MSD results, although the extractions were performed outside of holding time. Further justification was requested in the comments for the September 2008 draft report as to why the results of the reextractions were reported. The justification provided in the Navy's response to comments did not provide any information on the LCS and MS/MSD recovery nonconformances associated with the initial extractions, as requested in the comment. Please provide this information in the explanation to support the reporting of the reextraction outside of holding time.*

Navy Response: The LCS associated with the initial analysis exhibited 4 non-compliant recoveries with one recovery below 10%. The associated MS/MSD exhibited 15 non-compliant recoveries with 3 below 10%. The LCS and MS/MSD associated with the re-extracted samples exhibited compliant recoveries for all compounds; therefore the re-extracted samples were used.

PREQB Comment 26*:* *Page 7-23, Section 7.4.1.3: A 95 percent upper confidence limit of the mean water hardness concentration from a stream located approximately four miles from the NAPR was used to calculate surface water screening values for various metals. Lacking suitable site-specific water hardness data, the 95 percent lower confidence limit of the mean water hardness value of this stream would represent a more conservative and appropriate value for conducting an ecological screening since a lower water hardness value equates to a lower screening value. Please re-evaluate the selection of surface water COPCs using this more appropriate water hardness value.*

Navy Response: Section 7.4.1.3 will be revised to reflect the 95 percent lower confidence limit of the mean (31.35 mg/L as $CaCO_3$; derived using Scout Version 1.00.1 software [USEPA, 2008]) for USGS water hardness data. As a result, hardness-dependent metals will now have more conservative total recoverable screening values.

In addition to the text changes in Section 7.4.1.3, the use of the 95 percent LCL of the mean will also result in revisions to Section 7.6.2.4, Section 7.9.1.4, Table 7-6, Table 7-16, and Figure 7-12.

PREQB Comment 27: *Page 7-27, Section 7.5.1: The report states that the maximum MDLs/RLs were used to estimate exposure for non-detected chemicals. Reporting Limits should be used to evaluate non-detected chemicals. Please clarify whether the Method Detection Limits or the Reporting Limits were used in the selection of COPCs.*

Navy Response: The laboratory reported data to the MDL in 2008 samples. Sediment samples collected in 2009 were reported to the RL. The maximum reported non-detect was used to evaluate non-detected chemicals. For soil, groundwater, and surface water (which were sampled only in 2008), this value was an MDL, while for sediment, this value was an MDL if the maximum non-detect was in 2008 data and was an RL if the maximum non-detect was in 2009 data. Based on the data, thallium was the only chemical for which the RL was used in the Step 2 risk evaluation. Text will be added to Section 7.5.1 referring the reader to Section 7.2, Sources of Available Analytical Data. The following text will be added to Section 7.2:

> "It is noted that the analytical laboratory reported non-detected results to the method detection limit (MDL) for soil, groundwater, surface water, and sediment samples collected during the 2008 CMS field investigation and pre-excavation field investigation. For the 2009 supplemental field investigation, the analytical laboratory reported non-detected results to the reporting limit (RL)."

The issue of the laboratory having reported MDLs rather than RLs 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.

PREQB Evaluation of Response (June 27, 2011 email from Gloria, Toto Agrait, PREQB): Please refer to PREQB's Evaluation of Response to General Comment 3.

Navy Response: Refer to the Navy's Response to PREQB General Comment 3.

PREQB Comment 28: *Page 7-40, Section 7.7: A source of uncertainty regarding sediment screening values for metals is that site-specific conditions such as AVS are not taken into account that can affect the bioavailability of certain metals. Please add a sentence to this bullet that notes that AVS/SEM samples were collected from a subset of the drainage ditch sediment samples and these data are discussed in Step 3A.*

Navy Response: The specified source of uncertainty will be revised as requested. The following will be added to the end of the fourth bullet of the Media-Specific Screening Values in Section 7.7 - Uncertainties Associated with the SERA:

> "However, AVS/SEM data collected during the 2009 supplemental field investigation from a subset of drainage ditch sediment samples will be discussed in Step 3a of the BERA."

PREQB Comment 29: *Page 7-50, Section 7.9.1.1: Lead was identified as an ecological COC for SWMU 56 surface soil as it exceeds its soil screening value and the lead background concentration. However, the report recommends no additional evaluation in form of corrective measures. It appears that this is a typographical error. Please eliminate "no" from the last sentence in the 1st paragraph on this page.*

Navy Response: The typographical error will be revised to indicate that lead is identified as an ecological COC for SWMU 56 surface soil and additional evaluation is the form of corrective measures is recommended.

PREQB Comment 30: *Page 7-55, Section 7.9.1.4: Please see comment above regarding non-conservative use of the 95 percent upper confidence limit of the mean water hardness concentration.*

Navy Response: As stated above, Section 7.9.1.4 will be revised to reflect the use of 95 percent lower confidence limit of the mean (31.35 mg/L as $CaCO_3$) for USGS water hardness data.

PREQB Comment 31: *Page 7-78, Section 7.10.1.2: An iterative process substituting values for surface soil concentrations using the equation presented in this section was reported to be used in determining a dietary intake rate that was equal to the NOAEL-based TRV. The surface soil concentrations presented for this equation (95 percent UCL for cadmium and lead) presumably represent the initial surface soil concentrations entered into the equation and these values were subsequently replaced with lower surface soil values in order to equal the NOAEL-based TRV. It appears that several additional parameters need to be included in the equation. Specifically, the concentration in the food item (plant/invertebrate) needs to incorporate the surface soil concentration (entered on an iterative process) and the appropriate bioaccumulation factor. Alternatively, the equation could be clarified to indicate that each substitution of the surface soil concentration results in a new food item concentration (for both plants and invertebrates) based on the equations provided in Table 7-24 for cadmium and lead.*

Navy Response: The Navy offers the following points of clarification relative to this comment. The text in Section 7.10.1.2 incorrectly identifies dietary intake equation inputs for the concentration of cadmium and lead in SWMU 56 surface soil (95 percent UCL of the mean concentrations). As indicated in this section, risk-based CAOs for avian dietary exposures to cadmium and lead in SWMU 56 surface soil were identified using an interactive process. In this process, a surface soil concentration for a given metal was entered into the dietary intake equation presented in Sections 7.5.2.2.2 and 7.10.1.2 until a dietary intake was calculated that equaled the metal's NOAEL-based TRV. The surface soil concentration that results in a dietary intake equal to the NOAEL-based TRV was selected as risk-based CAO for avian dietary exposures. Given the process that was used to derive the CAOs, identification of equation input values for cadmium and lead surface soil concentrations is confusing and incorrect.

To accurately present the process that was performed during the development of CAOs for avian dietary exposures to cadmium and lead in SWMU 56 surface soil, text identifying surface soil inputs for these two metals will be removed from Section 7.10.1.2. In addition, as recommended by PREQB Specific Comment No. 31 above, the following sentence will be added to the last paragraph within this section:

> "As such, each substitution of cadmium and lead surface soil concentrations within the dietary intake equation during the interactive process resulted in a new plant and invertebrate tissue concentrations."

It is noted that while the text within Section 7.10.1.2 of the Revised Draft Report does not accurately present the approach used during CAO development, the risk-based CAOs presented in Table 7-37 for avian dietary exposures to cadmium and lead in SWMU 56 surface soil where derived using interactive process described above.

Section 7.10.1.4 will also be revised to clarify the approach used to derive the sediment CAO for lead.

PREQB Comment 32: _Pages 8-1 to 8-2, Section 8.2:_

a. *The purpose of evaluating two separate soil datasets in the human health risk assessment (HHRA) is to represent two exposure media unrelated to distinct soil layers. The surface soil dataset is used to evaluate exposure by current receptors, such as commercial/industrial workers and trespassers, who may be exposed to current surface soil, regardless of whether it is fill material or native material, while conducting activities at the site. A total soil dataset may be used for future receptors, depending on the distribution of contamination in total versus surface soil. Please clarify the use of a total soil dataset in the context of exposure media to which each receptor may be exposed. Note that Section 1.0 states that soil disturbance did "not impact areas where analytical data and suspected site related contamination had occurred…" indicating that the surface soil dataset is representative of current conditions within the impacted area (i.e., site).*

Navy Response: Refer to the second part of the Navy's response to the Evaluation of the Response to EPA General Comment 3.

b. *groundwater was encountered at 6 feet bgs. Please discuss whether typical construction practices for the area excavate down to 10 feet if groundwater is encountered at 6 feet bgs. If not, samples from depths greater than 6 feet bgs may not represent exposure media for the HHRA.*

Navy Response: As indicated in Section 5.0 of the report, groundwater was encountered at six feet in some locations. However, groundwater was not encountered during drilling. In fact, well 56SB01 was installed at a total depth of 16 feet below ground surface, but the initial borehole was advanced to a depth of 28 feet in search of groundwater. This borehole was left open for more than 24 hours, and the boring filled with water to approximately 3.4 feet bgs. Water production at SWMU 56 appears to be derived from the clays and silty clays encountered at varying depths, which is most likely controlled by fracturing in the surficial clay (refer to Section 5.3.2 of the report). These fractures are predominantly vertical and exhibit varying degrees of interconnectivity, and fracture frequency tends to decrease with depth. Given the uncertainty of the actual depth to the water table, a conservative approach was taken to include the analytical results of soil samples from six to ten feet bgs in the HHRA. As such, this approach included the maximum concentrations of vanadium (the primary risk driver), which were at depth. The evaluation of these concentrations demonstrated that the concentrations of vanadium at SWMU 56 were attributable to background and natural variations in the soil and rock in the vicinity of the site rather than a release from the site. Background levels of vanadium contributed approximately 80% of the risk to industrial receptors from exposure to SWMU 56 soil, and the excess risks were attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) (i.e., the used of a default ABS of 0.01 for vanadium) and the vanadium RfD (a conservative, second-tier PPRTV value used primarily for the calculation of screening levels) used in the HHRA. Removing the soil data in question from the quantitative risk evaluation would remove two of the four highest concentrations (one being the maximum) and leave two vanadium concentrations exceeding the background screening value (410 mg/kg at 5 to 7 feet bgs in 56SB06 and 430 mg/kg at 0 to 1 foot in 56SS09). A cursory review of the remaining data indicates that the calculated vanadium EPC would be less conservative. Additionally, the evaluation of the organic data would not change based on the revisions to the soil exposure pathway evaluation proposed in the Evaluation of the Response to EPA General Comment 3 (i.e., maximum concentrations in surface soil selected as EPCs for carcinogenic PAHs). Therefore, the outcome of the

HHRA would not change with the removal of soil data below 6 feet bgs, and revising the HHRA would not be cost effective or provide additional beneficial information. However, the following discussion will be added to the discussion of uncertainties in Section 8.3.6.3:

> "As indicated in Section 5.0, groundwater was encountered at six feet in some locations. However, groundwater was not encountered during drilling. In fact, well 56SB01 was installed at a total depth of 16 feet below ground surface, but the initial borehole was advanced to a depth of 28 feet in search of groundwater. This borehole was left open for more than 24 hours, and the boring filled with water to approximately 3.4 feet bgs. Water production at SWMU 56 appears to be derived from the clays and silty clays encountered at varying depths, which is most likely controlled by fracturing in the surficial clay (refer to Section 5.3.2). These fractures are predominantly vertical and exhibit varying degrees of interconnectivity, and fracture frequency tends to decrease with depth. Given the uncertainty of the actual depth to the water table, a conservative approach was taken to include the analytical results of soil samples from six to ten feet bgs in the HHRA. As such, this approach included the maximum concentrations of vanadium (the primary risk driver), which were at depth. Removing the soil data in question from the quantitative risk evaluation would remove two of the four highest concentrations (one being the maximum) and leave two vanadium concentrations exceeding the background screening value (410 mg/kg at 5 to 7 feet bgs in 56SB06 and 430 mg/kg at 0 to 1 foot in 56SS09). A cursory review of the remaining data indicates that the calculated vanadium EPC would be less conservative. Additionally, the evaluation of the organic data would not change (i.e., maximum concentrations in surface soil selected as EPCs for carcinogenic PAHs). Therefore, this approach is likely an overestimate of true risk and errs on the side of conservativeness."

PREQB Comment 33: *Page 8-2, Section 8.2:*

a. *Groundwater is classified as potable in accordance with Puerto Rico's Water Quality Standards. Therefore, future commercial/industrial receptors may be exposed to groundwater via ingestion and dermal exposure pathways in addition to inhalation of vapors emanating from groundwater. Please revise the HHRA accordingly.*

Navy Response: The Navy respectfully disagrees with this comment. Evaluation for groundwater exposure via ingestion will not be included for the future industrial/commercial worker for the following reasons. Groundwater exposure is not listed as a potentially complete pathway for a future industrial worker in the RCRA §7003 Administrative Order on Consent for NAPR (USEPA, 2007). It is unlikely that a future worker (assuming an indoor office setting) would consume a significant amount of tap water while working at a site when compared to the amount of tap water consumed at a residence. The HHRA currently includes an evaluation of the groundwater ingestion exposure pathway for future residential and future construction worker receptors. Therefore, the potential groundwater exposure is adequately evaluated using the future residential and construction worker receptors. No revisions to the HHRA are proposed.

PREQB Evaluation of Response (June 27, 2011 email from Gloria, Toto Agrait, PREQB): It is PREQB's understanding in consultation with EPA that the Navy is required to clean up to levels protective of future uses of the site. In addition, Puerto Rico's Water Quality Standards are applicable, relevant and appropriate requirements (ARARs). The potential exists for future commercial/industrial development of this area, and groundwater is considered a potable drinking water source. Therefore, consistent with other Navy projects in Puerto Rico, quantitatively evaluate the ingestion of groundwater exposure pathway, where a commercial worker ingests 1 liter of water per day, in the HHRA.

Navy Response: In order to address the concerns expressed in the Evaluation of Response to PREQB Specific Comment 33(a), ingestion of 1 liter of groundwater per work day will be added to the quantitative evaluation for the future industrial/commercial worker. All corresponding text and tables will be revised accordingly.

b. *In the last paragraph of this section, please describe the exposure media and pathways evaluated for the residential exposure scenario, consistent with the other receptors and exposure scenarios discussed in this section.*

Navy Response: The following sentence will be added to the last paragraph of Section 8.2:

> "Potential exposures to all media (soil, groundwater, surface water, and sediment) were conservatively assumed for future residents."

PREQB Comment 34: *Page 8-3, Section 8.3.1.1: Please verify the section where the Phase II ECP data is discussed qualitatively. The text indicates that this discussion is presented in Section 8.3.1.2.2, which is "Use of Surrogate Chemicals for Missing Screening Values."*

Navy Response: Section 8.3.1.2.2 was incorrectly referenced as the location of the qualitative discussion of the Phase II ECP data. Note that this discussion will be removed from the HHRA as these data were not used in the HHRA (data did not meet data quality objectives).

PREQB Comment 35: *Page 8-4, Section 8.3.1.2.1): Section 8.3.1.2.1 describes a comparison of metals to background concentrations as part of the COPC selection section process. Please revise this section for consistency with Section 8.3.1.2, which states that "no metals were eliminated from the risk evaluation based on their occurrence at background levels." . Please clarify why a comparison to background is discussed a COPC selection criterion if no metals were eliminated based on this comparison?*

Navy Response: The following sentence will be added to the second paragraph of Section 8.3.1.2.1.

> "As previously discussed, no metals were eliminated from the risk evaluation based on their occurrence at background levels."

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): Please remove this paragraph from this section of the report, since a background comparison was not used in the COPC selection process.

Navy Response: The paragraph will be removed from this section of the report.

PREQB Comment 36: *Page 8-5, Section 8.3.1.2.2: Please also discuss whether there are any natural processes occurring at the site that would result in the presence of hexavalent chromium via oxidation of trivalent chromium.*

Navy Response: The following text will be added to Section 8.3.1.2.2.

> "It should be noted that chromium will be present predominantly in the trivalent chromium oxidation state in most soils. While hexavalent chromium contamination is generally associated with industrial activity, it can occur naturally. Oxidation of trivalent chromium to hexavalent chromium can occur in the soil environment. The relation between trivalent chromium and hexavalent chromium strongly depends on pH (the process is enhanced at pH values greater than 6) and oxidative properties of the location, but in most cases, the trivalent chromium is the

dominating species (Kotaś and Stasicka, 2000). Most trivalent chromium in soil is immobilized due to adsorption and complexation with soil materials. As such, due to the lack of availability of mobile trivalent chromium, a large portion of chromium in soil will not be oxidized to hexavalent chromium even with favorable oxidation and pH conditions (ATSDR, 2008)."

The following references will be added to Section 8.5:

"Agency for Toxic Substances and Disease Registry (ATSDR), 2008. Draft Toxicological Profile for Chromium. September 2008."

"Kotaś, J. and Z. Stasicka 2000. "Chromium occurrence in the environment and methods of its speciation". *Environmental Pollution* 107 (3): 263–283."

PREQB Comment 37: *Page 8-6, Section 8.3.1.2.3, Total Soil:*

a. *Note that data were collected during the Phase II ECP that were not third-party validated. Please revise this section to indicate that data were collected but not used in the HHRA as they did not meet data quality objectives.*

Navy Response: There were no soil samples collected during the Phase II ECP investigation. Therefore, no revisions to this section are proposed.

b. *Please note that EPA's Regional Screening Levels are typically referred to as either residential RSLs or industrial RSLs. For clarity and consistency, please consider using this acronym, as the text refers to them as SLs, and the tables refer to these values as SSLs. The acronym "SSL" typically refers to EPA's soil screening levels, where the Protection of Groundwater SSLs are presented on EPA's RSL table (May 2010).*

Navy Response: Section 8.0 will be revised to use the acronym "RSLs" when referencing the Regional Screening Levels. Section 8.0 text, tables, and appendices will be revised accordingly. Additionally, the acronym "SSL" will be corrected on the tables.

c. *Benzo(a)pyrene is a mutagenic mode of action (MMOA) chemical. Please revise the HHRA to evaluate child exposure to BAP and dibenz(a,h)anthracene, also included as a COPC. This comment applies to all exposure media where these chemicals are identified as COPCs.*

Navy Response: MMOA chemicals are currently addressed quantitatively in the risk calculations in this HHRA. This is presented in the risk calculation spreadsheets found in Appendix K. It should be noted that as recommended in USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005), adjustments are also applied to the other carcinogenic PAHs, not just benzo(a)pyrene and dibenz(a,h)anthracene. However, for clarity the following section will be added to the HHRA to discuss the treatment of MMOA chemicals in the HHRA.

"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 56 soil and sediment. 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 K."

The following reference will be added to Section 8.5:

"USEPA, 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. EPA/630/R-03/003F. March 2005."

PREQB Comment 38: *Page 8-7, Section 8.3.1.2.3, Surface Water and Sediment: Please clarify why the Phase II ECP data is discussed in this section on selection of COPCs. How is the information presented used in the selection process? Although this data may be useful for evaluating nature and extent of contamination, it is inappropriate for use in the risk assessment due to validation issues.*

Navy Response: The discussion of the Phase II ECP data will be removed from Section 8.3.1.2.3 since data quality objectives were not met, and those data were not used in the HHRA.

PREQB Comment 39: *Page 8-8, Section 8.3.2.1: Please clarify why a current/future outdoor worker exposure scenario is not being evaluated in the HHRA. Please discuss whether the culverts are cleared or whether other maintenance activities conducted by an outdoor worker take place at the site.*

Navy Response: Refer to the Navy's response to the Evaluation of the Response to EPA General Comment 8.

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): The cumulative risks for each receptor group evaluated in an HHRA are presented separately. Therefore, please include all relevant exposure media and pathways for each receptor and exposure scenario and revise the proposed text accordingly. Also, please address the comment concerning culvert and other outdoor maintenance activities. Note that this receptor is a potential future receptor and outdoor worker exposure to soil, sediment and surface water needs to be evaluated in the HHRA.

Navy Response: In order to address the concerns expressed in the Evaluation of Response to PREQB Specific Comment 39, an adult on-site worker receptor will be added to the HHRA and quantitatively evaluated for exposure to soil, surface water, and sediment. All corresponding text and tables will be revised accordingly. Concerning the culvert and outdoor maintenance activities, the culverts are currently overgrown with vegetation and there are no maintenance activities occurring. This information will be added to Section 8.3.2.1.

PREQB Comment 40: *Page 8-9, Section 8.3.2.1:*

a. This section states that a commercial/industrial worker is evaluated for exposure to groundwater. However, Table 8-5 does not include any exposure parameters for evaluating ingestion and dermal exposure to groundwater under a future exposure scenario. Please revise the HHRA to evaluate these exposure routes as groundwater is classified as potable per Puerto Rico Water Quality Standards (2010).

Navy Response: Section 8.3.2.1 states that a commercial/industrial worker is evaluated for exposure to volatiles in groundwater emitted through soil into buildings. Ingestion and dermal contact are not discussed as potential exposure pathways for this receptor. Therefore, exposure parameters for evaluation of ingestion and dermal contact were not included in Table 8-5 for the commercial/industrial worker. In response to the second part of the comment, refer to the Navy's response to PREQB Comment 33. No revisions to the HHRA are proposed.

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): Please refer to PREQB's Evaluation of Response to Comment 33.

Navy Response: Refer to Navy's response to Specific Comment 2 (PREQB's Evaluation of Response to Comment 33).

b. *Please revise this sentence to indicate that a residential scenario is used to evaluate unrestricted land use at the site, rather than stating it is the worst-case exposure scenario, "A residential land use is also assumed to estimate the worst-case exposure conditions."*

Navy Response: The sentence referenced in the comment will be revised as follows:

> "A residential land use scenario is also incorporated to evaluate unrestricted land use and provide the most conservatively protective risk estimation."

c. *Please revise this section for consistency with the HHRA, Section 8.3.2.5, where only tapwater RSLs are used to evaluate volatilization from groundwater. As previously commented on, the use of the 2002 vapor intrusion screening levels is not appropriate for evaluating VOCs volatilizing into a trench or while showering.*

Navy Response: Section 8.3.2.1 included a discussion of the comparison of volatile compounds detected in groundwater to both tap water RSLs and the 2002 vapor intrusion screening levels. The tap water RSLs were used to evaluate VOCs volatilizing into a trench or while showering. The 2002 vapor intrusion screening levels were used to evaluate the potential for VOCs in groundwater to be emitted through soil into building (i.e., vapor intrusion). The 2002 vapor intrusion screening levels were not used to evaluate VOCs volatilizing into a trench or while showering. No revisions to this section are proposed.

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): Please verify that the toxicity criteria used in developing the 2002 vapor intrusion screening levels are the current toxicity criteria, and include this evaluation in the text.

Navy Response: A review of the current toxicity criteria available from IRIS indicates that the RfD for acetone has been revised since the 2002 vapor intrusion screening levels were developed (0.1 mg/kg-day to 0.9 mg/kg-day in 2003). However, this change in the RfD would not impact the magnitude of the vapor intrusion screening level such that the acetone concentration in SWMU 56 groundwater would exceed this level. This evaluation will be added to Section 8.3.2.1.

PREQB Comment 41: *Page 8-10, Section 8.3.2.1: Please add ingestion of groundwater for the future commercial/industrial worker receptor as groundwater is classified as potable.*

Navy Response: Refer to the Navy's response to PREQB Comment 33.

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): Please refer to PREB's evaluation of the Navy's response to Comment 33.

Navy Response: Refer to Navy's response to Specific Comment 2 (PREQB's Evaluation of Response to Comment 33).

PREQB Comment 42: *Page 8-11, Section 8.3.2.4: Please clarify in the text that the 95% UCLs were calculated in the "with NDs" mode rather than in the "Full" mode (i.e., surrogate values for non-detects were not used, consistent with current EPA guidance).*

Navy Response: The following sentence will be added to the end of the third paragraph of Section 8.3.2.4.

> "Note that the 95% UCLs were calculated in the "with NDs" mode, as applicable."

PREQB Comment 43: *Page 8-14, Section 8.3.2.5: Please clarify why soil from 0-10 feet bgs was included in the total soil dataset when groundwater is present at 6 feet bgs at this site.*

Navy Response: Refer to the Navy's response to PREQB Comment 32b.

PREQB Comment 44: *Page 8-15, Section 8.3.3: Please address MMOA chemicals and how they are evaluated in this section.*

Navy Response: Refer to the Navy response to PREQB Comment 37c.

PREQB Comment 45: *Page 8-12, Section 8.3.6.1: Please clarify if the intent of the third paragraph is to show that the contribution to overall site risks attributable to site-related impacts is below acceptable risk and hazard levels. If so, please revise the last sentence to emphasize this point rather than emphasizing that site risks are comparable to background. It would be preferable to discuss that the relative contribution to overall site risk from site-related activities is below acceptable cancer risk and hazard levels rather than emphasizing that the relative contribution to overall site risk from site-related activities is comparable to background cancer risks and hazard levels, because they both may exceed acceptable levels individually.*

Navy Response: The last sentence of the third paragraph will be revised as follows to convey that the intent of the third paragraph is to show the contribution to overall site risks attributable to site-related activities is below acceptable hazard levels:

> "Therefore, the contribution of risks from vanadium in SWMU 56 total soil to overall risk from site-related activities is below the acceptable hazard level for the current/future adult and youth trespasser receptors."

Additionally, similar language throughout Section 8.3.5 will be revised accordingly.

PREQB Comment 46: *Page 8-26, Section 8.3.5.6: Please add a discussion of whether there are potential sources for vanadium associated with site activities/use. This may be an additional line of evidence concerning whether vanadium is naturally occurring.*

Navy Response: The following discussion will be added to Section 8.3.5.6:

"Hangar 200 has historically been used for aircraft maintenance, and former use of the concrete apron as an aircraft wash down area is considered likely. While interviews confirmed past spills of POL and hazardous materials from the 1950s to the 1990s, there are no records indicating potential sources of vanadium were released at the SWMU."

PREQB Comment 47: *Page 9-2, Section 9.5, Paragraph 2: Please clarify the apparent discrepancy between the statement that there are sediments in Segment A-B containing barium, cadmium, chromium,* *lead and zinc in excess of the CAOs versus the indication on Figure 9-2 that only cadmium and lead exceed the CAOs in this segment.*

Navy Response: Figure 9-2 will be corrected to indicate concentrations of barium, chromium, and zinc (in addition to cadmium and lead) in Segment A-B in excess of the sediment CAOs.

PREQB Comment 48: *<u>Page 11-2, Section 11.1, Bullet #6:</u> This bullet suggests that confirmation samples be analyzed for cadmium and lead. Please include the requirement that these analyses be performed by SW-846 method 6020A using ICP-mass spectrometry. Due to the proposed cleanup level of 0.99 mg/kg for cadmium in sediment as discussed in Section 10.1.2, this more sensitive method will be required to achieve low enough quantitation limits below the cleanup level. Since this is not the method cited for metals in the current Work Plan for this SWMU, it is highly recommended that this be included in the requirements so it is not overlooked in the next investigation.*

Navy Response: Table 4-3 presents method performance limits and method numbers. For both cadmium and lead, a quantitation limit of 0.5 mg/kg (wet weight) is specified using method 6010B (ICP-mass spectrometry). Soil CAOs (1.80 mg/kg for cadmium and 96 mg/kg for lead) are greater than these quantitation limits. Please note that bullet 6 refers to soil remediation, not sediment remediation. As such, the sediment CAOs do not apply. The bullet will be revised as follows: "Analyze confirmation samples for cadmium and lead using SW-846 method 6010B/6020A using ICP-mass spectrometry."

<u>PREQB Evaluation of Navy Response (June 27, 2011 email from Gloria Toto Agrait, PREQB)</u>: Please note that Table 4-3 references SW-846 method 6010B, not method 6020A. SW-846 6010B is not an ICP/mass spectrometry method. Therefore, if ICP/mass spectrometry is not needed to achieve the soil CAOs, bullet 6 should be revised to reflect SW-846 method 6010B only. Please note that should sediment samples be required, then ICP/MS is needed to achieve the 0.99 mg/kg CAO because although the QL of 0.5 mg/kg is below the sediment CAO, the QL will likely end up over this CAO due to the moisture content of the sediment samples.

Navy Response: The referenced bullet will be revised as follows: "Analyze confirmation samples for cadmium and lead using SW-846 method 6010B using ICP."

PREQB Comment 49: *<u>Table 4-1:</u>*

a. *The information presented in this table with regard to surface soil samples 56SS01 through 56SS12 implies that the samples were submitted to the laboratory for the full suite of Appendix IX metals analysis, however the text on Page 4-4, Section 4.1 indicates that only select metals were analyzed. Please clarify.*

Navy Response: Table 4-1 will be corrected to indicate that surface soil samples 56SS01 through 56SS06 were analyzed for lead and selenium and surface soil samples 56SS07 through 56SS12 were analyzed for selenium and vanadium.

b. *As per the boring logs and/or field log book notes in Appendix A, the following depth intervals on this table are inconsistent with the information provided in the field notes:*
    a. *56SB03-04: Depth interval should be 7.0-9.0 ft bgs, not 9.0-10.0.*
    b. *56SB05-05: Depth interval should be 9.0-10.0 ft bgs, not 9.0-11.0.*
    c. *56SB06-03: Depth interval should be 5.0-7.0 ft bgs, not 9.0-11.0.*
    d. *56SB06-01D: Depth interval should be 1.0-3.0 ft bgs since this is a field duplicate of 56SB06-01.*

Navy Response: Table 4-1 will be corrected to show the appropriate sample depth intervals as indicated.

PREQB Comment 50: *Table 4-2: Please provide an "X" in each appropriate box to indicate for which parameters for which field blank sample JUNE09-FB02 was analyzed.*

Navy Response: Table 4-2 will be edited to indicate that field blank sample JUNE09-FB02 was analyzed for Appendix IX metals.

PREQB Comment 51: *Table 4-3:*

a. *Please revise units for metals in soil to mg/kg.*
b. *Please replace "total organic compounds" with "total organic carbon."*

Navy Response: Table 4-3 will be corrected as requested.

PREQB Comment 52: *Table 5-2: Please format the table such that the columns will accommodate the word "Groundwater".*

Navy Response: Table 5-2 will be formatted as requested.

PREQB Comment 53: *Tables 6-1 through 6-6: Previous comments on the September 2008 draft report requested the reporting of nondetect results down to the quantitation limit instead of the MDL on these tables. Since results are still reported down to the MDL, please revise the notes section of the table and replace "quantitation limit" with "method detection limit" for the "U" and "UJ" qualifier.*

Navy Response: The notes will be edited as indicated in the comment.

PREQB Comment 54: *Table 6-5: Please remove the shading from the blank cells on pages 4 and 6 of 6.*

Navy Response: The table will be edited as requested.

PREQB Comment 55: *Table 6-10: This table was mis-placed between Tables 6-1 and 6-2 in the electronic copy of this report.*

Navy Response: The table will be moved into the correct position in the electronic copy of the final report.

PREQB Comment 56: *Table 7-21: Shaded cells are used to indicate detected chemicals that were identified as COPCs. Please shade thallium for evaluating risk to upper trophic level avian receptors within the drainage ditch sediment (HQ = 1.38). In addition, please correct the footnote for 1,4-Naphthoquinone to "6".*

Navy Response: Since thallium was not detected in drainage ditch sediment (as indicated in Table 7-17), it does not meet the prerequisites for shading. However, the footnote was incorrect, identifying thallium as a detected chemical. The footnote has been corrected to "14". Additionally, the footnote for 1,4-Naphthoquinone has been changed to "6".

PREQB Comment 57: *Table 7-38: Please correct the footnote numbers listed at the bottom of this table.*

Navy Response: The footnote numbers in Table 7-38 will be corrected.

PREQB Comment 58: *Figure 4-2: Please show Drainage Ditch Segment G –H, as referenced in the text of the report.*

Navy Response: Figure 4-2 will be revised to include drainage ditch segment G-H.

PREQB Comment 59: *Figures 5-5 and 5-6: Based on the configuration of the well network (both for SWMU 56 alone, as well as in conjunction with the other SWMUs), there is a very narrow corridor within which the ground water elevations can be interpolated. Please revise the ground water contours on both figures to reflect dashed lines where data cannot be interpolated, but is inferred.*

Navy Response: The figures will be edited with dashed lines to indicated data that are inferred, as requested.

PREQB Comment 60: *Table 8-5: A child resident would typically be outdoors every day; therefore, please revise the exposure frequency for sediment and surface water to 350 days per year.*

Navy Response: The Navy respectfully disagrees with this comment. The ditch system in the vicinity of the site (where surface water/sediment exposure would take place) covers a very large area, most of which is outside the SWMU boundary. It is unlikely that a young child would be exposed to all segments of the ditch system at a frequency of 350 days per year. When considering an average exposure across the entire ditch system, an exposure frequency of one day per week for a young child (1 to 6 years of age) is considered reasonable. No revisions to the HHRA are proposed.

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): Under the residential scenario, it is PREQB's preference to take a conservative approach, as this scenario represents unrestricted use of a site. As no specific location is more reasonable than another for a residence, the potential exists for a residence to be located along a stretch of the drainage system with the highest COPC concentrations. Furthermore, a drainage system is an attractive play area for children. Therefore, it is PREQB's preference to evaluate child exposure to surface water and sediment using an EF of 350 days/year. However, PREQB will defer to EPA on this issue.

Navy Response: The exposure frequency for sediment and surface water exposure at SWMU 56 for the future residential child will remain 52 days/year

Appendix H

PREQB Comment 1: *Please clarify what soil depth range is represented by 0-0, as shown in the Depth Range header column for some soil samples.*

Navy Response: The soil depth range for those soil samples should be 0-1.0. The Depth Range header will be corrected to show 0-1.0 for those soil samples.

Appendix J

PREQB Comment 1: *Pages J-2 and J-3, Inhalation of Fugitive Dust/Volatiles from Soil:*

a. Please revise the units for AT to hours.

Navy Response: The units for AT will be revised to reflect hours.

b. Please present the equations used to calculate the volatilization factors and particulate emission factors or refer the reader to the relevant spreadsheets in Appendix K.

Navy Response: Page J-3 will be revised to refer the reader to the relevant spreadsheets in Appendix K.

PREQB Comment 2: *Page J-4, Dermal contact with groundwater: The equation presented is not consistent with the equation presented in EPA's RAGS Part E. The CDI equation should not include ET, exposure time, as this is accounted for in the DAevent equation as the event duration (t_{event}) expressed in hours per event. The appropriate term should be EV, event frequency (i.e., the number of events per day). Please revise this appendix, Appendix K and the HHRA accordingly.*

Navy Response: The equation for dermal contact with groundwater on page J-4 will be revised to replace the ET term with EV. Additionally, the EV term will be added to the CDI equations at the top of the groundwater dermal contact spreadsheets. However, no revisions are required to the equations actually used to calculate the dermally absorbed dose as these equations correctly account for ET in the DA_{event} equation.

PREQB Evaluation of Response (June 27, 2011 email from Gloria Toto Agrait, PREQB): Please clarify the last sentence of the response. The tevent is the event duration; therefore an ET term should not also be included in the DAevent calculations.

Navy Response: The term "ET" was incorrectly referenced in the above Navy Response. The last sentence of the Navy Response to PREQB Comment 2 should read, "…as these equations correctly account for event duration (t_{event}) in the DAevent equation."

PREQB Comment 3: *Page J-5, DAevent for organics and inorganics: Please note that under the definition of terms, there appears to be a typographical error for t_{event}, where the text states "assume one event per day," The event duration should express the duration of each event in hours per event.*

Navy Response: The phrase "assume one event per day" was intended to reflect the EV. However, this phrase will be relocated to the groundwater dermal contact CDI equation as a result of the inclusion of the EV term (refer to Navy response to PREQB Comment 2).

PREQB Evaluation of Response *(June 27, 2011 email from Gloria Toto Agrait, PREQB)* : Please indicate in the introduction to the equation that only inorganic COPCs were identified in water and, therefore, the equation presented is for the evaluation of dermal exposure to inorganics in surface water. Note that the most current guidance should be used in conducting HHRAs and RAGS Part E should be referenced for evaluating dermal exposures.

Navy Response: The text will be revised as indicated in the PREQB Evaluation of Response.

PREQB Comment 4: *Page J-5, Ingestion of Surface Water: Please revise the units for ingestion rate (IR) to L/hour for consistency with Table 8-5 and Appendix K.*

Navy Response: The units for the ingestion rate of surface water will be revised to reflect L/hour.

PREQB Comment 5: *J-6, Dermal Contact With Surface Water: Please revise this equation to remove the ET term and replace with EV. Please revise this appendix, Appendix K and the HHRA accordingly.*

Navy Response: The ET term is used appropriately in this equation. The equation used to quantitatively evaluate dermal exposure to surface water was taken from RAGS Part A (USEPA, 1989). This approach is consistent with the quantitative evaluation of dermal contact with inorganics, which were the only COPCs for SWMU 56 surface water. No revisions to this equation are proposed.

Appendix K

PREQB Comment 1: *Inhalation of Fugitive Dust spreadsheets: Please consider revising the title of these spreadsheets for all receptors to reflect inclusion of the inhalation of volatiles from total soil.*

Navy Response: The title on the spreadsheets for Inhalation of Fugitive Dust will be revised to include inhalation of volatiles from soil (specifically, "Inhalation of Fugitive Dusts/Volatiles Emanating from Soil").

PREQB Comment 2: *Adult and Youth Trespassers Adult Industrial Workers, Adult Construction Workers, Inhalation of Fugitive Dust Emanating from Total Soil: Please revise the units shown for averaging time (AT), as the numerical values listed reflect the correct units of hours for both carcinogens and noncarcinogens.*

Navy Response: The units for AT will be revised to reflect the correct units of hours for both carcinogens and noncarcinogens.

FINAL CORRECTIVE MEASURES STUDY REPORT SWMU 56

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. N62470-07-D-0502
DO 0002

September 29, 2011

IQC for A/E Services for Multi-Media Environmental Compliance Engineering Support

FINAL
CORRECTIVE MEASURES STUDY REPORT
SWMU 56

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

SEPTEMBER 29, 2011

Prepared for:

DEPARTMENT OF THE NAVY
NAVFAC SOUTHEAST
North Charleston, SC

Under:

Contract No. N62470-07-D-0502
DELIVERY ORDER 0002

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: **Mark E. Davidson**

Title: **BRAC Env. Coordinator**

Date: **September 29, 2011**

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLES

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

FIGURES

TABLE OF CONTENTS
(continued)

APPENDICES – VOLUME II of II

TABLE OF CONTENTS
(continued)

LIST OF ACRONYMS AND ABBREVIATIONS

ADAF	Age-Dependent Adjustment Factors
AF	Adherence Factor
AFWTF	Atlantic Fleet Weapons Training Facility
APA	Aerial Photography Analysis
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
AVS	Acid volatile Sulfide
BAF	Bioaccumulation Factors
Baker	Michael Baker Jr., Inc.
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BRAC	Base Realignment and Closure
BTAG	Biological Technical Assistance Group
$CaCO_3$	Calcium Carbonate
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
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	Contaminant of Concern
COPC	Chemical of Potential Concern
CRQL	Contract Required Quantitation Limit
CSF	Cancer Slope Factor
DAD	Dermally Absorbed Dose
DCQAP	Data Collection Quality Assurance Plan
DDT	Dichlorodiphenyltrichloroethane
DGPS	Differential Global Positioning System
DI	Deionized
DMMP	Dredged Material Management Program
DMP	Data Management Plan
DO	Delivery Order
DoN	Department of the Navy
DPT	Direct Push Technology
DRO	Diesel-Range Organics
EA	Environmental Assessment
EC_{50}	Median Effective Concentration

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

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-Median
ESCP	Erosion and Sediment Control Plan
ESL	Ecological Screening Level
ET	Exposure Time
F	Fahrenheit
FCVs	Final Chronic Values
FID	Flame Ionization Detector
FIR	Food Ingestion Rate
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
HM	Hazardous Material
HMW	High Molecular Weight
HQ	Hazard Quotient
HSA	Hollow-Stem Auger
HSP	Health and Safety Plan
IAS	Initial Assessment Study
ICM	Interim Corrective Measure
ICSAB	Interference Check Sample Solution AB
IC_{50}	Inhibition Concentration
IDW	Investigation-Derived Waste
ILCR	Incremental Lifetime Cancer Risk
IR	Ingestion Rate
IRIS	Integrated Risk Information System
ISQGs	Interim Freshwater Sediment Quality Guidelines
IUR	Inhalation Unit Risk
kg	kilogram

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

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-Core®
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-BW/day	milligram per kilogram Body Weight per day
m^3/hr	Cubic meters per hour
MHSPE	Ministry of Housing, Spatial Planning and Environment
ml	milliliter
MRL	Method Reporting Limit
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
MS/MSD	Matrix Spike/Matrix Spike Duplicate
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
NOEC	No Observed Effects Concentration
NOEL	No Observed Effects Level
NPL	National Priorities List
NSRR	Naval Station Roosevelt Roads
NTU	Nephelometric Turbidity Unit

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

OECD	Organization for Economic Co-Operation and Development
OEPA	Ohio Environmental Protection Agency
ORNL	Oak Ridge National Laboratory
PAH	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDF_i	Proportion of Diet Composed of Food Item i
PDS	Proportion of Diet Composed of Soil/Sediment
PEC	Probable Effect Concentration
PEL	Probable Effect Level
PEM	Palustrine Emergent Persistent
PEM	Palustrine Emergent Persistent
PI	Photo Identified
PID	Photoionization Detector
PMO	Program Management Office
PMP	Project Management Plan
POL	Petroleum, Oils and Lubricant
PPRTVs	Provisional Peer Reviewed Toxicity Values
PPT	Parts Per Thousand
PRDNR	Puerto Rico Department of Natural Resources
PREQB	Puerto Rico Environmental Quality Board
PRWQSR	Puerto Rico Water Quality Regulation
PRWQS	Puerto Rico water Quality Standard
PSI	Physical Site Inspection
PSQGs	Provincial Sediment Quality Guidelines
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RL	Reporting Limit
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
RRF	Relative Response Factor
RTK	Real-Time Kinematic
RWEC	Right Way Environmental Contractors, Inc.
SAR	Structure Activity Relationships
SCV	Secondary Chronic Value
SDG	Sample Delivery Group
SE	Southeast
SEL	Severe Effect Level

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

SEM	Simultaneously Extracted Metals
SERA	Screening-level Ecological Risk Assessment
SF	Square Feet
SID	Screening Information Database
SL	Screening Level
SQAGs	Sediment Quality Assessment Guidelines
SQUIRTs	Screening Quick Reference Tables
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
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Values
UCL	Upper Confidence Limit
ULM	Upper Limit of the Means
UNEP	United Nations Environmental Program
USACE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound
%D	Percent Difference
%R	Percent Recovery

1.0 INTRODUCTION

This document presents the results of the Revised Draft Corrective Measures Study (CMS) investigation conducted for Solid Waste Management Unit (SWMU) 56 (Hangar 200 Apron) at Naval Activity Puerto Rico, Ceiba, Puerto Rico and also presents an evaluation of corrective measures to mitigate potential human health and ecological risks at the SWMU. 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 (Environmental Protection Agency [EPA] Docket No. RCRA-02-2007-7301) (USEPA, January 29, 2007), which identified SWMU 56 (formerly referred to as Environmental Condition of Property [ECP] 2) 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 56 (Baker, December 2007) was approved by the USEPA on April 10, 2008. The CMS investigation was conducted in April through May 2008, the 2008 Pre-Excavation Investigation was conducted in September 2008, and the 2009 Supplemental Field Investigation in June 2009. The work was conducted in accordance with the approved Final Corrective Measures Study Work Plan for SWMU 56 (Baker, December 2007).

The Navy submitted a Draft CMS Report on September 26, 2008. In a letter dated December 3, 2008, the Navy retracted the Draft CMS due to soil disturbance activities at the SWMU by the Puerto Rico Ports Authority. Since that time it has been determined that the soil disturbance activities did not impact areas where analytical data and suspected site related contamination had occurred. However, new background data set for soils and sediment that is specifically representative of the airfield area has been developed and approved and is used for comparison of the surface soil, subsurface soil and sediment data collected as part of this CMS Investigation. This revised draft CMS also includes revisions made as a result of responding to the USEPA and PREQB comments (comment letter dated January 15, 2009) that were provided on the September 26, 2008 Draft CMS.

1.1 Purpose of Report

This report has been prepared to complete the characterization of SWMU 56 and serves as the basis for the selection of corrective measures to protect human health and the environment at SWMU 56. This report presents the environmental data, evaluates potential human health and ecological risks, develops chemicals of concern (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 56, as specified in the Administrative Order on Consent (USEPA, January 29, 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 56

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

- Evaluation of potential corrective measures that could be implemented at SWMU 56 to meet the CAOs

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

1.3 Organization of CMS 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 Naval Activity Puerto Rico (NAPR) and the history and previous investigations at SWMU 56. 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, groundwater, surface water, and sediment sampling, quality assurance/quality control (QA/QC) procedures and other investigation considerations. Section 4 also discusses the Pre-excavation Investigation and the Supplemental Field Investigation. 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 laboratory analysis performed on the environmental media samples and QA/QC samples collected during the CMS investigation with a comparison to appropriate background values. Analytical results from previous investigations are also included in this section for the purpose 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 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 56.

1.4 References

Baker, December 2007. Final Corrective Measures Study Work Plan for SWMU 56. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 6, 2007.

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 56. This section also includes a summary of the results of previous investigations conducted at SWMU 56.

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 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 (Ofstie 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 6 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 Environmental Condition of Property 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 (Environmental Protection Agency [EPA] Docket No. RCRA-02-2007-7301), which identifies SWMU 56 (formerly referred to as

ECP Site 2) 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 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. However, in accordance with the Administrative Order, the Covenant Deferral request and Quitclaim Deed of transfer, the US Navy maintains responsibility for the investigation and cleanup of SWMU 56.

2.2 SWMU 56 Description and History

SWMU 56 (also known as ECP Site 2) covers an area of approximately 1.3 acres and is located on the south side of Ofstie Field, just off of the aircraft apron on the northwest side of Hangar 200, as shown on Figures 2-2 and 2-3.

The aerial photography analysis (APA) presented within the Phase I ECP Report (LANTDIV, 2004), identified this area as photo identified Site 2. During the APA, as presented in the Environmental Condition of the Property Report (LANTDIV, 2004) an extensive analysis of aerial photography and records reviews was conducted. Aerial photographs were used to identify anomalies (e.g., large spills/stains, ground scars, debris piles, pits, possible disposal areas, etc.) that were not identified in previous investigations. As shown on Figure 2-3, areas of disturbance are represented by the 1958, 1961 and 1964 polygons. It was noted in the APA that there were stains/liquid observed extending off the edge of the hardstand to a surrounding drainage ditch from 1958-1965. A concrete channel is estimated to have been constructed between 1985 and 1995, in the area of the stained soil adjacent to the concrete apron. The Phase I ECP records review confirmed that Hangar 200 has historically been used for aircraft maintenance. The physical site inspections did not observe any significant stains or stressed vegetation. However, interviews confirmed numerous past spills of petroleum, oils, and lubricant (POL) and hazardous materials from the 1950s to the 1990s, and former use of the concrete apron as an aircraft wash down area is considered likely.

The Phase II ECP investigation performed in 2004 observed that the surrounding drainage ditch mentioned above is concrete lined and filled with water (NAVFAC Atlantic, 2005) (see Photograph A-1 in Appendix A). Photograph A-2 in Appendix A shows the surface water observed east of the drainage culvert under the tarmac leading to the runway on the northwestern side of the site. Also observed during the investigation was an old floating absorbent sock that would have been utilized to stop potential phase-separated hydrocarbons from moving further downgradient within the stormwater drainage system. This material was observed immediately east of the drainage tunnels as mentioned above (Photograph A-2). Fish were observed within this drainage ditch of approximately four inches in length. The majority of the drainage ditch contains thick organic material including long grass and other plant material as observed in Photograph A-3. There were no signs of any stains or stressed vegetation observed during the investigation.

The 2004 Phase II ECP investigation conducted at this site indicated that surface water and sediment were impacted by past operations in the area. These impacts are discussed further in Section 2.3.

2.3 Previous Investigations

SWMU 56, originally known as ECP Site 2, was included in the 2004 Phase II ECP investigation performed by Baker. Two surface water samples, along with one sediment sample that was a composite throughout the concrete-lined drainage swale, were collected.

The surface water samples were collected near the surface utilizing the direct dip method; the sediment sample was collected utilizing a stainless steel spoon and compositing sediments from the entire 200 foot length of the drainage swale. Both surface water sampling locations (2E-SW01 and 2E-SW02) were surveyed in the field using a hand held Global Positioning System (GPS) receiver. Sample locations are shown on Figure 2-3. The surface water samples were analyzed for Appendix IX Volatile Organic Compounds (VOCs), Appendix IX Semivolatile Organic Compounds (SVOCs), total petroleum hydrocarbons (TPH) diesel range organics (DRO) and gasoline range organics (GRO), as well as Appendix IX total metals. The sediment sample was analyzed at the fixed-base analytical laboratory for Appendix IX VOCs, Appendix IX SVOCs, TPH DRO and GRO, and Appendix IX metals.

A summary of the analytical results from this investigation as they were published in the ECP report can be found in Section 6 of this document and in Appendix B. In the surface water media, one VOC, three SVOCs, and TPH DRO and GRO were detected at very low, estimated concentrations. Five inorganic compounds were quantified in the surface water as well. The VOC, toluene, and the TPH GRO and DRO were only found at location 2E-SW02. The SVOCs were quantified in the duplicate sample analysis only, and only at location 2E-SW01. Similar concentrations of inorganics were found at all locations. Comparison of the surface water samples to relevant surface water screening criteria indicated slight exceedances of copper and mercury.

Sediment analyses resulted in the detection of four VOCs, four SVOCs, and TPH DRO. Thirteen inorganic compounds were also detected in the sample. Although not strictly applicable to the sediment collected in the drainage swale, sediment data was compared to marine sediment screening values. This comparison showed exceedances of four organic compounds (acetone, chrysene, fluoranthene, and meta and para [m&p] cresol). In addition, all detected inorganic compounds exceeded the marine sediment screening criteria with the exception of beryllium and mercury.

Based on the above, it appears that past activities have impacted the environment at this location and the contamination at the site is primarily related to metals and fuel contamination. The ECP recommended continued RCRA corrective measures activities, which was the basis for incorporating SWMU 56 into the USEPA Administrative Order and ultimately for conducting this CMS investigation.

2.4 References

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.

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 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^{o} North, 30^{o} 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. The mean annual minimum temperatures vary 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 although a dry winter season occurs from December through April. About 22 thunderstorm-days occur per year, with maximum frequencies of 3 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; maximum winds exceed 95 knots during severe hurricanes. 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^{o} 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 56 area. In 2004, Baker conducted a series of Phase II ECP investigations across NAPR. SWMU 56 was investigated during the ECP; however, no subsurface borings were advanced at that time.

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.

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, 2004). Some consistent stratigraphic trends were observed during the ECP, which is discussed in this subsection. The site hydrogeology discussed in Section 5 for SWMU 56 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, and 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 by 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. 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 56 is located in the airfield area, which is in the inland flat area discussed above. Soil borings were not advanced during the Phase I/II ECP investigation. A site-specific discussion of the hydrogeology based on the recent CMS investigation of SWMU 56 is provided in Section 5 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. There are four field investigations that are included as part of the CMS 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 CMS Investigation sampling event was conducted from April through May 2008, the 2008 Pre-Excavation Investigation was conducted in September 2008, and the 2009 Supplemental Field Investigation in June 2009; each investigation is discussed below. The work was conducted in accordance with the approved Final Corrective Measures Study Work Plan for SWMU 56 (Baker, December 2007).

Phase II ECP

A Phase II ECP investigation was conducted in 2004 and involved the collection of two surface water samples (designated 2E-SW01 and 2E-SW02) and one sediment sample (designated 2E-SD01) from the concrete-lined portion of the drainage ditch system. Each surface water sample and the single sediment sample was analyzed for Appendix IX VOCs, SVOCs, and metals (total recoverable fraction), 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.

2008 CMS Investigation

The CMS field investigation was conducted from April 29, 2008 to May 3, 2008 and involved the collection of surface and subsurface soil, groundwater, and drainage ditch surface water and sediment, as discussed below and as shown on Figure 4-1:

- The collection of surface soil from eight locations. Samples 56SB01-00 through 56SB08-00 were analyzed for Appendix IX VOCs, SVOCs (including low-level polynuclear aromatic hydrocarbons [LLPAHs]), and metals. Surface soil samples were collected from the 0.0 to 1.0-foot depth interval.

- The collection of sixteen subsurface soil samples from eight locations that were submitted for laboratory analysis of Appendix IX VOCs, SVOCs (including LLPAHs], and metals.

- The installation of permanent monitoring wells at each of the eight boring locations.

- The collection of groundwater samples from each of the eight monitoring wells. The groundwater samples were submitted for laboratory analysis of Appendix IX VOCs, SVOCs (including LLPAHs), and total and dissolved metals.

- The collection of drainage ditch surface water samples from five locations. The surface water samples were submitted for laboratory analysis of LLPAHs, and total and dissolved metals.

- The collection of three drainage ditch sediment samples (56SD03 through 56SD05) from locations collocated with surface water samples and submitted for laboratory analysis of Appendix IX VOCs, SVOCs (including LLPAHs), metals and total organic carbon (TOC).

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

Pre-excavation Investigation

This investigation was conducted in support of a planned (albeit not implemented) Interim Corrective Measure (ICM) and consisted of further delineation of the distribution of COCs identified in the Draft CMS Report for SWMU 56 in surface soil and sediment, The pre-excavation field investigation was conducted from September 24, 2008 to September 25, 2008 and involved the collection of surface soil and drainage ditch sediment. As shown on Figure 4-2 a total of twelve surface soil samples (designated 56SS01 through 56SS12; collected from the 0.0 to 1.0-foot depth interval) and three drainage ditch sediment samples (designated 56SD12 through 56SD14) were collected. Also as depicted on Figure 4-2, sediment was collected from Drainage Ditch Segment E-F. Surface soil samples 56SS01 through 56SS06 were analyzed for lead and selenium and surface soil samples 56SS07 through 56SS12 were analyzed for selenium and vanadium, while each drainage ditch sediment sample was analyzed for Appendix IX metals.

Sediment samples 56SD12 through 56SD14 were collected as part of the Pre-excavation delineation in September 2008 and are included as part of this revised CMS Report.

During the pre-excavation sampling, there were five sediment samples that were collected that are not included as part of the Revised SWMU 56 CMS Investigation (56SD06, 56SD07, 56SD08, 56SD09 and 56SD11). Several metals (e.g., arsenic, cobalt, copper, lead, vanadium, and zinc) were detected in three sediment samples (56SD08, 56SD09 and 56SD11) at concentrations greater than ecological-based screening values previously established and used in ecological risks assessments at NAPR. These samples were identified as a potential source of contamination and were investigated under separate cover as Site 56A/SWMU 80.

The need for revising the surface soil background data set for use in SWMU investigations at the airfield at NAPR was discussed and agreed upon during a meeting October 30, 2008 at the USEPA Region 2 Offices in New York, New York. Field investigations at the airfield indicated that the surface soil background concentrations established basewide for NAPR and used for screening results and establishing cleanup objectives may not be representative of actual conditions at the airfield. Sediment samples 56SD06 and 56SD07 (sampled September 25, 2008) were combined with upgradient stormwater drainage ditch/background sediment samples to supplement the background data set and recalculate background screening values. The airfield background soil data set and airfield drainage ditch sediment data set are described and presented in Addendum B and Addendum C, respectively, of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010).

Supplemental Field Investigation

The purpose of the supplemental field investigation conducted on June 27, 2009 was to further delineate the distribution of potential COCs in the drainage ditch sediment. The Supplemental Field investigation involved the collection of eight sediment samples (designated 56SD15 through 56SD22), as shown on Figure 4-2. Sediment samples 56SD15, 56SD16, 56SD17, 56SD18, 56SD19, and 56SD20 were collected from Drainage Ditch Segment E-F, while sediment samples 56SD21 and 56SD22 were collected from Drainage Ditch Segment G-H (see Figure 4-2). Each sediment sample was analyzed for Appendix IX metals, acid volatile sulfide (AVS), and simultaneously extracted metals (SEM).

Section 4.1 provides a more detailed discussion of surface and subsurface soil sampling activities. Section 4.2 discusses the monitoring well installation and groundwater sampling activities. Section 4.3 discusses the groundwater level measurement activity. Section 4.4 discusses the surface water/sediment sampling activities.

The environmental samples collected from the site were analyzed at a fixed-base laboratory and the data was validated by an independent third party. 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. Other Quality Assurance/Quality Control (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, surface water/sediment sampling notes, 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

Surface soil samples were collected during the 2008 CMS Investigation and the Pre-Excavation Investigation. Subsurface samples were collected during the 2008 CMS Investigation as discussed below.

2008 CMS Investigation

Surface and subsurface soil samples were collected from the soil boring locations shown on Figures 4-1 and 4-2. Soil borings 56SB01 through 56SB05 were advanced near the edge of the apron and alongside the concrete channel. These borings were intended to obtain data to determine the extent of the contamination that may be associated with the previously observed stained area and any releases from the concrete channel. Soil borings 56SB06, 56SB07, and 56SB08 were advanced along the downstream earthen ditch adjacent to the culvert outfalls to verify whether any of the contamination in the drainage ditch has migrated to the groundwater. All of the borings were located within the fenced airfield area except for 56SB08 which was located outside the fenced area. Soil boring 56SB08 was located near the drainage channel where data was expected to reflect both site-related and non-site related impacts to the subsurface.

Soil borings were advanced using a direct push rig (Geoprobe 66DT rig operated by GeoEnviroTech, Inc., of San Juan, Puerto Rico) and samples were collected using 4-foot Macro-Cores®. The work plan specified the collection of 2-foot split-spoon samples during monitoring well installation using hollow-stem auger (HSA) rigs; however because a direct push technology (DPT) rig with augering capability was used for installing monitoring wells, the soil samples were collected using Macro-Cores®. It was determined during planning that the deviation would not result in loss of data quality. Soil boring logs are presented in Appendix A.

Soil samples were field-screened for non-specific, total VOCs using a photoionization detector (PID) equipped with an 11.7 eV probe and calibrated to isobutylene. The PID readings were recorded on the drilling logs for each boring (Appendix A). The field screening procedure for soils collected using the Geoprobe Macro-Core® (MC) Sampler (disposable plastic liner) involved making a longitudinal cut along the entire length of the Geoprobe MC liner, separating the two edges of the liner, and screening the entire length of the soil core with a PID. Measurable organic vapors above background levels were not observed in any of the eight boreholes or during the general PID air monitoring.

Surface soil samples were collected from eight locations (56SB01 through 56SB08) using Macro-Cores® during boring advancement from a depth of 0.0 to 1.0 foot bgs. One duplicate sample was collected from 56SB03 and analyzed for the same parameters as the primary samples. Table 4-1 provides a summary of the surface soil samples collected at SWMU 56. Surface soil samples were collected after removing any vegetation and topsoil/root zones. VOC samples were collected immediately after the sample was liner was cut and the sample was screened with the PID. VOCs samples 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. Following VOC sampling, soil was homogenized and soil samples for Appendix IX SVOCs (including LLPAHs) and metals were transferred directly into pre-labeled sample jars and placed on ice. A total of eight surface soil samples were collected and analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals.

Two subsurface soil samples were collected from each of the eight soil borings for a total of 16 subsurface soil samples (one field duplicate sample was also collected from location 56SB06). Subsurface soil was collected from either the 1.0 to 3.0-foot depth interval (56SB01-01, 56SB06-01, and 56SB08-01), 3.0 to 5.0-foot depth interval (56SB02-02, 56SB03-02, 56SB07-02, and 56SB08-02), 5.0 to 7.0-foot depth interval (56SB04-03, 56SB05-03, 56SB06-03, and 56SB07-03), 7.0 to 9.0-foot depth interval (56SB01-04, 56SB02-04, 56SB03-04, and 56SB04-04), or the 9.0 to 10.0-foot depth interval (56SB05-05). Field observations and Photoionization Detector (PID) readings did not indicate the presence of specific zones of contamination. Because of the clayey soil type, the presence of groundwater was not apparent; therefore sampling depths were selected based on the field geologist's discretion, including observations of changes in soil types and moisture content. (As discussed in Section 5.0, one soil boring, 56SB01 was advanced to a total depth of 28 feet below ground surface in –order to identify a significant water bearing zone. This boring was subsequently backfilled with drill cuttings to a total depth of 16 feet below the ground surface. Drill cuttings last out of the hole were replaced first thereby approximating the original stratigraphy at this location. Note that PID monitoring and visual/olfactory observations did not indicate the presence of contamination at this boring location.) Soil boring logs are presented in Appendix A. Sampling was conducted as described for surface soil, with VOC samples collected using Terra Core kits immediately after cutting the liner and screening the soil with the PID, followed by soil homogenization, and then the collection of SVOC (including LLPAHs) and metals samples. The samples were transferred into pre-labeled sample jars and placed on ice. A total of 17 samples (16 primary environmental samples plus one duplicate sample) were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs) and metals. A sampling summary is provided on Table 4-1.

Pre-excavation Investigation

A pre-excavation field investigation was conducted from September 24, 2008 to September 25, 2008 and involved the collection of additional surface soil samples. A total of twelve surface soil samples were collected from the 0.0 to 1.0-foot depth interval. Surface soil samples 56SS01 through 56SS06 were analyzed for lead and selenium and surface soil samples 56SS07 through 56SS12 were analyzed for selenium and vanadium.

4.2 Monitoring Well Installation and Groundwater Sampling

Monitoring wells were installed at soil boring locations 56SB01 through 56SB07 within the fenced airfield area during the 2008 CMS Investigation. A monitoring well was also installed at soil boring location 56SB08 outside the airfield fence. These monitoring wells were installed to gather data to evaluate whether contaminants may have migrated from the drainage ditch and impacted the groundwater. Monitoring wells 56SB01 through 56SB05 were located adjacent to the drainage ditch where site-related drainage could have impacted the groundwater. Monitoring wells 56SB06 to 56SB08 were adjacent to the drainage at locations where both site-related as well as non-site related surface water discharges could have impacted the groundwater. The locations of the monitoring wells are shown on Figures 4-1 and 4-2. Monitoring well construction logs are provided in Appendix A.

The monitoring wells were installed using a DPT rig with augering capability, as mentioned above. Soil sampling including classification was conducted during well installation.

The wells were constructed of 2-inch ID, Schedule 40 polyvinyl chloride (PVC), with flush joint threads and 10-foot long well screens. Monitoring wells 56SB01 through 56SB07 were installed to a depth of 16 feet bgs to ensure that the most likely depth of the saturated zone (i.e., field geologist's observations of moist/damp soil) was straddled. Monitoring well 56SB08 was installed to a depth of 14 feet bgs based on the observation of saturated soil at a shallower depth. 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 HSAs were withdrawn from the borehole. The sand was extended an additional two feet above the top of the screened interval at all monitoring well locations except at 56SB08 where the sand was extended to only one foot above the screen because of the shallow depth of the well. A 2-foot thick 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 2-foot "stickup" risers to provide visibility because of the vegetation present in this area. 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. Steel bollards were installed around the concrete pads as additional protection and painted a bright yellow color to aid in visibility. All wells were provided with a locking cap installed on the protective steel casing.

Each new permanent 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. In most cases, more than three well volumes of water were removed in an effort to reduce turbidity and improve clarity to ensure successful low flow sampling parameter equilibrium. An attempt was made to reduce turbidity to less than 20 Nephelometric Turbidity Units (NTUs), as specified in the work plan. 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, turbidity, conductivity, dissolved oxygen, and oxidation-reduction potential were obtained with appropriate instrumentation prior to sampling. The groundwater samples were placed into appropriate laboratory supplied containers. The groundwater samples were filtered in the field for the dissolved metals analyses. Notes containing the groundwater parameters during well development, purging, and sample collection are provided in Appendix A.

Groundwater samples were collected for analysis of Appendix IX VOCs, SVOCs (including LLPAHs), and total and dissolved metals. Samples were transferred directly from the discharge of the tubing into pre-labeled sample jars and placed on ice. Eight groundwater samples and one duplicate were collected for analysis as outlined on Table 4-1. Samples were shipped in coolers with chain-of-custody forms (presented in Appendix A), which included the requested analyses for the samples.

4.3 Groundwater Level Measurements

The depth to the groundwater surface in the eight monitoring wells at SWMU 56 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 the risers were surveyed on May 6, 2008 following the methods described in Section 4.7. The water level measurements and elevations are discussed further in Section 5.0.

4.4 Surface Water and Sediment Sampling

Surface water and sediment samples were collocated as shown on Figures 4-1 and 4-2. At each location (beginning with the most downstream location 56SW05/56SD05 and proceeding upstream towards 56SW02), a surface water sample was collected first, followed by the sediment sample. This sequence of sampling ensured that entrainment of sediment particles in surface water was minimized and therefore, the samples were more representative of the normal, undisturbed, stream-flow conditions. Sample location 56SW05/56SD05 was approximately 500 feet downstream of the point where the earthen ditch discharging from the site meets a second offsite drainage ditch as described in Section 2.2. Sample location 56SW04/56SD04 was approximately 100 feet upstream of this confluence point. Sample location 56SW03/56SD03 was where the earthen ditch begins downstream of the concrete channel and it is the closest point to the concrete apron where evidence of any historical impacts to the sediment in the ditch could be collected. Sample locations 56SW01 and 56SW02 were further upstream within the concrete channel, where no sediment samples were planned to be collected, because very minimal sediment was previously noted to be present and it was previously sampled (as discussed in Section 2.4).

Beginning at the most upstream locations to location 56SW03/56SD03, the data are intended to reflect the residual impacts of the discharges from the site. The data from downstream locations 56SW04/56SD04 and 56SW05/56SD05 are intended to reflect the combined impact of the residual site-related discharges as well as any current, offsite (non-site related) discharges. Surface water/sediment sample collection notes are provided in Appendix A.

4.4.1 Surface Water Sampling

Surface water samples were collected from the locations shown on Figures 4-1 and 4-2 during the 2008 CMS Investigation. Samples were collected using the direct-dip method from an appropriate water depth determined in the field, as described in the work plan. The direct dip method uses a 1-liter laboratory certified clean, unpreserved amber glass bottle. The surface water was then decanted into appropriate laboratory supplied containers and placed on ice for laboratory-based chemical analysis. Five surface water samples (from 56SW01 through 56SW05) and one duplicate (from 56SW04) were collected for analysis of LLPAHs, and total and dissolved metals as outlined on Table 4-1. Samples were shipped in coolers with chain-of-custody forms (presented in Appendix A), which included the requested analyses for the samples.

4.4.2 Sediment Sampling

Sediment samples were collected during the 2008 CMS Investigation, the Pre-excavation Investigation and the Supplemental Field Investigation.

2008 CMS Investigation

Sediment samples were collected from the locations shown on Figures 4-1 and 4-2. Samples were collected using a dedicated stainless steel spoon, as described in the work plan and transferred into laboratory-supplied glass jars and polyethylene containers. Fourteen sediment samples were collected as part of this investigation. Three of the sediment samples (from 56SD03, 56SD04, and 56SD05) and one duplicate (from 56SD04) were collected for analysis of Appendix IX VOCs, SVOCs (including LLPAHs), and metals. Sediment samples from the three locations were also analyzed for total organic carbon (TOC). Sediment sample collected for VOCs included the use of Terra Core kits. The Terra Core kits included one disposal syringe, one dry weight container, two-40 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. The samples for the analyses of SVOCs (including LLPAHs), metals, and TOC were transferred from the stainless steel spoon directly into the sample containers after removing any debris and vegetation.

Pre-excavation Investigation

Upgradient stormwater drainage ditch sediment samples were collected as part of the pre-excavation delineation sampling at SWMU 56 conducted from September 24, 2008 to September 25, 2008. The purpose of the pre-excavation sampling was to further define the extent of contamination. A total of three drainage ditch sediment samples (designated 56SD12 through 56SD14) were collected and analyzed for Appendix IX metals and are included as part of this investigation.

Supplemental Field Investigation

The supplemental field investigation was conducted on June 24, 2009 and involved the collection of eight sediment samples (designated 56SD15 through 56SD22). Sediment samples 56SD15, 56SD16, 56SD17, 56SD18, 56SD19, and 56SD20 were collected from Drainage Ditch Segment E-F, while sediment samples 56SD21 and 56SD22 were collected from Drainage Ditch Segment G-H (see Figure 4-2). Sample 56SD15 was placed between sample 56SD12 and 56SD13. Sample 56SD16 was placed 20 feet upgradient from sample 56SD13 where lead was detected at a concentration greater than the sediment screening value, sample 56SD17 was approximately 20 feet downgradient of sample 56SD13, but upgradient of the drainage ditch confluence within the SWMU 56 drainage ditch. Sample 56SD18 was established approximately 20 feet upgradient and 56SD19 approximately 20 feet downgradient of historical sample 56SD14. Sample 56SD20 was established at the midpoint between historical sample location 56SD14 and historical location 56SW05/56SD05. Sample 56SD21 and 56SD22 were established 20 feet and 40 feet downgradient, respectively from a double box culvert. This segment of the drainage ditch was not sampled during previous investigations. Each sediment sample was analyzed for Appendix IX metals, acid volatile sulfide (AVS), and simultaneously extracted metals (SEM).

4.4.3 Deviations from the Work Plan

As stated in the CMS Work Plan, this section includes a discussion on any problems encountered or deviations from the Work Plan.

During the development of groundwater monitoring well 56GW02, the well was purged dry after the collection of the second round of groundwater quality parameters. The next day, the well was sampled without purging or the collection of groundwater quality parameters since the well was low yield. On May 1, 2008 ORP readings were not collected due to an oversight of the field team.

The work plan specified the collection of 2-foot split-spoon samples during monitoring well installation using HSA rigs; however because a DPT rig with augering capability was used for installing monitoring wells, the soil samples were collected using Macro-Cores®. It was determined during planning that the deviation would not result in loss of data quality. Soil boring logs are presented in Appendix A.

The work plan states that wells will be developed until turbidity measurements (typically less than 20 NTUs are reached). However, wells 56GW01, 56GW03, 56GW06 and 56GW07 were developed before turbidity was reduced to less than 20 NTUs.

Consecutive water quality measurements for samples 56GW05 and 56GW08 were collected every 10-11 minutes instead of every 5 minutes as per Region 2 low flow sampling procedures. The work plan states that cement/bentonite grout of the monitoring well should be allowed to cure for a minimum of 24 hour prior to well development, well development was performed prior to the minimum 24-hour waiting period.

4.5 Investigation Derived Waste

Disposable sampling tools were used for soil, groundwater, surface water and sediment sampling to the extent practicable, in order to minimize the generation of liquid investigation-derived waste (IDW) from decontamination. Laboratory supplied bottles were used for surface water sampling and dedicated, disposable sampling tools (stainless steel spoons) were used for sediment sampling. Wastewater from decontamination of the drill rig before and after entering the site were containerized, characterized, and disposed of appropriately. IDW characterization and disposal documentation is provided in Appendix A.

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 mapping-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 encountered.

4.7 Surveying

Initial locations of borings were determined using a mapping grade differential GPS (DGPS) that utilizes satellite corrections from Omnistar in "real-time". Prior to entering the field, an electronic "shape file" (which included each proposed soil boring location) was obtained from the Computer Aided Design and Drafting (CADD)/Geographic Information System (GIS) at Baker and 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 numbered accordingly. Then, the borings were advanced at these locations. The coordinate system utilized for the survey was U.S. State Plane 1983, Puerto Rico/Virgin Island 5200, and the North American Datum (NAD) 1983, with units in feet.

After the monitoring wells were installed, their coordinates were more accurately surveyed using Real-Time Kinematic (RTK) GPS methods. RTK GPS surveying was selected specifically because of the accuracy of data it provides to produce groundwater contour mapping. RTK GPS surveying employs a GPS base station and a GPS rover that reads satellite carrier phase signals. Using the carrier phase signal in conjunction with a base station provides a horizontal accuracy of approximately 0.1 feet and an elevation accuracy of approximately 0.02 feet. The coordinate system used for the survey was U.S. State Plane 1983, Puerto Rico/Virgin Island 5200, and the North American Datum (NAD) 1983, with units in feet.

Each monitoring well at SWMU 56 was surveyed using the RTK GPS method on May 6, 2008. An elevation was obtained from the top of PVC riser (highest point) 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 CADD. Coordinates were obtained and input into the CADD/GIS to produce the maps used in this CMS report.

4.8 QA/QC Sampling

The following QA/QC samples were collected during the investigation of this site:

- Field Duplicates
- Matrix Spike/Matrix Spike 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, the Pre-excavation Investigation and the Supplemental Field Investigation.

2008 CMS Field Investigation

Two field duplicate soil samples (56SB03-00D and 56SB06-01D) and one field duplicate sediment sample (56SD04D) were collected. One field duplicate surface water sample (56SW04D) was collected corresponding to five surface water samples. One field duplicate groundwater sample (56GW03D) was collected corresponding to eight groundwater samples. Field duplicates were analyzed for the same parameters as the primary samples (with the exception of TOC for the sediment sample) and the results were used to evaluate the field sampling methodology.

Pre-excavation sampling

One field duplicate soil samples (56SS11D) and one field duplicate sediment sample (56SD14D) were collected corresponding to 15 solid samples. Field duplicates were analyzed for the same parameters as the primary samples (with the exception of TOC for the sediment sample) and the results were used to evaluate the field sampling methodology.

Supplemental Filed Investigation

One field duplicate sediment sample (56SD22D) was collected corresponding to eight solid samples. The field duplicate was analyzed for the same parameters as the primary sample and the results were used to evaluate the field sampling methodology.

4.8.2 Trip Blanks

One trip blank sample was included in each cooler containing samples from the site intended for VOC analysis. A total of six trip blanks (56TB01, 56TB02, 56TB03, 56TB04, QATB01 and 74TB12) accompanied samples from this site during the 2008 CMS Investigation. These trip blanks were analyzed for Appendix IX VOCs to evaluate whether cross contamination occurred during shipping of samples.

4.8.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates were collected at the rate of approximately 5 percent of primary environmental samples from soil, sediment, and groundwater. Two sets of MS/MSDs (56SB05-03MS/MSD and 56SB06-03MS/MSD) were collected corresponding to 24 soil samples for the 2008 CMS Investigation. One MS/MSD (56SS09MS/MSD) was collected corresponding to 12 soil samples for the Pre-excavation Investigation. One MS/MSD (56SD04MS/MSD) was collected corresponding to four sediment samples for the 2008 CMS Investigation. One MS/MSD (56SD14MS/MSD) was collected corresponding to four sediment samples for the Pre-excavation Investigation. One MS/MSD (56SD22MS/MSD) was collected corresponding to nine sediment samples for the Supplemental Field Investigation. One MS/MSD (56GW03 MS/MSD) was collected corresponding to eight groundwater and five surface water samples for the 2008 CMS Investigation. The MS/MSD samples were analyzed for the same parameters as the primary samples (with the exception of TOC for the sediment sample), and the results were used to evaluate the effect of each type of matrix on the analytical method.

4.8.4 Field Blanks

One field blank sample (FB01) was collected from laboratory-grade deionized water used as the source water for the equipment rinsate samples during the 2008 CMS Field Investigation. One field blank (JUNE09-FB02) was collected during the 2009 Supplemental Field Investigation from laboratory-grade deionized. 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 samples were analyzed for Appendix IX VOCs, SVOCs, and metals, to determine whether the water used for generating the equipment rinsates was free of chemicals at levels of concern for the site (Sample JUNE09-FB02 was also analyzed for Pesticides/PCBs).

4.8.5 Equipment Rinsates

Equipment rinsates were collected from the disposable sampling tools and analyzed for the same parameters as the corresponding primary environmental samples. Seven equipment rinsate samples were collected during the 2008 CMS Field Investigation. ER01 and ER07 were collected from Macro Core Liners used on two different days. ER02 was collected from a stainless steel spoon representing the tool used for soil and sediment sample collection. ER04, ER05, ER06, and ER10 were collected from tubing that was used for groundwater sampling on four different days. Equipment rinsate samples ER01, ER02, ER04, and ER05 were analyzed for Appendix IX VOCs, SVOCs, and metals. Equipment rinsate samples ER06, ER07, and ER10 were analyzed for Appendix IX VOCs and metals. The analysis for LLPAHs (corresponding to surface water samples) was not included for equipment rinsate samples because surface water samples were collected using dedicated, laboratory-certified clean glass bottles with the direct-dip method.

One equipment rinsate sample (JUNE09-ER02) was collected during the 2009 Supplemental Field Investigation. The rinsate was collected from a stainless steel spoon representing the soil and sediment sample collection tool and analyzed for Appendix IX VOCs, SVOCs, Pesticides, PCBs and metals.

4.9 Laboratory Analysis

Fixed-base laboratory analysis was conducted by Test America, Savannah, Georgia for the 2008 CMS Investigation and the Pre-excavation Investigation. Columbia Analytical Services of Rochester, New York conducted the analysis for the Supplemental Field Investigation. 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, Limited Liability Corporation (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, 2010. Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. July 30, 2010.

Baker, 2007. Final Corrective Measures Study Work Plan for SWMU 56. Naval Activity Puerto Rico, Ceiba, Puerto Rico. December 6, 2007.

5.0 PHYSICAL RESULTS

The following sections provide a brief discussion of the current site conditions at SWMU 56 at the time of the CMS field investigation including a review of the site surface hydrology. The site geology and hydrogeology, as ascertained from the soil boring program and other available information, also is described herein.

5.1 Current Conditions

As shown on Figure 5-1, SWMU 56 consists of approximately 1.3 acres on the northwest side of the Hangar 200 apron. At the time of the CMS investigation, and because of the Base closure, the area encompassed by SWMU 56, Hangar 200 and the apron area was vacant and had not been used for several years. No debris or staining was noted on the concrete apron. The drainage ditches in the vicinity of the site were heavily vegetated with brush and tall grass. Water was noted in the ditches. Photographs of the current site conditions are provided in Appendix A photos A-4 through A-8.

5.2 Site Hydrology

SMWU 56 consists of the immediate vicinity surrounding the drainage ditch coming from the apron area northwest of Hangar 200, as shown on Figure 5-1. This portion of the apron is sloped to the northwest and also to a central discharge feature consisting of a curbed/bermed area along the edge of the apron to channel water into a shallow concrete channel (approximately eighteen inches wide and six inches deep). The channel (ditch segment A-B on Figure 5-1) slopes gently away from the apron area (slope not measured) and trends west and southwest for approximately 248 feet toward a 24-inch diameter culvert. Surface water sample 56SW01 was collected upstream from this culvert and, as will be discussed in Section 7.1.2, hydrophytic vegetation (i.e., vegetation adapted to grow in hydric soils) was observed within and immediately adjacent to the ditch. The culvert (ditch segment B-C) routes the flow about 133 feet under the western taxiway where it discharges into an earthen drainage ditch several feet wide with sloped sides. Although not measured, the depth of the drainage ditch at the downstream end of the 24 inch culvert is estimated to be between 8 and 12 feet. Flow was about two-feet wide and two feet deep. Surface water sample 56SW03 was collected immediately downstream from this culvert.

The earthen drainage ditch (ditch segment C-D) extends approximately 533 feet from the 24-inch diameter culvert southeast and south, past the southwestern portion of the Hangar 200 apron to a 36-inch culvert that carries the flow under Bogue Street. Visual indications such as eroded soils were observed during the field investigation indicating that some runoff from the apron area southwest of Hangar 200 flows into this reach of the drainage ditch; however, engineered drainage structures were not noted in this portion of the apron area. Additionally, a small drainage ditch discharges to this reach from the west. As indicated previously, sample 56SW03 was collected downstream from the 24-inch diameter culvert, at the beginning of this reach. Surface water sample 56SW04 was collected upstream from the 36-inch diameter culvert, at the downstream end of this reach.

The 36-inch diameter culvert (ditch segment D-E on Figure 5-1) routes the flow south, under Bogue Street approximately 181 feet, where the flow is again discharged into an earthen drainage ditch. Flow continues east and southeast another 527 feet to a double 4-foot by 8-foot box culvert (approximately 53 feet long) under an airfield access road (ditch segment F-G). Additional flows enter the drainage ditch along this reach from the west and southwest. Sample 56SW05 was collected from the downstream portion of this reach, prior to flow entering the 4-foot by 8-foot box culvert.

Flow continues northeast in the earthen drainage ditch (ditch segment G-H) another 376 feet where it is comingled with flows from other portions of the airfield and routed into triple 5-foot by 9-foot box culverts. Flow is transmitted south through a series of box culverts and earthen drainage ditches (ditch segment H-I) about 822 feet to a discharge point in a vegetated area adjoining an E2SS3 wetland (estuarine, intertidal, scrub-shrub, broad-leaved evergreen wetland).

5.3 Geology/Hydrogeology

The following sections discuss the geology and hydrogeology in the vicinity of SWMU 56.

5.3.1 Geology

SWMU 56 is located within the inland flat area as previously described and stated in Section 3.3.4. A total of eight borings were advanced during the 2008 CMS field effort and eight groundwater monitoring wells installed at these boring locations (see Figure 4-1). Generally, a consistent stratigraphic sequence was observed at the boring locations. Boring logs for each borehole are presented in Appendix A. A thin layer of topsoil, made up of dark brown silty or sandy loam, and gravel was observed within the first one half (0.5) to one and a half (1.5) feet below ground surface at the borings. This was followed by significant layers of clay and/or silty clay to depth at each of the boreholes. One boring, 56SB01, was drilled deeper than the rest in an attempt to find significant water bearing zones. This borehole was ultimately backfilled with drill cuttings to approximately 16 feet below ground surface for monitoring well installation. In general, the clay and silty clay encountered was light gray to white intermixed with maroon or dark reddish brown clay. Occasionally, zones would change to greenish gray and resemble a more saprolitic or weathered bedrock characteristic. At the deeper boring, 56SB01, consistent saprolite laminar conditions were noted at approximately 20 feet below ground surface. A geologic cross section was drawn depicting the geologic conditions and water levels relative to well placement and topography from 56SB04 to 56SB08. A geologic cross section location map is presented as Figure 5-2, Cross Section A-A' is shown on Figure 5-3 and Cross Section B-B' is shown on Figure 5-4.

5.3.2 Hydrogeology

Groundwater yields at SWMU 56 were observed to be generally low and were estimated to be below one gallon per minute. Based on professional experience and the literature, surficial clays typically exhibit common features. Upper portions of surficial clays tend be fractured due to weathering (Parker, 1999). These fractures are predominantly vertical and exhibit varying degrees of interconnectivity. Fracture frequency tends to decrease with depth. Because of the parallel orientation of the fractures and typical vertical soil bore holes, fractures are often not observed. As mentioned previously, well 56SB01 was installed at a total depth of 16 feet below ground surface, but the initial borehole was advanced to a depth of 28 feet in search of groundwater. This borehole was left open for more than 24 hours, and the boring filled with water to approximately 3.4 feet below ground surface. Water production at SWMU 56 appears to be derived from the clays and silty clays encountered at varying depths, which is most likely controlled by fracturing in the surficial clay. Some wells were pumped dry during development using low flow rates while other wells could consistently produce at low flow rates.

5.3.3 Aquifer Characterization Testing

Slug tests were performed at six of the eight newly installed monitoring wells following completion of well installation, development and groundwater sampling. Slug tests were performed during the 2008 CMS field investigation in wells at locations 56SB01 through 56SB03 and 56SB06 through 56SB08. 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 and recording this information 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 some cases, where recovery was very slow (i.e. wells locations 56SB02 and 56SB03) only the falling head test results were recorded. The average hydraulic conductivity was 0.003 feet/day from 56SB02, and 0.02 feet/day from 56SB03, lower than the hydraulic conductivity form the other wells at SWMU 56 which ranged from 1.49 feet/day to 4.61 feet/day. All wells were similarly logged as containing clay and silty clay; however, the degree of microfracturing present at a location can have an impact on the magtnitude of the hydraulic conductivity.

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 0.302 ft and a casing radius of 0.083 ft were used as inputs for all well tests at SWMU 56 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 56 is 1.85 feet/day.

5.3.4 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 following development and groundwater sample collection on May 07, 2008 and again on July 22, 2008. Water level measurements and calculated groundwater elevations are presented on Table 5-2. Groundwater elevation contours are provided on Figure 5-5 for the immediate vicinity of SWMU 56 using the May 7, 2008 data. Regional groundwater flow, generated using groundwater depth measurements from numerous wells within the airfield area associated with SWMUs 56, 69 and 74 is illustrated on Figure 5-6 using the July 22, 2008 data. The groundwater flow direction at SWMU 56 is towards the southeast with an average gradient of 0.005. By multiplying the average hydraulic conductivity obtained from the slug tests with the hydraulic gradient calculated from the contours, and dividing by an assumed effective porosity, an average groundwater flow velocity is calculated as 0.031 feet/day. The effective porosity for the fractured clay was assumed to be 30 percent. This groundwater flow velocity value does not take into account flow retardation factors or contaminant physical properties, but gives a general potential contaminant transport rate.

5.4 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.

Parker, 1999. Beth L. Parker. Role of Matrix and Diffusion, Short Course on DNAPLs in Fractured Geologic Media: Monitoring Remediation, and Natural Attenuation. December, 1999.

6.0 ANALYTICAL RESULTS

This section discusses the results of the laboratory chemical analysis of the environmental samples collected from SWMU 56. With the exception of Phase II ECP data, the laboratory analytical data went through a formal data validation process. Complete validated data tables for the CMS investigation are included in Appendix B; a summary of the detections for each media and the QA/QC samples are provided in Tables 6-1 through 6-6. Relevant portions of the data validation reports for the CMS investigation for SWWMU 56 are provided in Appendix C; a summary discussion of the necessary laboratory level data adjustments to the data is presented in Section 6.6.

Phase II ECP

Two surface water and one sediment sample were collected during the Phase II ECP (NAVFAC Atlantic, 2005). In the surface water media, as shown on Tables 6-7 and 6-8, one VOC, three SVOCs, and TPH DRO and GRO were detected at very low, estimated concentrations. Five inorganic compounds were quantified in the surface water as well as shown on Table 6-8. The VOC, toluene, and the TPH GRO and DRO were only found at location 2E-SW02. The SVOCs were quantified in the duplicate sample analysis only, and only at location 2E-SW01. Similar concentrations of inorganics were found at all locations. Comparison of the surface water samples to relevant surface water screening criteria indicated slight exceedances of copper and mercury.

Sediment analyses resulted in the detection of four VOCs, four SVOCs, and TPH DRO (see Table 6-9). Thirteen inorganic compounds were also detected in the sample (see Table 6-10). Although not strictly applicable to the sediment collected in the drainage swale, sediment data was compared to marine sediment screening values. This comparison showed exceedances of four organic compounds (acetone, chrysene, fluoranthene, and meta and para [m&p] cresol). In addition, all detected inorganic compounds exceeded the marine sediment screening criteria with the exception of beryllium and mercury.

Based on the above, the ECP Report concluded that past activities have impacted the environment at SWMU 56 and the contamination at the site is primarily related to metals and fuels. The ECP recommended continued RCRA corrective measures activities, which was the basis for incorporating SWMU 56 into the USEPA Administrative Order and ultimately for conducting this CMS investigation.

This section presents a summary of the detected compounds in surface and subsurface soil, groundwater, surface water and sediment as well as a comparison to NAPR Basewide background concentrations, where applicable for the 2008 CMS Investigation, the Pre-excavation Investigation and the Supplemental Field Investigation. The detected concentrations of metals in environmental media (with the exception of surface water due to lack of appropriate background data for comparison) sampled at SWMU 56 (specifically, surface and subsurface soil, groundwater, and sediment) were compared to NAPR-specific background concentrations (ULM for each inorganic) established in the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010), for NAPR.

6.1 Surface Soils

Surface soil was collected from twenty locations (including the 2008 CMS Investigation, and the Pre-excavation Investigation). Eight surface soil samples (56SB01-00 through 56SB08-00) and one duplicate sample (56SB03-00D) were collected during the 2008 CMS Investigation and analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals. Twelve surface soil samples 56SS01 through 56SS12 and two duplicate samples (one duplicate from location 56SB03 and the second from location 56SS11) were collected during the Pre-Excavation Investigation and submitted for laboratory analysis of lead, selenium and/or vanadium. The detected results for the surface soil data set are provided in Table 6-1. Figure 6-1 presents the detected organic compounds and inorganics detections above the applicable NAPR basewide background value.

Five VOCs were detected in the surface soil data set including acetone, benzene, carbon disulfide, chloromethane and iodomethane. Acetone was detected in seven of eight 2008 CMS Investigation samples, iodomethane in four of eight samples, benzene in two of eight samples and carbon disulfide and chloromethane each in one of eight samples. All detections were relatively low (i.e., near the detection limits). It is noted that the analytical laboratory reported non-detected results to the method detection limit (MDL) for soil, groundwater, surface water, and sediment samples collected during the 2008 CMS field investigation.

Fourteen SVOCs were detected in the 2008 CMS Investigation surface soil samples including 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, butyl benzyl phthalate, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene and pyrene. One or more of these compounds were detected at low concentrations (i.e., near detection limits) in three of the eight surface soil samples: 56SB03-00, 56SB07-00 and 56SB08-00; no SVOCs were detected in the remaining five surface soil samples.

Sixteen metals were detected in the 2008 CMS Investigation and the Pre-excavation Investigation surface soil samples including:

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

Of these sixteen metals, six were detected in one or more samples at concentrations in excess of the NAPR basewide background screening value, as shown on Table 6-1. Selenium was detected above background screening values in five samples as shown on Table 6-1. Arsenic exceeded the background screening value in four samples (and one duplicate sample); lead exceeded background in two samples; cadmium, cobalt and vanadium exceeded the screening value in one sample. The highest concentrations detected (values that were detected at two times the background screening value) were lead in surface soil sample 56SB01 and 56SS01 with a concentration of 210 mg/kg and 83 mg/kg, respectively as compared to the background screening value of 16.86 mg/kg and cadmium in surface soil sample 56SB01 at a concentration of 3.3 J mg/kg as compared to the background value of 0.65 mg/kg. The location of these all inorganics detected at concentrations above background are shown on Figure 6-1.

6.2 Subsurface Soil

Sixteen subsurface soil samples and one duplicate sample were collected and analyzed during the 2008 CMS investigation at SWMU 56. All of the subsurface soil samples were analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals. The detected results for the subsurface soil data set are provided in Table 6-2. Figure 6-2 presents the location of detected organic compounds and inorganic detections above the applicable NAPR basewide background value.

Three VOCs were detected in the subsurface soil data set including acetone, carbon disulfide and iodomethane. Acetone was detected in fourteen of sixteen samples, iodomethane in three of sixteen samples, and carbon disulfide each in one of sixteen samples. All VOC detections were relatively low (i.e., near the detection limits).

Nine SVOCs were detected in the subsurface soil sample including 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, di-n-butyl phthalate, fluoranthene, and pyrene. One or more of these compounds were detected at low concentrations (i.e., near detection limits) in four of the sixteen subsurface soil samples: 56SB04 03, 56SB05-05, 56SB07-02 and 56SB08-01; no SVOCs were detected in the remaining twelve subsurface soil samples.

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, seven were detected in one or more samples at concentrations in excess of the NAPR basewide background screening value, as shown on Table 6-2. Mercury was detected above the background screening value in four samples. Selenium also exceeded the background screening value in four samples, and one duplicate sample. Arsenic and vanadium exceeded the NAPR basewide background screening value for the airfield in three samples, chromium in two samples and barium and cobalt exceeded the screening value in one sample. The location of these exceedances of the NAPR basewide background is shown on Figure 6-2.

6.3 Groundwater

Eight groundwater samples (56GW01 through 56GW08) and one duplicate sample (56GW03D) were collected and analyzed during the 2008 CMS investigation at SWMU 56. 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 6-3. Figure 6-3 presents the location of the detected organics and the detected inorganics in excess of the background screening value.

Two VOCs were detected in the groundwater samples including acetone (detected in two of eight samples and a rejected result in one sample), and chloromethane (detected in one sample and a rejected result in one sample). All detections of VOCs in the groundwater samples are considered low (i.e., near detection limits). Rejected results are discussed in Section 6.6.

Eight SVOCs were detected in the groundwater samples including 1,4-dichlorobenzene, 3&4 methylphenol, anthracene, bis(2-ethylhexyl)phthalate, diethyl phthalate, fluoranthene, fluorene and phenanthrene. Phenanthrene was detected in two samples, while the remaining SVOCs were detected in one sample each. Similar to the VOC detections, the detected concentrations of SVOCs are considered low (i.e., near detection limits).

Nine total metals were detected in the groundwater samples, including:

- Arsenic
- Barium
- Chromium
- Cobalt
- Copper
- Nickel
- Selenium
- Vanadium
- Zinc

None of these total metals were detected at concentrations in excess of the NAPR basewide background screening value for groundwater.

Nine dissolved metals were detected in the groundwater samples, including:

- Antimony
- Arsenic
- Barium
- Cobalt
- Mercury
- Nickel
- Selenium
- Vanadium
- Zinc

None of these dissolved metals were detected at concentrations in excess of the NAPR basewide background screening value for groundwater.

6.4 Surface Water

Five surface water samples (56SW01 through 56SW05) and one duplicate sample (56SW04D) were collected and analyzed during the 2008 CMS investigation at SWMU 56. All of the surface water samples were analyzed for Low Level Polynuclear Aromatic Hydrocarbons (PAHs), total metals and dissolved metals. The detected results for the surface water data set are provided in Table 6-4. The locations of the detected results are shown on Figure 6-4. Note that NAPR Basewide background concentrations have not been established for fresh surface water. A comparison of the analytical data to applicable ecological or human health screening values is provided in detail in Sections 7.0 and 8.0 of this report.

No low level PAHs were detected in the surface water samples.

Eleven total metals were detected in the surface water samples including:

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

Six dissolved metals were detected in the surface water. These include:

- Barium
- Cobalt
- Copper
- Lead
- Nickel
- Zinc

During the ECP Phase II investigation, two surface water samples were collected and analyzed for VOCs, SVOCs, TPH DRO and GRO and total metals. Consistent with this CMS investigation, there were no organic detections in the ECP Phase II data above the surface water screening values used in that report. Only two total metals, copper and mercury (in the duplicate sample only) slightly exceeded the surface water screening values used in the ECP Phase II report.

6.5 Sediment

Fourteen sediment samples were collected as part of this investigation. Three of the sediment samples (56SD03, 56SD04, and 56SD05) and one duplicate (from 56SD04) were collected for analysis of Appendix IX VOCs, SVOCs (including LLPAHs), and metals during the 2008 CMS Investigation. Sediment samples from the three locations were also analyzed for total organic carbon (TOC). Eleven sediment samples (56SD12 through 56SD22) and two duplicate samples (from 56SD14 and 56SD22) were collected during the Supplemental Field Investigation and were analyzed for Appendix IX Metals and AVS/SEM metals. The detected results for the sediment data set are provided in Table 6-5. The locations of the detected results are provided on Figure 6-5.

Four VOCs were detected in sediment samples (56SD03, 56Sd04 and 56SD05) including 2-butanone (detected in one sample) acetone (detected in three of the sediment samples), carbon disulfide (detected in two of four samples), and iodomethane (detected in one sample). Acetone, 2-Butanone, and iodomethane were rejected in one sample (56SD04), as discussed in Section 6.6.

Fifteen SVOCs were detected in the sediment samples (56SD03, 56Sd04 and 56SD05) including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzyl alcohol, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, phenol and pyrene. Although all detections were relatively low (i.e., near detection limits), the highest concentrations generally were noted in sample 56SD03 with the lowest concentrations in 56SD05.

Sixteen total metals were detected in the sediment samples (from the 2008 CMS Investigation and the Supplemental Field Investigation) including:

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

The sediment samples were compared to the freshwater drainage ditch (airfield) background screening values as shown on Table 6-5. Of the sixteen metals detected, ten were detected at concentrations exceeding the background screening values. Analytical results for samples 56SD04 and 56SD22 showed that six metals detected above background; sample 56SD14 had five metals detected above background screening values. Please refer to Table 6-5 and Figure 6-5 for the metals detected in sediment that were above background screening numbers.

The detected metals were distributed across sediment samples collected during the CMS investigation; indicate a potential impact to sediment from site related contamination. A more detailed comparison to relevant criteria is given in Sections 7.0 and 8.0. The AVS/SEM data was incorporated into the ecological risk assessment as part of this document and is not presented in this Section; please refer to Section 7.0 and Table 7-32 for results and discussion.

Total organic carbon concentrations ranged from 36,000 J mg/kg to 76,000 J mg/kg. TOC was not analyzed for in the duplicate sample.

These results indicate a potential impact to sediment for site related contaminants that will be more fully evaluated in Sections 7.0 and 8.0.

6.6 Laboratory Data Validation Summary

A discussion of the compounds detected in the Field QA/QC samples is presented in Section 6.6.1. A summary of the data validation findings, as they relate to each sample delivery group (SDG), are discussed in Sections 6.6.2 through 6.6.11 below. Data validation narrative reports are included in Appendix C. In addition, the Puerto Rican Chemist Certifications for each Test America SDG are also presented in Appendix C.

6.6.1 Summary of Detected Compounds in Field QA/QC Samples

Field generated QA/QC samples for the field effort consisted of a field blank, equipment rinsates, trip blanks, and environmental duplicates. The blanks were analyzed for all fractions requested in this investigation. Table 6-6 presents the detected compounds found in the field blank, equipment rinsates, and trip blanks.

Two field blank samples, FB01 and JUNE09-FB02 were collected representing laboratory grade deionized water. Detections in the field blanks included: one VOC (2-butanone); four SVOCs (1,4-dichlorobenzene, acetophenone, diethyl phthalate and di-n-butyl phthalate); and two metals (copper and lead).

Six trip blanks were collected. Data from 56TB01 were rejected during data validation, and are presented in Appendix B but not shown on Table 6-6. Chloromethane (0.38J ug/L) was detected in one of the trip blanks (56TB03). No other VOCs were detected in the trip blank samples.

Eight equipment rinsate samples were collected as indicated on Table 6-6. The VOC acetone was detected in JUNE09-ER02, which was collected from a stainless steel spoon. The VOC toluene was detected in ER04 and ER05, which were collected from groundwater sampling tubing. Eight SVOCs (as shown on Table 6-6) were detected in ER01 (from a macro core liner), ER02 (stainless steel spoon), ER04 and ER05 (groundwater sample tubing) and/or JUNE09-ER02 (stainless steel spoon). Note that SVOCs were not analyzed for in ER06, ER07 and ER10. Five metals (arsenic, copper, lead, tin and vanadium) were detected in the equipment rinsate samples. There were no detections of metals in ER04, ER05, or JUNE09-ER10.

6.6.2 Test America SDG SWMU36289-1

This SDG is relevant to the analytical findings associated with the surface soil, subsurface soil, and sediment sampling at SWMU 56. 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:

6.6.2.1 VOCs

The initial and continuing calibration exhibited some compounds with low relative response factor (RRF) values, which resulted in qualifying non-detected values as rejected for these compounds. VOC compounds that were rejected include acrolein, acetonitrile, 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 percent difference (%D) values in the continuing calibrations, some compounds were qualified as estimated (J).

Blank contamination was noted in the method and quality control (QC) blank (FB01) associated with samples in this batch. 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 2-butanone (U) were added to samples 56SD04D and 56SD05 method blank/QC blank contamination.

Sample 56SD04 exhibited low recovery for all internal standards; therefore all associated compound positive results were qualified as estimated (J) and non-detected results were rejected (R). The duplicated sample collected for 56SD04 exhibited non-comparable results for acetone with a 200 percent relative percent difference (RPD); therefore the results were estimated with a J.

Sample 56SD05 exhibited results for carbon disulfide that exceeded the calibration range; the result was qualified as estimated. The sample was re-analyzed at a dilution with limited amount of sample volume, but the results did not compare. The dilution was not used since no usable data was obtained from the analysis.

6.6.2.2 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.

Blank contamination was noted in the method blank and QC blanks (FB01, ER01 and ER02) 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 and di-n-butylphthalate (U) were added to the data due to method blank contamination.

A matrix spike and matrix spike duplicate was submitted for sample 56SD04. The Matrix Spike (MS) exhibited 1% recovery and the Matrix Spike Duplicate (MSD) exhibited 0% for hexachlorocyclopentadiene and the MSD exhibited 9% recovery for 2,4-dinitrophenol. These compounds were qualified as estimated (J/UJ) in sample 56SD04.

The field duplicate pair of samples 56SD04 and 56SD04D exhibited non-comparable results for benzo(b)fluoranthene with 200% RPD and benzo(k)fluoranthene with 200% RPD. The results for these compounds were qualified as estimated (J/UJ).

Samples 56SB02-04RE, 56SB04-04RE, 56SD03RE, 56SD03RA and 56SD03RERA were re-extracted out of holding time due to non-compliant surrogate recoveries in the initial analysis. The re-extractions exhibited similar results. Therefore, the re-extracted samples were not used in favor of the initial analysis.

Sample 56SD03 exhibited low recovery for internal standards for perylene-d12 and chrysene-d12; therefore all the associated compounds were qualified as estimated (J/UJ). Samples 56SB02-04, 56SB04-04 and 56SD03 exhibited non-compliant surrogate recoveries for 2-fluorophenol and phenol-d5, associated compounds were qualified as estimated (J/UJ).

6.6.2.3 Metals

The interference check sample solution AB (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 field duplicate pair of samples 56SD04 and 56SD04D exhibited non-compliant RPD for the analytes lead and vanadium. Based on Region II guidelines, these analytes were qualified as estimated (J) in both the field sample and the field duplicate.

The matrix spikes of sample 56SD04 exhibited non-compliant percent recoveries (%Rs) and %Ds for analytes that required qualification in sample 56SD04. Barium, copper, vanadium, and zinc were qualified as estimated (J).

The associated matrix spikes exhibited non-compliant %Rs for three analytes for which qualifications were required. Positive and non-detected results for barium and copper were flagged as estimated (J/UJ) in the samples. Positive and non-detect results for zinc were flagged as estimated (J/UJ). Although the MS for zinc was acceptable, the MSD exhibited a recovery that was below 30%. Based on professional judgment, the validator did not reject zinc in the samples, but it should be noted that a biased low matrix effect might be present.

6.6.2.4 Data Validation Summary for SWMU36289-1

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 to 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. The sediment samples within this SDG (56SD03, 56SD04, 56SD04D and 56SD05) contained 50-90 percent water that resulted in the qualifications of the results as estimated (J/UJ) for VOCs, SVOCs, metals and TOC. 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.

6.6.3 Test America SDG SWMU36289-4

This SDG is relevant to the analytical findings associated with the surface water and groundwater samples as well as a trip blank sample at SWMU 56. 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:

6.6.3.1 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. Due to high %D values in the continuing calibrations, some compounds were qualified as estimated (J/UJ) as listed in the data validation narrative included in Appendix C.

All sample vials for 56TB01 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.

6.6.3.2 PAHs

All samples were re-extracted out of extraction holding time due to non-compliant laboratory control sample (LCS) recoveries. Dibenz(a,h)antracene was 121 percent; outside of the quality control limit of 42-112 percent. The re-extracted LCS exhibited compliant recoveries; therefore the re-extracted sample batch was used.

6.6.3.3 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 in the method blank and QC blank (FB01) associated with this SDG. The laboratory reported non-detects results to the MDL for this project. Antimony, arsenic, chromium, cobalt, tin and vanadium were qualified if results were greater than the MDL up to the reporting limit (RL) with a U qualifier (not-detected).

The matrix spikes of sample 69GW11 (from SDG SWMU36360-5) 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.

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 all samples. Based on the guidelines, the positive results reported for cadmium were rejected in all samples. Cobalt in these samples was significantly higher in the dissolved analysis. The cobalt results in almost all of the total samples (except 56SW05) were negated due to blank contamination. However, the cobalt concentrations in the dissolved samples were above the RL in all cases so they were not flagged due to the low concentration blank contamination.

6.6.3.4 Data Validation Summary for SWMU36289-4

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 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, unless discussed above. 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.

6.6.4 Test America SDG SWMU36360-6

This SDG is relevant to the analytical findings associated with the surface and subsurface soil sampling at SWMU 56. 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:

6.6.4.1 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 acrolein and isobutyl alcohol. 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.

The field duplicate pair of samples 56SB06-01 and 56SB06-01D exhibited noncomparable results for acetone with 200% RPD. The results for acetone were qualified as estimated (J/UJ).

6.6.4.2 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 4-nitroquinoline-1-oxide and hexachloropropene results were rejected. Due to high %D values in continuing calibrations, some compounds were qualified as estimated as shown in the data validation narrative for this SDG included in Appendix C.

Blank contamination was noted in the method and QC blank (ER01) 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.

The field duplicate pair of samples 56SB03-00 and 56SB03-00D exhibited noncomparable results for benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, benzo(a)anthracene, benzo(g,h,i)perylene and perylene. The results for these compounds were qualified estimated (J/UJ).

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 exceeded holding times.

6.6.4.3 Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for cadmium and silver. Based on Region II guidelines all positive and non-detect results for cadmium and silver were qualified as estimated J/UJ.

Blank contamination was noted in method blanks 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, arsenic, beryllium and silver were qualified with a U (non-detected) for results greater than the MDL up to the reporting limit.

The matrix spikes of samples 56SB05-03 and 56SB06-03 exhibited non-compliant %Rs for analytes that required qualification in the field samples. Positive and non-detect results for antimony, zinc, and selenium were flagged as estimated (J/UJ) in the samples. Positive results for barium, cobalt and mercury were flagged as estimated (J) in the samples.

The associated matrix duplicate exhibited non-compliant RPDs for several analytes for which qualifications were required. Positive and non-detect results for vanadium, barium, chromium, copper, lead and zinc were flagged as estimated J/UJ in the samples.

The associated serial dilution of sample 56SB05-03 exhibited a non-compliant %D for nickel. Positive and non-detect results for the analyte nickel were qualified as estimated J/UJ in the samples.

The field duplicate pair of samples 56SB06-01 and 56SB06-01D exhibited non-compliant RPD the analytes barium, cobalt, copper and nickel and a absolute difference >2X the CRDL for the analyte mercury (0.053). These analytes were flagged as estimated J in the field duplicate pair. The analytes chromium, lead and vanadium exhibited RPDs >120% and the analyte arsenic (4.04) exhibited an absolute difference > 4X CRDL. These analytes were rejected R in the field duplicate pair. All qualifications were made based on the Region II guidance.

6.6.4.4 Data Validation Summary for SWMU36360-6

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 April 29, 2008 to May 1, 2008 and samples were received at the laboratory on May 1 and May 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.

6.6.5 Test America SDG SWMU36360-7

This SDG is relevant to the analytical findings associated with the surface water and groundwater samples as well as a trip blank sample at SWMU 56. 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:

6.6.5.1 VOCs

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in qualifying non-detected values as rejected for isobutyl alcohol. 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.

All sample vials for 56GW01 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.

6.6.5.2 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 (J/UJ), details are provides in the Data Validation Narrative for this SDG included as 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 recoveries. The re-extraction exceeded the extraction holding time and therefore was not used in favor of the initial analysis. The LCS associated with the samples exhibited low recovery for hexachlorocyclopentadiene at 7%. The results for this compound were qualified as estimated (J/UJ) in all samples.

6.6.5.3 PAHs

No qualifications to the data were required.

6.6.5.4 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 in the method blank and QC blank (FB01) associated with this SDG. The laboratory reported non-detects results to the MDL for this project. Antimony, arsenic, chromium, cobalt, copper, lead, tin and vanadium 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 (from SDG SWMU36360-5) 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.

Region II required a detailed comparison between the total and dissolved sample analyses. The comparison between total and dissolved results is made only when both of the following conditions are met: first, the dissolved concentrations is greater than the total concentration, and second, that the dissolved concentration is greater than or equal to 5X the MDL. The analyte cobalt met both of these criteria in all samples. Based on the guidance for Region II, the positive results for total and dissolved cadmium were rejected in 56GW01 and 56GW02. Please note that cobalt in these samples was significantly higher in the dissolved analysis.

6.6.5.5 Data Validation Summary for SWMU36360-7

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 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. One groundwater sample, 56GW01 was 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.

6.6.6 Test America SDG SWMU36419-1

This SDG is relevant to the analytical findings associated with the groundwater samples as well as a trip blank sample at SWMU 56. 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:

6.6.6.1 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 are isobutyl alcohol and acrolein (in 56TB03). 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.

The field duplicate pair of samples 56GW03 and 56GW03D exhibited non-comparable results for chloromethane with 200% RPD. The results for chloromethane were qualified estimated (J/UJ).

6.6.6.2 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 (J/UJ), details are provides in the Data Validation Narrative for this SDG included as Appendix C.

Blank contamination was noted in the method blank 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 bis(2-ethylhexyl)phthalate (U) were added to the data due to method blank/QC blank contamination.

The LCS and MS/MSD associated with samples, 56GW03, 56GW03D, 56GW05, 56GW03MS and 56GW03MSD 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.

6.6.6.3 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 in the method blank and QC blank (FB01) associated with this SDG. The laboratory reported non-detects results to the MDL for this project. Copper, lead, and tin were qualified if results were greater than the MDL up to the RL with a U qualifier (not-detected).

Region II required a detailed comparison between the total and dissolved sample analyses. The comparison between total and dissolved results is made only when both of the following conditions are met: first, the dissolved concentrations is greater than the total concentration, and second, that the dissolved concentration is greater than or equal to 5X the MDL. The analyte cobalt met both of these criteria in samples 56GW03 and 56GW05. Based on the guidance for Region II, the positive results for total and dissolved cadmium were qualified as estimated (J).

6.6.6.4 Data Validation Summary for SWMU36419-1

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 5/1/08-5/2/08 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 except as noted above. All samples were received at the laboratory at an elevated temperature of 11.8 degrees Celsius. In accordance with Region II guidelines, stating that samples above 10 degrees Celsius are to be qualified as estimated (J/UJ); qualifications were added to the data.

6.6.7 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:

6.6.7.1 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).

6.6.7.2 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.

6.6.7.3 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.

6.6.7.4 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.

6.6.8 Test America SDG SWMU36426-5

This SDG is relevant to the analytical findings associated with the groundwater sampling at SWMU 56. 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:

6.6.8.1 VOCs

The continuing calibration exhibited some compounds with low RRF values that resulted in non-detected values being rejected for acrolein. Due to high %D values some compounds were qualified as estimated (J/UJ) as shown in the Data Validation Narrative included as Appendix C.

6.6.8.2 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, hexachloroethane and 4-nitroquinoline-1-oxide were rejected (R). Other compounds were qualified as estimated (UJ), details are provides in the Data Validation Narrative as Appendix C.

Blank contamination was noted in the method and QC blanks (FB01) associated with samples in this batch. 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 bis(2-ethylhexyl)phthalate, di-n-butylphthalate (U) were added to the data.

6.6.8.3 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 in method and QC blanks (FB01 and ER06), qualification was required in this sample deliver group (SDG). The laboratory reported non-detects results to the method detection limit (MDL) for this project. Arsenic, cobalt, copper and vanadium were qualified if results were greater than the MDL up to the reporting limit (RL) with a U qualifier (not-detected).

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 sample 56GW07. Therefore, positive results reported for cadmium were qualified as estimated (J) in sample 56GW07 (total and dissolved).

6.6.8.4 Data Validation Summary for SWMU36426-5

The SDG was received complete and intact. Resubmissions were required for the SVOC fraction due to a missing Form V and information listing the temperatures of the sample coolers upon receipt at the laboratory. This information was requested and provided by the laboratory. Clarification was required from the laboratory for the metals fraction. According to chain of custody records, sampling was performed on 5/3/08 through 5/5/08 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.

6.6.9 Test America SDG SWMU36426-6

This SDG is relevant to the analytical findings associated with surface and subsurface soil sampling at SWMU 56. 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:

6.6.9.1 VOCs

The calibration standards exhibited RRF and %D that were non-complaint and resulted in qualifying non-detected results for acetonitrile, acrolein and 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.

Blank contamination was noted in the method blank and QC blanks (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 2-butanone (U) were added to the data due to method blank/QC blank contamination.

6.6.9.2 SVOCs

The initial and continuing calibrations exhibited some compounds with low RRF values, which resulted in qualifying non-detected values for hexachlorophene and 4-nitroquinoline-1-oxide as rejected for these compounds. Due to high %D values, in the continuing calibrations, other compounds were qualified as estimated (UJ), details are provides in Appendix C.

Blank contamination was noted in the method blank 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 bis(2-ethlhexyl)phthalate (U) were added to the data due to method blank/QC blank contamination.

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 due to similar results and exceeded holding times.

6.6.9.3 Metals

Blank contamination was noted in the method blank and QC blanks (ER07 and FB01) and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project. Antimony, beryllium, cadmium, copper, lead and silver were qualified if results were greater than the MDL up to the RL with a U qualifier (not-detected).

The matrix spikes of sample 56SB08-02 exhibited non-compliant %Rs for antimony that required qualifications in the field samples. The matrix spike duplicate for the same sample exhibited a non-compliant %D for cobalt that was qualified as estimated (J/UJ).

6.6.9.4 Data Validation Summary for SWMU36426-6

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 from 5/3/2008 to 5/5/2008 and samples were received at the laboratory on 5/6/2008. 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.

6.6.10 Test America SDG SWMU36517-3

This SDG is relevant to the analytical findings associated with the QA/QC sampling at SWMU 56. Laboratory analytical services were performed by Test America Laboratories (Savannah, Georgia). Validation services were provided by DataQual Environmental Services, LLC. Validation conclusions are as follows:

6.6.10.1 VOCs

The continuing calibration exhibited some compounds with low RRF values that resulted in non-detected values being rejected for acrolein. Due to high %D values, some compounds were qualified as estimated. Details are provided in the data validation narrative in Appendix C.

6.6.10.2 Metals

The ICSAB standards exhibited non-compliant recoveries (132%/129%) above the quality control limit for the analyte zinc. Based on Region II guidelines, all positive results for zinc in the samples were qualified as estimated (J).

Blank contamination was noted in the method blank and QC blanks (FB01) and qualification was required in this SDG. The laboratory reported non-detects results to the MDL for this project. Antimony, arsenic. beryllium, copper, lead, silver, tin and vanadium were qualified if results were greater than the MDL up to the RL with a U qualifier (not-detected).

6.6.10.3 Data Validation Summary for SWMU36517-3

The SDG was received complete and intact. Resubmissions were not required. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

6.6.11 Test America SDG SWMU36517-4

This SDG is relevant to the analytical findings associated with the groundwater sampling at SWMU 56. 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:

6.6.11.1 VOCs

The continuing calibration exhibited some compounds with low relative response factor (RRF) values that resulted in non-detected values being rejected for acrolein. Due to high percent difference (%D) values some compounds were qualified as estimated (J/UJ) as shown in the Data Validation Narrative included as Appendix C.

6.6.11.2 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, hexachloroethane and 4-nitroquinoline-1-oxide were rejected (R). Other compounds were qualified as estimated (UJ), details are provides in the Data Validation Narrative as Appendix C.

Blank contamination was noted in the method and/or quality control (QC) blanks (FB01) associated with samples in this batch. 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 (U) were added to the data.

The associated LCS exhibited low recovery for 3,3-dichlorobenzidine. The LCS was re-extracted; however, the extraction holding time was exceeded and therefore not used. Therefore, the compound was qualified as estimated (UJ) in sample 56GW08.

6.6.11.3 Metals

The Interference Check Sample Solution AB **(**ICSAB) standards exhibited non-compliant recoveries above the upper QC limit for the analyte zinc. Based on Region II guidelines all positive results for zinc were qualified as estimated (J).

Blank contamination was noted in method and QC blanks (FB01 and ER10), qualification was required in this sample deliver group (SDG). The laboratory reported non-detects results to the method detection limit (MDL) for this project. Arsenic, copper and lead were qualified if results were greater than the MDL up to the reporting limit (RL) with a U qualifier (not-detected).

6.6.11.4 Data Validation Summary for SWMU36517-4

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 5/7/08 and samples were received at the laboratory on 5/8/08. 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.

6.6.12 Test America SDG SWMU36517-5

This SDG is relevant to the analytical findings associated with the QA/QC sampling at SWMU 56. 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:

6.6.12.1 VOCs

The calibration standards exhibited some compounds with low RRF values that resulted in qualifying acrolein as rejected. Due to high %D values in the continuing calibrations, some compounds were qualified as estimated.

6.6.12.2 Metals

The ICSAB standards exhibited non-compliant recoveries below the QC limit for the analyte zinc. Based on Region II guidelines all positive and non-detect results for zinc in the metals samples were qualified as estimated (J).

6.6.12.3 Data Validation Summary for SWMU36517-5

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 5/3/08-5/7/08 and samples were received at the laboratory on 5/8/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

6.6.13 Test America SDG SWMU40743-1

This SDG is relevant to the analytical findings associated with surface soil sampling at SWMU 56. 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:

6.6.13.1 Metals

The field duplicate pair of samples 56SS11 and 56SS11D exhibited a relative percent difference greater than 35% but less than 120% for the analyte vanadium (38%). Therefore, vanadium was qualified as estimated (J) based on Region II guidelines in both samples.

6.6.13.2 Data Validation Summary for SWMU40743-1

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 9/24/08 and samples were received at the laboratory on 9/25/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

6.6.14 Test America SDG SWMU40837

This SDG is relevant to the analytical findings associated with sediment sampling at SWMU 56. 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:

6.6.14.1 Metals

Blank contamination was noted in the method and/or quality control) blanks associated with samples in this batch. 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 antimony, beryllium, mercury and silver (U) were added to the data.

The field duplicate pair of samples 56SD14 and 56SD14D exhibited a RPD greater than 35% but less than 120% for the analyte lead (45%). Therefore, lead was qualified as estimated (J) based on Region II guidelines.

Samples 56SD08, 56SD09, 56SD11, 56SD12, 56SD13, 56SD14 and 56SD14D exhibited percent moisture levels that were above 50%. All reported postive and non-detect results in all sediment samples were qualified as estimated J/UJ based on Region II guidelines.

6.6.14.2 Data Validation Summary for SWMU40837

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 9/25/08 and samples were received at the laboratory on 9/27/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

6.6.15 Columbia Analytical Services SDG R0903519

This SDG is relevant to the analytical findings associated with sediment sampling at SWMU 56. Laboratory analyses were performed by Columbia Analytical Services (Rochester, New York). Validation services were provided by DataQual Environmental Services, LLC located in St. Louis, Missouri. Validation conclusions are as follows:

6.6.15.1 Metals

The matrix spike exhibited a non-compliant recovery for the analyte copper (127 %). All positive results are reported as estimated (J).

The field duplicate pair of samples 56SD22 and 56SD22D exhibited a RPD greater than 35% for the analyte silver (39%) and the parameter AVS (43%). For this reason the silver and AVS were qualified as estimated in the field duplicate pair only.

Field sample moisture content was above 50% in all samples. Field sample moisture was not above 90% in any sample. For this reason, all reported positive results in all sediment samples were qualified as estimated (J/UJ) based on Region II guidelines.

6.6.15.2 Data Validation Summary for SWMU40837

The SDG was received complete and intact. Resubmissions were not required. According to chain of custody records, sampling was performed on 6/24/09 and samples were received at the laboratory on 6/25/09. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

6.6.16 Test America SDG 0906174

This SDG is relevant to the analytical findings associated with sediment sampling at SWMU 56. 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:

6.6.16.1 VOCs

Calibration standards exhibited relative response factors that were non-compliant for certain VOCs as listed in the Data validation narrative, this resulted in qualifying non-detected values as rejected for these compounds.

6.6.16.2 Metals

Blank contamination was noted in the method and/or quality control) blanks associated with samples in this batch. 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 antimony, beryllium, mercury and silver (U) were added to the data.

6.6.16.3 Data Validation Summary for SDG 0906174

The SDG was received complete and intact. Resubmissions were not required. According to chain of custody records, sampling was performed on 6/23/2009 to 6/27/2009 and samples were received at the laboratory on 6/25/2009 to 6/30/2009. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

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.

7.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3A OF THE BASELINE ECOLOGICAL RISK ASSESSMENT

This section presents a screening level ERA (SERA) and Step 3a of the baseline ERA (BERA) for SWMU 56 – Hangar 200 Apron, 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 (see 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 to address potential ecological risks at SWMU 56.

7.1 Environmental Setting

The sections that follow provide a description of the habitats occurring within and contiguous to SWMU 56, 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, as well as information from a benthic macroinvertebrate survey (discussed in Section 7.1.3.4) and vegetative assessment (discussed in Section 7.1.2) conducted within a portion of the drainage ditch system downgradient from SWMU 56 on January 14, 2009 and June 27, 2009, respectively.

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 56 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 56 until ownership of the airfield parcel (Ofstie airfield) was transferred to the Puerto Rico Ports Authority on February 7, 2008. However, the frequency of these operations was significantly reduced. It is not known if the Puerto Rico Ports Authority 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, coastal scrub forest communities are located approximately 650 feet south and 630 feet southwest of SWMU 56 (see 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 southwest of SWMU 56. 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 (see 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 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 [*Lutijanus griseus*], lane snapper [*Lutijanus synagris*], and gold and black tricolor [*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 [*Acsidia 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 56 are an unnamed lagoon north of the Los Machos mangrove forest (approximately 1.1 miles northeast of SWMU 56) and the Ensenada Honda (approximately 1.0 miles southeast of SWMU 56). 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 56 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 [see 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 56. However, several isolated, depressional Palustrine Emergent Persistent (PEM1) wetland units are located east, northeast, and southeast, and southwest of the Hangar 200 apron. The nearest PEM1 wetland unit is located approximately 800 feet east of SWMU 56. None of the PEM1 wetland units are hydrologically connected to SWMU 56.

The most significant wetland feature in the vicinity of the airport is the Los Machos mangrove forest (located approximately 2,200 feet east of SWMU 56; see Figures 7-2 and 7-3). Based on 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)

A smaller estuarine wetland system (primarily E2SS3 wetland units with pockets of E2US3 and E2US4 wetland units) is located approximately 1,800 feet southeast of SWMU 56 (see Figure 7-3). Based on the groundwater flow direction at SWMU 56 (toward the southeast; see Section 5.3.4 and Figure 5-5), this estuarine wetland system represents a potential discharge point for SWMU 56 groundwater.

Surface water run-off at SWMU 56 flows into the drainage ditch system depicted on Figure 5-1. Initially, run-off from the Hangar 200 apron enters a concrete-lined ditch (Drainage Ditch Segment A-B). Flow within this ditch travels in a southwestern direction for approximately 250 feet before discharging through a 24-inch culvert. The 24-inch culvert conveys storm water run-off under an airfield taxiway. On the southern side of the culvert, the ditch continues in a southeast direction for approximately 530 feet where flow is routed through a 36-inch culvert extending under Bogue Street. It is noted that the drainage ditch segment between the airfield taxiway and Bogue Street (Drainage Ditch Segment C-D) is earthen (no longer lined with concrete). Surface run-off exiting the 36-inch culvert under Bogue Street enters an earthen drainage ditch traveling in an eastern direction. Flow within this drainage ditch (Drainage Ditch Segment E-F) travels approximately 530 feet before discharging through a double 4-foot by 8-foot box culvert that directs flow under Forrestal Drive. Flow continues in an eastern direction for approximately 375 feet (Drainage Ditch Segment G-H) before discharging into a triple 5-foot by 9-foot box culvert. As evidenced by Figure 5-1, surface water run-off from a significant portion of the airport facility is directed into this culvert. Upon discharge from the triple box culvert, surface run-off flows within an earthen drainage ditch for approximately 600 feet before entering a finger of the E2SS3 estuarine wetland system identified in the preceding paragraph.

The concrete-lined segment (Drainage Ditch Segment A-B) was generally devoid of water during the 2004 Phase II ECP and 2008 CMS field investigations. However, pooled water was present at the headwaters of the ditch and at the entrance point to the 24-inch culvert that conveys storm water under the airfield taxiway during both investigations (see Photographs A-1 and A-2, respectively, in Appendix A). The accumulation of water at the headwaters of the concrete-lined ditch segment is caused by vegetative debris which impedes flow into the channel, while water accumulation at the entrance point to the 24-inch culvert can be attributed to a lower ditch elevation relative to the culvert inlet elevation. This situation is likely due to settling of the concrete channel. Debris within the culvert also may be impeding flow. Sediment has accumulated within the concrete channel, resulting in the establishment of emergent wetland vegetation of unknown species composition (see Photograph A-3). The unlined drainage ditch south of the 24-inch culvert (Drainage Ditch Segment C-D) also is generally devoid of standing water along its entire length. However, pooled water is located at the outlet of the 24-inch culvert that conveys storm water under the airfield taxiway (likely due to scouring of the ditch substrate during high flow conditions) and at the entrance point into the 36-inch culvert that conveys water under Bogue Street (again, likely due to scouring of ditch substrate, which has resulted in a ditch elevation at this location that is lower than the culvert inlet elevation). Identical to the concrete-lined segment, emergent wetland vegetation (unknown species composition) is growing along the length of this ditch segment.

Shallow water was observed within Drainage Ditch Segments E-F and G-H during the 2008 CMS and pre-excavation field sampling investigations, as well as the 2009 benthic macroinvertebrate survey (conducted on January 14, 2009 [see Section 7.1.3.4]) and the supplemental field sampling investigation/vegetative assessment (conducted on June 27, 2009). Flow conditions encountered during the 2009 supplemental field sampling investigation/vegetative assessment within Drainage Ditch Segment G-H is shown in Photograph A-9. Vegetation growing within Drainage Ditch Segments E-F and G-H and adjacent upland habitat was documented during the vegetative assessment and presented within the Functional Assessment and Supplemental Sediment Sampling and Analytical Program Within the Drainage Ditch Downgradient from SWMU 56 (Right Way Environmental Contractors, Inc. [RWEC], 2009). As evidenced by Figure 5-1, Drainage Ditch Segment E-F forms the northern border of a coastal scrub forest community. The dominant vegetation encountered included the following:

- Ditch habitat**:** southern cattail (*Typha domingensis*), golden leather fern (*Acrostichum aureum*), and knotted spikerush (*Eleocharis interstincta*)

- Adjacent upland habitat: white lead tree, oceanblue morning-glory (*Ipomoea indica*), royal poincianna (*Delomix regia*), Puerto Rico royal palm (*Roystonea borinquena*), and coca (*Erythroxylum* spp.)

The regional wetland indicator status (Caribbean region) for vegetation growing within the drainage ditch (southern cattail, golden leather fern, and knotted spikerush) is obligate wetland (United States Department of Agriculture [USDA], 2010). The Caribbean region wetland indicator status for dominant vegetation growing within the adjacent upland habitat has been established for white lead tree and oceanblue morning-glory. Both species are classified as facultative (USDA, 2010).

7.1.3 Biota

A description of the biota 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 56 and within the downgradient drainage ditch system.

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-tounged 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 leporinu*)

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 56. However, as there are no transport pathways from SWMU 56 to these surface water bodies, they are not expected to represent potential exposure points for West Indian manatee dietary exposures to chemicals in SWMU 56 soil and groundwater.

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 56 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 adjacent to SWMU 56 is limited to grasses of unknown species composition. Because yellow-shouldered blackbirds are arboreal feeders that forage within the canopy and sub-canopy of trees (USFWS, 1996a), they are not expected to forage within this habitat. The coastal scrub forest communities located south and southwest of SWMU 56 represent potential foraging habitat for the yellow-shouldered blackbird. However, there are no transport pathways from SWMU 56 to these vegetative communities. Furthermore, 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 <u>Guidance for Developing Ecological Soil Screening Levels</u> (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 56 during the 2008 CMS and pre-excavation field sampling investigations, and the 2009 benthic macroinvertebrate survey and supplemental field sampling investigation/vegetative assessment. Birds also were not observed within the upland habitat adjacent to Ditch Segments E-F and G-H. 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 56 soil and groundwater.

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 56 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 or during previous investigations.

A qualitative benthic macroinvertebrate survey was conducted within drainage ditch Segment E-F on January 14, 2009 using the Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish: Second Edition (USEPA, 1999a) as a general guide. The survey was conducted during a site visit attended by representatives of the Puerto Rico Environmental Quality Board (PREQB), TRC (consultant to PREQB), and Baker. At the time of sampling, flow within the channel was minimal. The channel's gradient was low and exhibited no sinuosity. Habitat was fairly consistent throughout the drainage ditch and can be characterized as shallow glides (runs and riffles were absent). Substrate consisted of silt/sand with no gravel. Decaying plant material was prevalent throughout the ditch. In general, habitat quality within the drainage ditch for benthic macroinvertebrates can be described as poor.

A total of three benthic macroinvertebrate samples were collected from Drainage Ditch Segment E-F using a D-frame dip net. Samples were collected at accessible locations (i.e., locations devoid of emergent vegetation) with an abundance of decaying organic material on the channel bottom. Results of the benthic macroinvertebrate survey were presented in the Functional Assessment and Supplemental Sediment Sampling and Analytical Program within the Drainage Ditch Downgradient from SWMU 56 (RWEC, 2009). As discussed in this document, only snails were collected at each location (20 to 30 individuals of unknown species composition per location). Snail shells were observed within the concrete-lined ditch segment during the 2008 CMS field investigation (see field notes in Attachment A), indicating that snails are prevalent throughout the drainage ditch system. 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. Their absence also may indicate that flow within Drainage Ditch Segment E-F is intermittent or ephemeral.

Small fish (unknown species) were observed within Drainage Ditch Segment A-B during the 2004 Phase II ECP field investigation and 2008 CMS field investigation (pool located in front of 24-inch culvert). However, no fish were observed within Drainage Ditch Segments A-B, C-D, and E-F during the 2008 pre-excavation field investigation or within drainage ditch Segments E-F and G-H during the 2009 qualitative benthic macroinvertebrate survey and supplemental field sampling investigation/vegetative assessment (Drainage Ditch Segments A-B and C-D were not evaluated during any of the 2009 field investigations).

The results of the benthic macroinvertebrate survey indicate that the drainage ditch provides limited foraging opportunities for avian invertebrate consumers. The lack of a permanent fish population (as indicated by the absence of fish during the 2008 pre-excavation field sampling investigation, 2009 benthic macroinvertebrate survey, and 2009 supplemental field sampling investigation/vegetative assessment) also indicates that the drainage ditch system does not represent significant foraging habitat for avian piscivores.

7.2 Sources of Available Analytical Data

Sampling activities at SWMU 56 have been conducted under four separate investigations (Phase II ECP, CMS, pre-excavation, and supplemental field investigations). A Phase II ECP investigation was conducted in 2004 and involved the collection of two surface water samples (designated 2E-SW01 and 2E-SW02) and one sediment sample (designated 2E-SD01) from the concrete-lined portion of the drainage ditch system discussed in Section 7.1.2 (see Figure 2-3). Each surface water sample and the single sediment sample was analyzed for Appendix IX VOCs, SVOCs, and metals (total recoverable fraction), 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 water and sediment 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 drainage ditch surface water and sediment 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 and subsurface soil, groundwater, and drainage ditch surface water and sediment. A total of eight surface soil samples (designated 56SB01-00 through 56SB08-00), sixteen subsurface soil samples (designated 56SB01-01, 56SB01-04, 56SB02-02, 56SB02-04, 56SB03-02, 56SB03-04, 56SB04-03, 56SB04-04, 56SB05-03, 56SB05-05, 56SB06-01, 56SB06-03, 56SB07-02, 56SB07-03, 56SB08-01, and 56SB08-02), eight groundwater samples (designated 56GW01 through 56GW08), five drainage ditch surface water samples (designated 56SW01 through 56SW05), and three drainage ditch sediment samples (designated 56SD03 through 56SD05) were collected. 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 (56SB01-01, 56SB06-01, and 56SB08-01), 3.0 to 5.0-foot depth interval (56SB02-02, 56SB03-02, 56SB07-02, and 56SB08-02), 5.0 to 7.0-foot depth interval (56SB04-03, 56SB05-03, 56SB06-03, and 56SB07-03), 7.0 to 9.0-foot depth interval (56SB01-04, 56SB02-04, 56SB03-04, and 56SB04-04), or the 9.0 to 10.0-foot depth interval (56SB05-05). Sampling locations are depicted on Figure 4-2. Each surface soil, subsurface soil, groundwater, and sediment sample was analyzed for Appendix IX VOCs, SVOCs, and metals (total recoverable), while each surface water sample was analyzed for Appendix IX PAHs and metals (total recoverable). Groundwater and surface water samples also were analyzed for dissolved Appendix IX metals.

A pre-excavation field investigation was conducted from September 24, 2008 to September 25, 2008 and involved the collection of surface soil and drainage ditch sediment. A total of twelve surface soil samples (designated 56SS01 through 56SS12; collected from the 0.0 to 1.0-foot depth interval) and three drainage ditch sediment samples (designated 56SD12 through 56SD14) were collected. As depicted on Figure 4-2, sediment was collected from Drainage Ditch Segment E-F. Surface soil samples 56SS01 through 56SS06 were analyzed for lead and selenium and surface soil samples 56SS07 through 56SS12 were analyzed for selenium and vanadium, while each drainage ditch sediment sample was analyzed for Appendix IX metals.

The supplemental field investigation was conducted on June 27, 2009 and involved the collection of eight sediment samples (designated 56SD15 through 56SD22). Sediment samples 56SD15, 56SD16, 56SD17, 56SD18, 56SD19, and 56SD20 were collected from Drainage Ditch Segment E-F, while sediment samples 56SD21 and 56SD22 were collected from Drainage Ditch Segment

G-H (see Figure 4-2). Each sediment sample was analyzed for Appendix IX metals, acid volatile sulfide (AVS), and simultaneously extracted metals (SEM).

Analytical data for soil samples collected from the 0.0 to 1.0-foot depth interval during the 2008 CMS and pre-excavation field investigations 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 five depth intervals during the CMS field investigation (1.0 to 3.0-foot depth interval, 3.0 to 5.0-foot depth interval, 5.0 to 7.0-foot depth interval, 7.0 to 9.0-foot depth interval, and 9.0 to 10.0-foot depth interval). Analytical data for soil samples collected from the 1.0 to 3.0-foot depth interval (56SB01-01, 56SB06-01, and 56SB08-01) were quantitatively evaluated as subsurface soil in the SERA. Analytical data for subsurface samples collected from the deeper depth intervals were not evaluated since these depths are not likely to represent a significant exposure point for ecological receptors. Analytical data for surface water and sediment samples collected within the drainage ditch system downgradient from SWMU 56 during the 2008 CMS investigation, 2008 pre-excavation field investigation, and 2009 supplemental field investigation also were quantitatively evaluated in the SERA. Finally, based on the groundwater flow direction at SWMU 56 (southeast, toward an estuarine wetland system located south of Forrestal Drive), analytical data for the seven groundwater samples collected during the CMS field investigation were quantitatively evaluated in the SERA. The surface soil, subsurface soil, groundwater, surface water, and sediment analytical data evaluated in the ERA are included as Appendix D. It is noted that the analytical laboratory reported non-detected results to the method detection limit (MDL) for soil, groundwater, surface water, and sediment samples collected during the 2008 CMS field investigation and pre-excavation field investigation. For the 2009 supplemental field investigation, the analytical laboratory reported non-detected results to the reporting limit (RL).

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 56. 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 Areas

The Hangar 200 concrete apron represents a potential source for the release of chemicals to abiotic media (i.e., downgradient surface and subsurface soil and drainage ditch surface water and sediment). Contaminated surface soil also represents a potential source for the release of chemicals to downgradient surface soil, as well as subsurface soil, groundwater, and drainage ditch surface water and sediment, while contaminated subsurface soil represents a potential source for the release of chemicals to groundwater. Finally, drainage ditch sediment represents a potential source for the release of chemicals to surface water and sediment within the estuarine wetland system hydrologically connected to SWMU 56 via the drainage ditch system.

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 56 are believed to include the following:

- Transport of chemicals associated with historical POL and hazardous material spills to the surface of the Hangar 200 concrete apron via surface run-off to downgradient surface soil and drainage ditch surface water and sediment.

- Overland transport of chemicals with surface soil via surface runoff to downgradient surface soil and drainage ditch surface water and sediment.

- Leaching of chemicals from surface soil and/or subsurface soil by infiltrating precipitation and transport to downgradient estuarine wetland surface water and sediment with groundwater.

- Uptake by biota from surface soil, subsurface soil, and drainage ditch sediment and trophic transfer to upper trophic level receptors.

A fifth potential transport pathway at SWMU 56 involves the transport of chemicals with drainage ditch surface water and sediment to surface water and sediment within the estuarine wetland system south of Forrestal Drive (see Section 7.1.2). As estuarine wetland surface water and sediment were not collected during the 2004 Phase II ECP or subsequent investigations conducted in 2008 and 2009, this potential pathway was not quantitatively evaluated by the ERA. Instead, the spatial distribution of chemical concentrations in drainage ditch surface water and sediment were examined in Step 3a of the BERA. The presence of ecological COCs in drainage ditch surface water collected at 56SW05 (furthest downgradient surface water sample location) and/or drainage ditch sediment collected at 56SD22 (furthest downgradient sediment sample location) would indicate that transport to estuarine wetland surface water and sediment 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 56. 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 56 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 and mammals 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 56 is the drainage ditch system discussed in Section 7.1.2. As water within the drainage ditch system is freshwater (i.e., surface run-off) and surface water samples were collected from the drainage ditch system during the 2008 CMS field investigation, ingestion of surface water was considered in risk calculations for upper trophic level receptors.

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 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 SWMUs 56, 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 (see 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 56 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 56 are based on the survival, growth, and reproduction of lower trophic level terrestrial receptor groups (terrestrial plants and invertebrates), terrestrial reptiles, and upper trophic level terrestrial birds (herbivores, omnivores, and carnivores), while assessment endpoints for the drainage ditch are based on the survival, growth, and reproduction of lower trophic level aquatic receptor groups (aquatic plants, invertebrates, fish, 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. This assessment endpoint was agreed upon by TRC and Baker personnel during the January 14, 2009 site visit.

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 56 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 (see Table 7-2).

- Mourning dove (*Zenaida macroura*) (avian herbivore)

- American robin (*Turdus migratorius*) (avian omnivore)

- Red-tailed hawk (*Buteo jamaicensis*) (avian carnivore)

The American robin also was selected for dietary exposure modeling to chemicals in drainage ditch sediment. 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 (see 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 56 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 Hangar 200 apron (grasses of unknown species composition). The coastal scrub forest community located southeast of SWMU 56 and the upland habitat adjacent to Drainage Ditch Segments E-F and G-H represent 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. In addition, there are no transport pathways from SWMU 56 to these vegetative communities. 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 food web 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 food web exposures for the yellow-shouldered blackbird.

Although potentially complete and significant exposure pathways exist at SWMU 56 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).

Individual bat species also were excluded from evaluation. 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. Although upland coastal scrub communities, including the coastal scrub community bordering Drainage Ditch Segment E-F, contain plants on which bats of Puerto Rico are known to feed (e.g., white lead tree [nectar/pollen] and Puerto Rico royal palm [nectar/pollen]; Gannon et al., 2005), a frugivorous or nectivorous bat (i.e., Jamaican fruit bat, Antillean fruit bat, red fig-eating bat, brown flower bat, or greater Antillean long-tongued bat) was not selected as an ecological receptor because there are no apparent transport pathways from SWMU 56 to the coastal scrub forest community. Frugivorous and nectivorous bats in Puerto Rico also do not feed on the specific vegetation growing within the drainage ditch channel (Gannon et al., 2005). Finally, a piscivorous bat (i.e., Mexican bulldog bat) was excluded from evaluation based on the lack of a permanent fish population within the drainage ditch system. Dense vegetation within and overhanging the drainage ditch channel also is not conducive to the Mexican bulldog bat's foraging methods (use of echolocation while patrolling just above the water and trolling).

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 20035). 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, 2010; 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 surface water, the drainage ditch system downgradient from SWMU 56 may provide appropriate habitat for amphibian reproduction. Identical to terrestrial and aquatic plants and invertebrates, amphibians were dealt with on a community level via a comparison of drainage ditch surface water and sediment data to media-specific screening values. This approach also is consistent with USEPA Region III guidance (USEPA, 2006a), 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 not considered potential ecological receptors at SWMU 56 based on the absence of suitable habitat (see Section 7.1.3.3).

Although small fish were observed within the drainage ditch system downgradient from SWMU 56 during the 2004 Phase II ECP field investigation and 2008 CMS field investigation, they were not present during the 2008 pre-excavation field sampling investigation, January 14, 2009 site visit and benthic macroinvertebrate survey, and June 27, 2009 supplemental field investigation/vegetative assessment. 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 the SWMU 56 (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 56 (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 56, 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 soil), groundwater, surface water, and sediment, while TRVs were developed for the evaluation of potential risks to upper trophic level terrestrial receptors (i.e., avian omnivores, herbivores, and carnivores) from food web (dietary) exposures (i.e., ingested chemical doses).

7.4.1 Media-Specific Screening Values for Soil, Groundwater, Surface Water, and Sediment

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), groundwater, drainage ditch surface water, and drainage ditch sediment. The media-specific screening values, listed in Tables 7-4 (soil), 7-5 (groundwater), 7-6 (surface water), and 7-7 (sediment), 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 (1999b)

- 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 56 is southeast, toward an estuarine wetland system comprised primarily of E2SS3 wetland units. Because this estuarine wetland system represents a potential discharge point for SWMU 56 groundwater, the available groundwater data, collected during the 2008 CMS field investigation, were screened against the marine toxicological thresholds listed in Table 7-5. Puerto Rico Water Quality Standards (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:

- Chronic saltwater 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 2001a)

- Minimum chronic toxicity test endpoints (No Observed Effect Concentration [NOEC], No Observed Effect Level [NOEL], and MATC values based on reproduction, growth, or survival) for marine species reported in the ECOTOXicology (ECOTOX) Release 4.0 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 5 (Wentsel et al., 1996)

The order of preference was selected based on their level of protection. For example, NAWQC and 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 NAWQC, FCVs, USEPA Region 4 chronic screening values, chronic test endpoints, and chronic LOELs, screening values were derived from the literature-based acute saltwater 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 Release 4.0 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:

- A safety factor of 30 was used to convert an acute NOEC or NOEL to a chronic-based screening value (Wentsel et al., 1996)

- A safety factor of 50 was used to convert an Acute LOEC or LOEL to a chronic-based screening value (Wentsel et al., 1996)

- A safety 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. For those chemicals lacking saltwater toxicological thresholds and literature values, surface water screening values were identified or developed from freshwater values using the sources and procedures discussed in Section 7.4.1.3. In some cases, acute and/or chronic saltwater LOELs for chemical classes (e.g., PAHs) were available from the literature (Buchman, 2008). For a given chemical, a saltwater LOEL based on a chemical class was used as the groundwater screening value only if that chemical lacks freshwater and saltwater literature-based benchmarks and/or toxicity test endpoints.

As evidenced by Table 7-5, the screening value selected for mercury is USEPA saltwater NAWQC (i.e., criteria continuous concentration [CCC]). The saltwater CCC value for this metal is identified in National Recommended Water Quality Criteria (USEPA, 2009a) as a dissolved concentration. A total recoverable CCC value for this metal was derived for use as a groundwater screening value in the Step 2 screening level risk calculation by dividing the dissolved CCC value (0.94 µg/L) by 0.85 (saltwater conversion factor for mercury listed in Appendix A of National Recommended Water Quality Criteria [USEPA, 2009a]).

7.4.1.3 Surface Water Screening Values

The drainage ditch surface water data were screened against the freshwater toxicological thresholds listed in Table 7-6. PRWQS for Class SD surface waters listed in the PRWQR dated March 31, 2010 (PREQB, 2010) were preferentially used as surface water screening values. PRWQS for Class SD surface waters were selected based on the classifications contained within Rule 1302.2 of the PRWQR. For those chemicals lacking PRWQS for Class SD surface waters, surface water screening values were identified from the following information listed in their order of decreasing preference:

- Chronic freshwater NAWQC (USEPA, 2009a)
- FCVs for freshwater contained in ECO Update Volume 3, Number 2 (USEPA, 1996)
- USEPA Region 4 chronic screening values for freshwater contained in Ecological Risk Assessment Bulletins – Supplement to RAGS (USEPA 2001a) and USEPA Region 5 ecological screening levels (ESLs) (http://www.epa.gov/reg5rcra/ca/ESL.pdf) (USEPA, 2003b)
- Minimum chronic toxicity test endpoints (NOEC, NOEL, and MATC values based on reproduction, growth, or survival) for freshwater species reported in the ECOTOX Release 4.0 Database System (USEPA, 2007a)
- Great Lakes basin Tier II Secondary Chronic Values (SCVs) listed in the Great Lakes Initiative Toxicity Data Clearinghouse (http://www.epa.gov/gliclearinghouse/) (USEPA, 2009b)
- Chronic LOELs for freshwater contained in NOAA SQUIRTs (Buchman, 2008) with a safety factor of 5 (Wentsel et al., 1996)

Identical to the marine/estuarine-based groundwater screening values presented in Section 7.4.1.2, the order of preference was selected based on their level of protection. It is noted that USEPA Region 4 and Region 5 screening values were given equal preference. When a value was available from both sources, the minimum value was selected as the surface water screening value. In the absence of the above-mentioned freshwater FCVs, freshwater USEPA Region 4 and Region 5 screening values, freshwater chronic test endpoints, and freshwater chronic LOELs, screening values were derived from the literature-based acute freshwater values listed below:

- Acute LOELs for freshwater contained in NOAA SQUIRTs (Buchman, 2008)

- Acute toxicity test endpoints (NOEC, NOEL, LOEL, LOEC, LC_{50}, EC_{50} values) for freshwater species contained in the ECOTOX Release 4.0 Database System (USEPA, 2007a)

- LC_{50} values for freshwater 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 using the safety factors previously identified in Section 7.4.1.2 (i.e., safety factors recommended by 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. For those chemicals lacking freshwater toxicological thresholds and literature values, surface water screening values were identified or developed from saltwater values using the sources and procedures discussed in Section 7.4.1.2.
As evidenced by Table 7-6, the screening values selected for arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc are PRWQS for Class SD surface waters. In addition, the screening value selected for mercury is a USEPA freshwater NAWQC (CCC value), while the screening value for beryllium is a Great Lakes basin Tier II chronic criterion (i.e., SCV) developed by the Ohio Environmental Protection Agency (OEPA). The screening values listed in Table 7-6 for these eleven metals are expressed as total recoverable concentrations. PRWQS for cadmium, chromium, copper, lead, nickel, silver, and zinc, as well as the OEPA SCV for beryllium are further expressed as a function of water hardness (PREQB, 2010 and USEPA, 2009b). A hardness-dependent, total recoverable SCV for beryllium and hardness-dependent, total recoverable PREQS for cadmium, chromium, copper, lead, nickel, silver, and zinc were derived for use as surface water screening values using the following regression equations (PREQB, 2010 and USEPA, 2009b):

- Beryllium: exp[2.528(*ln* hardness)-10.77]
- Cadmium: exp[0.7409(*ln* hardness)-4.719]
- Chromium: exp[0.8190(*ln* hardness)+0.6848]
- Copper: exp[0.8545(*ln* hardness)-1.702]
- Lead: exp[1.273(*ln* hardness)-4.705]
- Nickel: exp[0.8460(*ln* hardness)+0.0584]
- Silver: exp[1.72(*In* hardness)-6.59]
- Zinc: exp[0.8473(*ln* hardness)+0.884]

In these equations, hardness concentrations are expressed in units of mg/L as calcium carbonate ($CaCO_3$). Hardness data are not available for surface water samples collected from the drainage ditch system downgradient from SWMU 56. The Water Resources Division of the United States Geological Survey (USGS), in cooperation with local and Federal agencies, obtains data pertaining to the water resources of Puerto Rico each year. Data are available in the National Water Information System water quality database available at http://waterdata.usgs.gov/nwis. A USGS monitoring station (i.e., 50071000) was identified within a stream located approximately 4 miles northwest of NAPR. From February 21, 1961 to August 10, 2004, a total of 231 hardness measurements were taken at this station. Hardness concentrations ranged from 4 mg/L to 61 mg/L as $CaCO_3$, with an arithmetic mean concentration of 32.2 mg/L as $CaCO_3$, a 95 percent lower confidence limit (LCL) of the mean concentration of 31.35 mg/L as $CaCO_3$ (derived using

Scout Version 1.00.1 software [USEPA, 2009c]), and a 95 percent upper confidence limit (UCL) of the mean concentration of 32.86 mg/L as $CaCO_3$ (derived using USEPA ProUCL Version 4.00.02 software [USEPA, 2007b]). Because NAPR and USGS monitoring station 50071000 are located within the same hydrologic unit (21010005), hardness data for the USGS monitoring station represent reasonable estimates of surface water hardness within the drainage ditch system downgradient from SWMU 56. Therefore, the 95 percent LCL concentration (i.e., 31.35 mg/L as $CaCO_3$) was used to derive the surface water screening values listed in Table 7-6 for beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

As discussed in Section 4.7.1.2, the USEPA saltwater CCC value for mercury is expressed as a dissolved concentration. The USEPA freshwater CCC value for this metal also is expressed as a dissolved concentration (USEPA, 2009a). A total recoverable, freshwater CCC for mercury was derived for use as a surface water screening value in the Step 2 screening level risk calculation by dividing the dissolved CCC value (0.77 µg/L) by 0.85 (freshwater conversion factor for mercury listed in Appendix A of National Recommended Water Quality Criteria [USEPA, 2009a]).

7.4.1.4 Sediment Screening Values

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 (see Table 7-7). 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 10^{th} and 50^{th} 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 7-7 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 7-7 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. For those organic chemicals lacking bulk sediment freshwater and marine/estuarine toxicological benchmarks, EqP-based screening values were either developed using the USEPA EqP approach (USEPA, 1993a and 1996 [see Appendix E]) or identified from the literature (Di Toro and McGrath, 2000). For a given chemical, when an EqP-based value was derived in accordance with USEPA (1993a and 1996) methodology and also was available from Di Toro and McGrath (2000), the minimum value was selected as the sediment screening value. As discussed in Appendix E, EqP-based screening values developed in accordance with USEPA (1993a and 1996) methodology are based, in part, on the fraction of organic carbon (f_{oc}) measured in SWMU 56 drainage ditch sediment. Specifically, a f_{oc} of 0.036 was used in their derivation (minimum measured value). This f_{oc} value also was used to adjust the Di Toro and McGrath (2000) EqP-based toxicological benchmarks selected as sediment screening values (published values are based on a default f_{oc} of 0.01).

7.4.2 Toxicity Reference Values for Avian Dietary Exposures

TRVs for avian dietary exposures to chemicals in surface soil, subsurface soil, and drainage ditch sediment were compiled from the literature for each receptor species and chemical evaluated for food web exposures. If available, TRVs identified and used by the USEPA in the derivation of avian Eco-SSLs were preferentially used to evaluate risks from ingested dietary doses.

For chemicals lacking an avian 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 terrestrial bird species selected as ecological receptors (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 7-8. 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 7-8 were not adjusted to reflect differences in body weights between avian test species and avian receptor species.

Not all chemicals analyzed for in surface soil, subsurface soil, and sediment were evaluated for terrestrial food web exposures. The organic chemicals evaluated for food web 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 F. For conservatism, all inorganic chemicals (i.e., metals) also were evaluated for food web exposures. The list of chemicals selected for evaluation of food web exposures contains many chemicals that are not identified as "important bioaccumulative compounds" by the USEPA (2000b). Their inclusion in the evaluation of terrestrial food web exposures is consistent with the conservatism of the SERA.

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, groundwater, drainage ditch surface water, and drainage ditch sediment.

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 to 1.0-foot depth interval) and subsurface soil data (analytical data for soil samples collected from 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 surface water and groundwater, only total (unfiltered) analytical data were used in the Step 2 screening level risk calculation.

- Maximum MDLs/RLs (see Section 7.2) were conservatively used to estimate exposure for non-detected chemicals.

- In some instances, duplicate samples were collected in the field (see 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), groundwater, drainage ditch surface water, and drainage ditch sediment 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 Terrestrial and Aquatic Receptor Groups

Maximum measured chemical concentrations in soil, groundwater, drainage ditch surface water, and drainage ditch sediment were compared to the media-specific screening values discussed in Section 7.4.1 and summarized in Tables 7-4 through 7-7 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 and sediment, as well as ingestion of surface water also were included when calculating the total level of exposure. As indicated previously, maximum measured soil, drainage ditch surface water, and drainage ditch sediment were 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), 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). In addition to the terrestrial food items identified above, tissue concentrations were modeled for benthic invertebrates inhabiting ditch sediments downgradient from SWMU 56. Benthic invertebrates may serve as a food source for terrestrial avian omnivores that potentially forage within the drainage ditches during dry periods when ditch sediments are exposed.

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 [2007c]) 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 (see Table 7-9). The chemical-specific BAF values listed in Table 7-9 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 (2007c) 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 (2007c):

$$Log\ BAF = (-0.4057)\ (Log\ K_{ow}) + 1.781$$

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 (see Table 7-9). The chemical-specific BAF values used in the SERA (see Table 7-9) 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, 1993b). 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 (2007c) 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 (see Table 7-10). The chemical-specific BAFs listed in Table 7-10 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, 1993b). 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).

Drainage ditch invertebrates. As discussed in Section 7.5.2.2, benthic invertebrates encountered within the drainage ditch system during the January 14, 2009 benthic macroinvertebrate survey (snails, see Section 7.1.3.4) may serve as a food source for terrestrial avian omnivores that potentially forage within the drainage ditches during dry periods when ditch sediments are exposed. Tissue concentrations in drainage ditch invertebrates were estimated using the uptake equations and BAF values presented in Table 7-9 for earthworms.

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 (1993b).

$$DI_x = \frac{[[\sum_i [(FIR)(FC_{xi})(PDF_i)]] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x]][AUF]}{BW}$$

where:

DI_x = Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR = Food ingestion rate (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/sediment (mg/kg; dry weight)
PDS = Proportion of diet composed of soil/sediment (unitless; dry weight basis)
WIR = Water ingestion rate (liters per day [L/day])
WC_x = Maximum concentration of chemical x in surface water (mg/L)
BW = Body weight (kg; wet weight basis)
AUF = Area Use Factor (unitless)

Conservative, receptor-specific exposure parameters (maximum food ingestion rates, maximum water ingestion rates, and minimum body weights) for the American robin, mourning dove, and red-tailed hawk are provided in Table 7-11. The food items selected for each receptor species are provided in Table 7-12. Although American robins are omnivores, an exclusive diet of earthworms was assumed for the SERA. Table 7-11 contains exposure parameters and Table 7-12 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.

As discussed in Section 7.5.2.2.1, chemical concentrations in receptor food items (FC_{xi}) were derived by chemical-specific uptake equations or by multiplying maximum measured soil/sediment concentrations for each chemical by conservative, chemical-specific BAFs. Uptake equations and BAF values used in the derivation of food item tissue concentrations are those listed in Tables 7-9 (soil-to-plant and soil-to-invertebrate uptake equations and BAFs) and 7-10 (soil-to-small mammal uptake equations and BAFs).

7.6 <u>Screening Level Risk Calculation</u>

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 potential 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), groundwater, drainage ditch surface water, and drainage ditch sediment.

- The maximum detected concentrations in surface soil, subsurface soil, groundwater, surface water, and sediment 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 HQ values. 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 food web exposures, maximum chemical concentrations in soil (surface and subsurface soil), drainage ditch sediment, and drainage ditch surface water 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 (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 considered 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 were 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 [see Figure 7-1]).

7.6.2 Screening Level Risk Calculation for Surface Soil, Subsurface Soil, Groundwater, Surface Water, Sediment, and Upper Trophic Level Food Web Exposures

Screening level risk calculations (i.e., HQ calculations) for SWMU 56 surface soil, subsurface soil, groundwater, drainage ditch surface water, and drainage ditch sediment are presented in Tables 7-13, 7-14, and 7-15, 7-16, and 7-17, 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, pelagic and benthic biota exposures to chemicals in groundwater discharging to the downgradient estuarine wetland system, and pelagic and benthic biota exposures to chemicals in drainage ditch surface water and sediment).

Screening level risk calculations for SWMU 56 avian food web exposures are presented in Tables 7-18 (surface soil), 7-19 (subsurface soil), while avian omnivore food web exposures to chemicals in drainage ditch sediment are presented in Table 7-20. 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 7-13 presents the results of the screening level risk calculation for plant and invertebrate exposures to chemicals in SWMU 56 surface soil. Five VOCs (acetone, benzene, carbon disulfide, chloromethane, and iodomethane) were detected in SWMU 56 surface soil. Maximum detected concentrations are 280 µg/kg for acetone, 0.99J for benzene, 1.9J µg/kg for carbon disulfide, 2.2J µg/kg for chloromethane, and 2.4J µg/kg for iodomethane. Based on a HQ value less than 1.0, benzene is not identified as an ecological COPC. However, acetone, carbon disulfide, chloromethane, and iodomethane are identified as ecological COPCs for SWMU 56 surface soil based on the lack of soil screening values. An additional twenty-three non-detected VOCs also are identified as ecological COPCs based on the lack of soil screening values (see Table 7-13).

Butyl benzyl phthalate was detected in one of eight (1/8) surface soil samples at 10J µg/kg. Because the single detected concentration is less than the soil screening value (6,010 µg/kg), this SVOC is not identified as an ecological COPC for SWMU 56 soil. Although not detected, fifty-four SVOCs are identified as ecological COPCs based on the lack of soil screening values.

Thirteen PAHs were detected in SWMU 56 surface soil. Information available from the literature indicates that PAH toxicities in waters, tissues, and sediments are additive or nearly additive (USEPA 2003c). Assuming that PAH toxicities in soils are also additive or nearly additive, the combined toxicological contributions of the PAH mixture in SWMU 56 soils was considered. The USEPA (2007d) 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 rings, while HMW PAHs are defined as PAH compounds composed of four or more rings (USEPA, 2007d). 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, dibenz[a,h]anthracene, chrysene, indeno[1,2,3-cd]pyrene, and pyrene) were analyzed for in SWMU 56 surface soil. The sum of maximum LMW PAH concentrations across the SWMU (41.96 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 (154.1 µg/kg) also is less than the HMW PAH Eco-SSL. 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 56 surface soil.

Sixteen metals were detected in SWMU 56 surface soil. Although detected, antimony, arsenic, barium, beryllium, cadmium, chromium, mercury, nickel, silver, thallium, and zinc are not identified as ecological COPCs because maximum detected concentrations are less than soil screening values (i.e., maximum HQ values are less than 1.0). However, maximum detected cobalt, copper, lead, selenium, and vanadium concentrations exceed soil screening values (HQ values range from 1.75 for lead to 21.50 for vanadium; see Table 7-13). Based on maximum detected concentrations greater than soil screening values, these five metals are identified as ecological COPCs for SWMU 56 surface soil.

In summary, cobalt, copper, lead, selenium, and vanadium were detected and identified as ecological COPCs for SWMU 56 surface soil because maximum detected concentrations exceed soil screening values. The detected VOCs acetone, carbon disulfide, chloromethane, and iodomethane also were identified as ecological COPCs based on the lack of soil screening values. An additional twenty-three 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 7-14 presents the results of the screening level risk calculation for plant and invertebrate exposures to chemicals in SWMU 56 subsurface soil (1.0 to 3.0 foot depth interval). Acetone and iodomethane were detected in SWMU 56 subsurface soil and are identified as ecological COPCs based on the lack of soil screening values. An additional twenty-six 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 56. However, fifty-three non-detected SVOCs are identified as ecological COPCs for SWMU 56 subsurface soil based on the lack of soil screening values.

As discussed in Section 7.6.2.1, PAH toxicities in soil are assumed to be additive or nearly additive. The USEPA (2007d) 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 (17.98 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 (13.30 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 56 surface soil.

Thirteen metals were detected in SWMU 56 subsurface soil. Although detected, arsenic, barium, beryllium, chromium, cobalt, lead, mercury, nickel, silver, and zinc are not identified as ecological COPCs because maximum detected concentrations are less than soil screening values (i.e., maximum HQ values are less than 1.0). Copper, selenium, and vanadium are identified as ecological COPCs because maximum detected concentrations exceed soil screening values. HQ values range from 1.07 for copper to 12.00 for vanadium.

In summary, copper, selenium, and vanadium were detected and identified as ecological COPCs for SWMU 56 subsurface soil because maximum detected concentrations exceed soil screening values. Two detected VOCs (acetone and iodomethane) were identified as ecological COPCs based on the lack of soil screening values. An additional twenty-six non-detected VOCs and fifty-three non-detected SVOCs were identified as ecological COPCs based on the lack of soil screening values.

7.6.2.3 Groundwater

Table 7-15 presents the results of the screening level risk calculation for SWMU 56 groundwater. Acetone and chloromethane were detected in SWMU 56 groundwater. However, because maximum detected concentrations (7.1J µg/L for acetone and 1.8J µg/L for chloromethane) are less than groundwater screening values (HQs = <0.01), 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 (2-chloro-1,3-butadiene, chloroethane, iodomethane, methacrylonitrile, and trans-1,4-dichloro-2-butene) are identified as ecological COPCs based on the lack of groundwater screening values.

1,4-Dichlorobenzene, 3,4-methylphenol, anthracene, bis(2-ethylhexyl)phthalate, diethyl phthalate, fluoranthene, fluorene, and phenanthrene were detected in SWMU 56 groundwater. As evidenced by Table 7-15, maximum detected concentrations for these eight SVOCs are less than groundwater screening values (maximum HQs range from <0.01 for 1,4-dichlorobenzene, anthracene, bis(2-ethylhexyl)phthalate, diethyl phthalate, fluoranthene, fluorene, and phenanthrene to 0.03 for 3,4-methylphenol). Based on HQ values less than 1.0, the detected SVOCs are not identified as ecological COPCs for SWMU 56 groundwater. Although not detected, hexachlorocyclopentadiene and pentachloronitrobenzene are identified as ecological COPCs because maximum MDLs exceed groundwater screening values (HQ = 7.00 for hexachlorocyclopentadiene and 1.30 for pentachloronitrobenzene). An additional sixteen non-detected SVOCs are identified as ecological COPCs based on the lack of groundwater screening values.

Arsenic, barium, chromium, cobalt, copper, nickel, selenium, vanadium, and zinc were detected within the total recoverable fraction of SWMU 56 groundwater. Because maximum detected arsenic, barium, chromium, cobalt, nickel, selenium and zinc concentrations are less than groundwater screening values (HQs range from 0.01 for arsenic and barium to 0.84 for cobalt), these seven metals are not identified as ecological COPCs. However, maximum detected copper and vanadium concentrations exceed groundwater screening values (HQ = 2.23 for copper and 1.67 for vanadium). Based on maximum detected concentrations greater than screening values, copper and vanadium are identified as ecological COPCs for SWMU 56 groundwater.

In summary, copper and vanadium were detected and identified as ecological COPCs for SWMU 56 groundwater because maximum detected concentrations exceed groundwater screening values. One non-detected VOC (acrolein) and two non-detected SVOCs (hexachlorocyclopentadiene and pentachloronitrobenzene) also were identified as ecological COPCs because maximum MDLs exceed screening values. An additional five non-detected VOCs (2-chloro-1,3-butadiene, chloroethane, iodomethane, methacrylonitrile, and trans-1,4-dichloro-2-butene) and sixteen non-detected SVOCs were identified as ecological COPCs based on the lack of groundwater screening values.

7.6.2.4 Drainage Ditch Surface Water

Table 7-16 presents the results of the screening level risk calculation for pelagic and benthic biota exposures to chemicals in drainage ditch surface water. As discussed in Section 7.2, drainage ditch surface water samples were analyzed for PAHs and metals. As evidenced by Table 7-16, PAHs were not detected in drainage ditch surface water. However, benzo(a)pyrene is identified as an ecological COPC because the maximum MDL for this PAH exceeds the surface water screening value (HQ = 1.71).

Eleven metals were detected within the total recoverable fraction of drainage ditch surface water. Cadmium, copper, lead, vanadium, and zinc are identified as ecological COPCs because maximum detected concentrations exceed surface water screening values (maximum HQ = 9.60 for cadmium, 3.75 for copper, 22.02 for lead, 1.83 for vanadium, and 1.03 for zinc).

In summary, cadmium, copper, lead, vanadium, and zinc were detected and identified as ecological COPCs for drainage ditch surface water because maximum detected total recoverable concentrations exceed surface water screening values. Although not detected, benzo(a)pyrene also was identified as an ecological COPC because the maximum MDL for this PAH compound exceeds the surface water screening value.

7.6.2.5 Drainage Ditch Sediment

Table 7-17 presents the results of the screening level risk calculation for benthic biota exposures to chemicals in drainage ditch sediment. Four VOCs (2-butanone, acetone, carbon disulfide, and iodomethane) were detected in drainage ditch sediment. The maximum 2-butanone concentration (65J) is less than the sediment screening value. Therefore, this VOC is not identified as an ecological COPC. However, maximum detected acetone and carbon disulfide concentrations (1,200J µg/kg and 800J µg/kg) exceed sediment screening values (maximum HQ = 33.73 for acetone and 16.01 for carbon disulfide). For this reason, these two VOCs are identified as ecological COPCs for drainage ditch sediment. Iodomethane also is identified as an ecological COPC based on the lack of a sediment screening value. Although not detected, acrylonitrile and xylenes (total) are identified as ecological COPCs because maximum MDLs exceed sediment screening values. An additional three non-detected VOCs (2-chloro-1,3-butadiene, methacrylonitrile, and trans-1,4-dichloro-2-butene) are identified as ecological COPCs for drainage ditch sediment based on the lack of sediment screening values.

Fourteen SVOCs were detected in drainage ditch sediment. Benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, and pyrene are identified as ecological COPCs because maximum detected concentrations exceed sediment screening values. Maximum HQ values range from 1.44 for bis(2-ethylhexyl)phthalate to 2.63 for benzo(k)fluoranthene. Although not detected, twenty-nine SVOCs were identified as ecological COPCs based on maximum MDLs greater than sediment screening values. An additional sixteen non-detected SVOCs were identified as ecological COPCs based on the lack of sediment screening values.

Sixteen metals were detected in drainage ditch sediment. Arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, tin, vanadium, and zinc are identified as ecological COPCs because maximum detected concentrations exceed sediment screening values (see Table 7-17). Maximum HQ values range from 1.06 for arsenic to 28.55 barium. Beryllium also was detected and identified as ecological COPCs based on the lack of sediment screening values. Although not detected, thallium is identified as an ecological COPC based on the lack of a sediment screening value.

In summary, acetone, carbon disulfide, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, pyrene, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, tin, vanadium, and zinc were detected and identified as ecological COPCs for drainage ditch sediment because maximum detected concentrations exceed sediment screening values. Iodomethane and beryllium also were detected and identified as ecological COPCs based on the lack of sediment screening values. Although not detected, two VOCs (acrylonitrile, and xylenes [total]) and twenty-nine SVOCs were identified as ecological COPCs because maximum MDLs exceed sediment screening values. Three non-detected VOCs (2-chloro-1,3-butadiene, methacrylonitrile, and trans-1,4-dichloro-2-butene), sixteen non-detected SVOCs, and one non-detected metal (thallium) were identified as ecological COPCs based on the lack of sediment screening values.

7.6.3 Avian Food Web Exposures

Results of the screening level risk calculation for SWMU 56 avian food web exposures are presented in Tables 7-18 (surface soil), Table 7-19 (subsurface soil), and Table 7-20 (sediment). A discussion of these results is presented in the sections that follow.

7.6.3.1 Avian Food Web Exposures: Surface Soil

Results of the screening level risk calculation for avian food web exposures to chemicals in SWMU 56 surface soil are presented in Table 7-18. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, nine detected metals (cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, and zinc) have HQ values greater than 1.0 for one or more of the terrestrial avian receptors. The highest HQ values were calculated for the American robin, including a HQ of 12.66 for mercury, 16.00 for chromium, and 61.68 for vanadium. Based on maximum exposures doses greater than NOAEL-based TRVs, these nine metals are identified as ecological COPCs for avian food web exposures to chemicals in SWMU 56 surface soil. One detected SVOC (butyl benzyl phthalate and one detected metal (beryllium), as well as nine non-detected VOCs, and twenty-eight non-detected SVOCs also are identified as ecological COPCs based on the lack of TRVs.

7.6.3.2 Avian Food Web Exposures: Subsurface Soil

Results of the screening level risk calculation for avian food web exposures to chemicals in SWMU 56 subsurface soil are presented in Table 7-19. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, five detected metals (chromium, copper, mercury, selenium, and vanadium) have HQ values greater than 1.0 for one or more of the terrestrial avian receptors. Identical to surface soil, the highest HQ values were calculated for the American robin, including a HQ of 14.96 for mercury and a HQ of 17.21 for vanadium. One detected metal (beryllium), nine non-detected VOCs, and twenty-eight non-detected SVOCs also are identified as ecological COPCs based on the lack of TRVs.

7.6.3.3 Avian Food Web Exposures: Drainage Ditch Sediment

Results of the screening level risk calculation for avian food web exposures to chemicals in SWMU 56 sediment are presented in Table 7-20. Based on the comparison of maximum exposure doses to NOAEL-based TRVs, thirteen detected metals (barium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc) have HQ values greater than 1.0 for the American robin. The highest HQ values were calculated for mercury (HQ = 72.86) and vanadium (HQ = 37.30). Based on maximum exposures doses greater than NOAEL-based TRVs, these thirteen metals are identified as ecological COPCs for avian food web exposures to chemicals in SWMU 56 sediment. Di-n-octyl phthalate was detected in SWMU 56 sediment and is identified as an ecological COPC based on the lack of an avian TRV. Although not detected, thallium and di-n-butyl phthalate are identified as ecological COPCs because maximum exposure doses exceed NOAEL-based TRVs. One detected metal (beryllium), nine non-detected VOCs, and twenty-nine non-detected SVOCs also are identified as ecological COPCs based on the lack of TRVs.

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 56 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 three 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. However, as chemical releases at the SWMU were initially to the Hanger 200 concrete apron and not to soil, it is unlikely that subsurface soil at the SWMU is impacted by site-related chemicals.

- A third source of uncertainty related to the analytical data applies to the spatial coverage of drainage ditch sediment data. A single sediment sample was collected from Drainage Ditch Segment E-F during the 2008 CMS field investigation, while no sediment samples were collected from Drainage Ditch Segments G-H and H-I. To reduce the uncertainty associated with the spatial coverage of sediment samples, a total of nine sediment samples were collected within Drainage Ditch Segment E-F during the 2008 pre-excavation and 2009 supplemental field investigations. An additional two sediment samples were collected from Drainage Ditch Segment G-H during the 2009 supplemental investigation. However, sediment was not collected from Drainage Ditch Segment H-I during the 2009 Supplemental field sampling investigation. This ditch segment was not sampled because it receives drainage from a significant portion of the airfield, as well as drainage from areas outside of the airfield's boundary. Based on these storm water inputs, it is the Navy's opinion that sediment quality within Drainage Ditch Segment H-I cannot be linked to SWMU 56. Regardless, the lack of sediment analytical data for Drainage Ditch Segment H-I represents a data gap. The uncertainty associated with this data gap was addressed in Step 3a by evaluating the spatial distribution of chemicals in drainage ditch sediment to determine if site-related chemicals have migrated beyond the furthest downstream sediment sampling point at concentrations greater than ecological screening values and statistically elevated above background concentrations.

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 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, 1993b), which specify the use of average media concentrations. Given the mobility of the upper trophic level receptor species used in the SERA, 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; see 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 and surface water screening values. USEPA NAWQC were used as surface water screening values for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Although USEPA NAWQC for these nine metals are expressed in terms of the dissolved fraction in the water column, the surface water screening values used were expressed as total recoverable concentrations. Because the filtered fraction more closely approximates the bioavailable fraction of these nine metals in the water column (USEPA, 1999c 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

NAWQC 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.

- A fourth source of uncertainty related to media-specific screening values applies to sediment screening values. 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 TOC and AVS, which can influence the bioavailability of organic chemicals and metals, respectively. As exposure does not necessarily equate to risk, bulk sediment screening values may overstate risks to benthic macroinvertebrates. However, AVS/SEM data collected during the 2009 supplemental field investigation from a subset of drainage ditch sediment samples will be discussed in Step 3a of the BERA.

- A fifth source of uncertainty related to media-specific screening values applies to sediment. Measurement endpoints for aquatic plants, amphibians, and fish included a comparison of chemical concentrations in sediment with sediment screening values. However, as discussed in Section 7.4.1.4, 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, amphibians and fish.

<u>Toxicity Reference Values</u>

- 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.

- A second source of uncertainty related to the derivation of TRVS applies to metals. Most of the toxicological studies on which the ingestion-based screening values for metals were based used forms of the metal (such as salts [see Table 7-8]) 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 third 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 56 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 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.

Food Web Exposure Modeling

- Chemical concentrations in avian food items (plants, invertebrates, and small mammal omnivores) 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 food web 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 food web 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.

<u>Chemical Mixtures</u>

- 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 3b through 7 of the Navy ERA process; see 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

The results of the SERA for SWMU 56 indicated that, based on a set of conservative exposure assumptions, there are one or more chemicals in surface soil, subsurface soil, groundwater, drainage ditch surface water, and drainage ditch sediment that may present risks to one or more of the receptors species/receptor groups evaluated (see Table 7-21). 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

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 receptor groups and/or specific receptor species. As such, the ERA process at SWMU 56 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 (see 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 food web 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 and sediment 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 4.00.04 software [USEPA, 2009d and 2009e; see Appendix G]). 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 less 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. 95 percent UCL of the 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 56 subsurface soil and surface water data sets (n = 3 and n = 5, 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. Refined risk estimates using 95 percent UCL of the mean concentrations for chemicals identified as ecological COPCs in Step 2 of the SERA for SWMU 56 groundwater (i.e. copper and vanadium) also were not performed based on their frequency of detection (i.e., neither SWMU 56 data set had eight detected values).

- Central tendency estimates (e.g., mean, median, midpoint) for body weight, food ingestion rate, and water ingestion rate (see Table 7-2 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 they represent the characteristics of a greater proportion of the individuals in the population. The evaluation of food web exposures still assumed an AUF of 1.0.

- The diet of the American robin and Norway rat (food item for the red-tailed hawk) was adjusted to reflect their omnivorous feeding behavior. Wheelwright (1986), as cited in USEPA (1993b), 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 percent (highest seasonal contribution reported by Wheelwright (1986) and Martin et al. (1951). Using the relationship presented in Sample and Sutter 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 and drainage ditch sediment. 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 7-23.

- 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 7-24 (plant and earthworm BAFs) and 7-25 (small mammal omnivore BAFs).

As discussed in the second bullet item above, the diet of the American robin was adjusted in Step 3a of the BERA (83.0 percent earthworms, 7.3 percent plants, and 8.7 percent soil/sediment). For American robin dietary intakes to ecological COPCs in drainage ditch sediment, tissue concentrations in the above-ground vegetative portion of emergent wetland vegetation were estimated using the same methodologies described above for terrestrial plants, including the uptake equations and BAFs listed in Table 7-24, except that sediment (not soil) concentrations were used in the calculation.

- In addition to the NOAEL-based risk estimates used in the SERA for the mourning dove and red-tailed hawk, 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 (2009f and 2009g) 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 56 surface soil, subsurface soil, groundwater, and drainage ditch sediment, 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 56 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 56 subsurface soil and groundwater data sets (n = 3 and 7, respectively), the statistical evaluation for these two media were limited to a descriptive comparison.

  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). A background drainage ditch surface water data set has not been established at NAPR (Baker, 2010). Furthermore, no freshwater samples have been collected during previous investigations that can be used to establish background drainage ditch water quality at NAPR. Therefore, Step 3a of the BERA did not include a statistical evaluation of surface water data.

- As exposure does not necessarily equate to risk, consideration was given to site-specific factors that can affect the bioavailability of chemicals in surface water and sediment to aquatic receptor groups. For surface water collected during the 2008 CMS field investigation, consideration was given to the concentration of metals in the dissolved (unfiltered) fraction. For sediment collected during the 2009 supplemental field investigation, consideration was given to the concentration of AVS. AVS is a reactive pool of solid-phase sulfide that represents an important partitioning phase controlling the bioavailability and toxicity of cadmium, copper, lead, nickel, silver, and zinc to sediment-associated biota (Ankley et al, 1996 and Berry et al., 1999). Cadmium, copper, lead, nickel, silver, and zinc, collectively termed SEM, represent those metals that form a more stable complex with sulfide than does iron. The model states that if the SEM concentration is less than the concentration of AVS, toxicity will not be observed. That is, if the SEM-to-AVS ratio is less than 1.0 or the SEM-to-AVS difference is less than zero (i.e., negative value), sufficient AVS is available to bind all the SEM and sediment-associated biota will not be exposed to toxic concentrations of these metals in the sediment pore water.

In addition to AVS, consideration was given to the concentration of TOC in drainage ditch sediment. For nonionic organic chemicals, TOC represents the primary sediment characteristic affecting bioavailability (USEPA 1993a, Di Toro and McGrath, 2000, and Fuchsman, 2003).

- 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 food web 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

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 56 surface soil. Screening level risk estimates (i.e., HQ values) also were provided in Table 7-13. A discussion of this evaluation was presented in Section 7.6.2.1. Cobalt, copper, lead, selenium, and vanadium were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values. Acetone, carbon disulfide, chloromethane, and iodomethane were detected and also 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 56 surface soil is presented in Table 7-26. 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., cobalt, copper, lead, selenium, and vanadium). The refined risk evaluation for SWMU 56 surface soil is presented and discussed within the paragraphs that follow.

As discussed above, four detected VOCs (acetone, carbon disulfide, chloromethane, and iodomethane) were identified as ecological COPCs for SWMU 56 surface soil in Step 2 of the SERA based on the lack of invertebrate or plant-based soil screening values. Acetone was detected in seven of eight (7/8) surface soil samples at concentrations ranging from 23J µg/kg (56SB04-00) to 280 µg/kg (56SB08-00). 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 (2009f and 2009g) 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/kg for the earthworm. The estimated chronic value for this predicted LC_{50} value (1.72 mg/kg; estimated by applying a safety factor of 100 to the LC_{50} value [USEPA, 1997 and Wentsel et al, 1996]) is greater than the maximum detected concentration in SWMU 56 surface soil (280 µg/kg). Based on the low toxicity of this VOC to terrestrial plants in solution, as well as the predicted LC_{50} value for the earthworm using SARs analysis, acetone is not identified as an ecological COC for SWMU 56 surface soil, and no additional evaluation is recommended.

Carbon disulfide and chloromethane were each detected in one of eight (1/8) surface soil samples (carbon disulfide: 1.9J µg/kg in 56SB07-00; chloromethane: 2.2J µg/kg in 56SB03-00), while iodomethane was detected in four of eight (4/8) surface soil samples at concentrations ranging from 1J µg/kg (56SB01-00) to 2.4 J µg/kg (56SB07-00). Identical to acetone, studies investigating the effects of carbon disulfide, chloromethane, and iodomethane on terrestrial plants and invertebrates were not identified from the literature. The USEPA (2009f and 2009g) ECOSAR Class Program (Version 1.00a) indicates that these three VOCs are relatively non-toxic to earthworms. The ECOSAR program predicts a 14-day earthworm LC_{50} of 134 mg/kg for carbon disulfide, 109 mg/kg for chloromethane, and 272 mg/kg for iodomethane. The estimated chronic values based on these predicted LC_{50} values (1.34 mg/kg for carbon disulfide, 1.09 mg/kg for chloromethane, and 2.72 mg/kg for iodomethane; estimated by applying a safety factor of 100 to the LC_{50} values [USEPA, 1997 and Wentsel et al, 1996]) are approximately three orders of magnitude greater than the carbon disulfide, chloromethane, and iodomethane detections in SWMU 56 surface soil. A comparison of detected concentrations to soil screening values developed for other VOCs (see Table 7-4) provides an additional line of evidence supporting the elimination of these three VOCs from further consideration. As evidenced by the available screening values listed in Table 7-4, detected carbon disulfide, chloromethane, and iodomethane concentrations in SWMU 56 surface soil are less than the minimum soil screening value developed for other VOCs (11 μg/kg [vinyl chloride screening value]). Based on the low magnitude of detections, comparisons to screening values developed for other VOCs, and predicted 14-day LC_{50} values for the earthworm using SARs analysis, carbon disulfide, chloromethane, and iodomethane are not identified as ecological COCs for SWMU 56 surface soil, and no additional evaluation is recommended.

Cobalt, copper, lead, selenium, and vanadium were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values (see Table 7-13). 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 (see Table 7-26). 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 56 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 cobalt, copper, lead, selenium, and vanadium detections above soil screening values and/or background concentrations.

Cobalt was detected in four of eight (4/8) surface soil samples at concentrations greater than the soil screening value of 13 mg/kg (29J mg/kg in 56SB03-00, 27J mg/kg in 56SB05-00, 50J mg/kg in 56SB07-00, and 24J mg/kg in 56SB08-00; see Figure 7-9). The Step 2 screening level risk estimate (HQ = 3.85; see Table 7-13) indicates that this metal may be presenting unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (30.29 mg/kg), also indicates that cobalt may be presenting unacceptable risk to terrestrial invertebrate and plant populations (HQ = 2.33). However, the descriptive and distributional statistics presented in Table 7-27 for the SWMU 56 surface soil data set and background airfield soil data set indicate that cobalt concentrations in SWMU 56 surface soil are not elevated above background levels. The maximum detected cobalt concentration in SWMU 56 surface soil (50J mg/kg) is less than the maximum detected background concentration (64 mg/kg) and is only slightly elevated above the background ULM concentration (46.43 mg/kg). The distributional statistics performed on the SWMU 56 surface soil and background airfield soil data sets (i.e., two-sample t-test, quantile test, and slippage test) concluded that cobalt concentrations in SWMU 56 surface soil are not statistically elevated above background levels. Based on the descriptive and distributional statistics presented in Table 7-27, cobalt is not identified as an ecological COC for SWMU 56 surface soil, and no additional evaluation is recommended.

Copper was detected in three of eight (3/8) surface soil samples at concentrations greater than the soil screening value of 70 mg/kg (81J mg/kg in 56SB01-00, 130J mg/kg in 56SB07-00, and 100 mg/kg in 56SB08-00; see Figure 7-9). The Step 2 screening level risk estimate (HQ = 3.85; see Table 7-13) indicates that copper may be presenting unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (94.04 mg/kg), also indicates that copper may be presenting unacceptable risk to terrestrial invertebrate and plant populations. However, as evidenced by the refined HQ value (HQ = 1.34; see Table 7-26) the magnitude of the 95 percent UCL of the mean concentration above the soil screening value is low. The descriptive and distributional statistics presented in Table 7-27 also show that copper concentrations in SWMU 56 surface soil are not elevated above background levels. The maximum detected copper concentration in SWMU 56 surface soil (130J mg/kg) is less than the maximum detected background concentration (260J mg/kg) and background ULM concentration (223 mg/kg), while the distributional statistics performed on the SWMU 56 surface soil and background airfield soil data sets (i.e., two sample t-test, quantile test, and slippage test) concluded that copper concentrations in SWMU 56 surface soil are not statistically elevated above background levels. Based on the low magnitude of the refined risk estimate above the soil screening value and the descriptive and distributional statistics presented in Table 7-27, copper is not identified as an ecological COC for SWMU 56 surface soil, and no additional evaluations is recommended.

Selenium was detected in eighteen of twenty (18/20) surface soil samples at concentrations greater than the soil screening value of 0.52 mg/kg (see Figure 7-9). The Step 2 screening level risk estimate (HQ = 6.73; see Table 7-13) indicates that selenium may be presenting unacceptable risk to terrestrial invertebrates and plants. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (1.75 mg/kg), also indicates that selenium may be presenting unacceptable risk to terrestrial invertebrate and plant populations (HQ = 3.37; see Table 7-26). However, the descriptive statistics presented in Table 7-27 show that selenium concentrations in SWMU 56 surface soil are similar to background levels. The maximum detected selenium concentration (3.5J mg/kg) is less than the maximum background airfield soil concentration (3.8J mg/kg) and is only slightly elevated above the background airfield soil ULM concentration (1.85 mg/kg). The distributional statistics performed on the SWMU 56 surface soil and background airfield soil data sets were impaired by the low frequency of detection (11/41) within the background airfield soil data set. Specifically, an evaluation of the mean/median of the distributions could not be performed. However, statistical evaluations performed on the right tail of the distributions (i.e., slippage test; see Table 7-27) concluded that selenium in SWMU 56 surface soil is not statistically elevated above background levels. Based on the descriptive and distributional statistics presented in Table 7-27, selenium is not identified as an ecological COC for SWMU 56 surface soil, and no additional evaluation is recommended.

Vanadium was detected in each SWMU 56 surface soil sample at concentrations greater than the soil screening value of 20 mg/kg (see Figure 7-9). As evidenced by the Step 2 screening level risk estimate (HQ = 21.50; see Table 7-13), the magnitude of the maximum detected concentration above the soil screening value is high. The refined risk estimate, derived using the 95 percent UCL of the mean concentration (267 mg/kg), also indicates that vanadium may be presenting unacceptable risk to terrestrial invertebrate and plant populations (HQ = 13.37; see Table 7-26). However, the descriptive statistics presented in Table 7-27 show that vanadium concentrations in SWMU 56 surface soil are not elevated above background levels. The maximum detected concentration in SWMU 56 surface soil (430 mg/kg) is only slightly elevated above the maximum background concentration (410 mg/kg). The distributional statistics performed on the SWMU 56 surface soil and background airfield soil data sets (two sample t-test, quantile test, and slippage test) also concluded that vanadium concentrations in SWMU 56 surface soil are not statistically elevated above background levels. Based on the descriptive and distributional statistics presented in Table 7-27, vanadium is not identified as an ecological COC for SWMU 56 surface soil, and no additional evaluation is recommended.

Lead was detected in one of fourteen (1/14) SWMU 56 surface soil samples at a concentration greater than the soil screening value of 120 mg/kg (210 mg/kg in 56SB01-00; see Figure 7-9).

The screening level risk estimate (HQ = 1.75; see Table 7-13) indicates that lead may be presenting unacceptable risk to terrestrial invertebrates and plants. Identical to the Step 2 screening level risk estimate, the refined risk estimate (HQ = 1.48; see Table 7-26), derived using the 95 percent UCL of the mean concentrations (177 mg/kg), also indicates that lead may be presenting unacceptable risk to terrestrial invertebrate and plant populations. The descriptive statistics presented in Table 7-27 (i.e., arithmetic mean, 95 percent UCL of the mean, and maximum concentrations) show that lead concentrations in SWMU 56 surface soil are elevated above background levels. The magnitude of the detected concentration (210 mg/kg) above the maximum background concentration (21J mg/kg) indicates the presence of a “hot spot” at 56SB02. The distributional statistics performed on the SWMU 56 surface soil and background airfield soil data sets (Wilcoxon rank sum test, quantile test, and slippage test) were contradictory. The Wilcoxon rank sum test and quantile test concluded that lead concentrations in SWMU 56 surface soil are statistically elevated above background levels, while the slippage test concluded that lead concentrations in SWMU 56 surface soil are not statistically elevated above background levels. Based on the magnitude of the detected concentration above the maximum background concentration and the descriptive and distributional statistics presented in Table 7-27, lead is identified as an ecological COC for SWMU 56 surface soil, and additional evaluation in the form of corrective measures is recommended.

In summary lead is identified as an ecological COC for SWMU 56 surface soil. Although acetone, carbon disulfide, chloromethane, iodomethane, cobalt, copper, selenium, and vanadium were detected in SWMU 56 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. Acetone, carbon disulfide, chloromethane, and iodomethane are not recommended for additional evaluation based on their predicted toxicity to earthworms using SARs, while cobalt, copper, selenium, and vanadium are not recommended for additional evaluation based on statistical evaluations performed on the SWMU 56 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 56 subsurface soil. Screening level risk estimates also were provided in Table 7-14. Copper, selenium, and vanadium were detected in SWMU 56 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 iodomethane) also 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 56 surface 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 = 3 for soil collected from the 1.0 to 3.0 foot depth interval). As such, the refined risk evaluation for these chemicals (copper selenium and vanadium) was limited to a statistical comparison to available background data.

Acetone and iodomethane were detected in SWMU 56 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 each subsurface soil sample (8.3J µg/kg in 56SB01-01, 50J µg/kg in 56SB06-01, and 110 µg/kg in 56SB27-01), while iodomethane was detected in a single subsurface soil sample (2.6J µg/kg in 56SB08-01. 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 (MATC for each species was 100 mg/L). The USEPA (2009f and 2009g) ECOSAR Class Program (Version1.00a) also indicates that acetone is relatively non-toxic to earthworms. Based on SARs, the ECOSAR program predicts a 14-day LC_{50} of 172 mg/kg for earthworms. The estimated chronic value based on this predicted LC_{50} value (1.72 mg/kg; estimated by applying a safety factor of 100 to the LC_{50} value [USEPA, 1997 and Wentsel et al, 1996]) is over an order of magnitude greater than the maximum detected concentration in SWMU 56 subsurface soil (110 µg/kg). Based on the low toxicity of acetone to terrestrial plants in solution, as well as the predicted LC_{50} value for earthworms using SARs analysis, acetone is not identified as an ecological COC for SWMU 56 subsurface soil, and no additional evaluation is recommended.

Identical to acetone, studies investigating the effects of iodomethane in soil on terrestrial plants and invertebrates were not identified in the literature. The USEPA (2009f and 2009g) ECOSAR Class Program (Version 1.00a) indicates that iodomethane is relatively non-toxic to earthworms. The ECOSAR program predicts a 14-day LC_{50} of 272 mg/kg for earthworms. The estimated chronic value based on this predicted LC_{50} value (2.72 mg/kg; estimated by applying a safety factor of 100 to the LC_{50} value [USEPA, 1997 and Wentsel et al, 1996]) is approximately three orders of magnitude greater than the single detected concentration in SWMU 56 subsurface soil (2.6J µg/kg). Based on the low magnitude of the single detection and the predicted LC_{50} for earthworms using SARs analysis, iodomethane is not identified as an ecological COC for SWMU 56 subsurface soil, and no additional evaluation is recommended.

Copper, selenium, and vanadium were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed soil screening values. To determine if these three metals are site-related, the SWMU data were compared to background airfield soil data set presented within Addendum B of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010). Due to the low sample size for the SWMU (n = 3 for subsurface soil collected from the 1.0 to 3.0 foot depth interval), the statistical evaluation was limited to a comparison of the descriptive statistics presented in Table 7-28.

Copper, selenium, and vanadium were detected in each of the SWMU 56 subsurface soil samples. As evidenced by Table 7-28, maximum detected copper, selenium, and vanadium concentrations (75J mg/kg for copper, 2.9 mg/kg for selenium, and 120 mg/kg for vanadium) are less than maximum background airfield soil concentrations (260J mg/kg for copper, 3.8J mg/kg for selenium, and 410J mg/kg for vanadium). Maximum copper and vanadium concentrations in SWMU 56 subsurface soil also are less than background ULM concentrations (223 mg/kg for copper and 367 mg/kg for vanadium), while the maximum selenium concentration in SMWU 56 subsurface soil (2.9 mg/kg) is only slightly elevated above the background ULM concentration (1.85 mg/kg). These data indicate that copper, selenium, and vanadium concentrations in SWMU 56 subsurface soil are consistent with background concentrations. As such, these three metals are not likely to be present at concentrations that would present ecological risks above background levels. For this reason, copper, selenium, and vanadium are not identified as ecological COCs for SWMU 56 subsurface soil, and no additional evaluation is recommended.

In summary, although acetone, iodomethane, copper, selenium, and vanadium were detected in SWMU 56 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not considered ecological COCs based on the discussion presented in the preceding paragraphs, and no additional evaluation is recommended. Acetone and iodomethane are not recommended for additional evaluation based on their predicted toxicity to earthworms using SARs, while copper, selenium, and vanadium are not recommended for additional evaluation based on a descriptive comparison of the SWMU 56 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 56 groundwater. Screening level risk estimates also were provided in Table 7-15. Copper and vanadium were detected in SWMU 56 groundwater and identified as ecological COPCs in Step 2 of the SERA because maximum detected total recoverable concentrations exceed groundwater screening values. One non-detected VOC (acrolein) and two non-detected SVOCs, (hexachlorocyclopentadiene and pentachloronitrobenzene) also were identified as ecological COPCs because maximum MDLs exceed groundwater screening values. As evidenced by Table 7-15, all detected organic chemicals in SWMU 56 groundwater (acetone, chloromethane, 1,4-dichlorobenzene, 3,4-methylphenol, anthracene, bis[2-ethylhexyl)phthalate, diethyl phthalate, fluoranthene, and fluorene) have HQ values less than 1.0. As such, they were not identified as ecological COPCs in Step 2 of the SERA (a conclusion of acceptable risk can be reached with high confidence). The spatial extent of detected ecological COPC concentrations greater than groundwater screening values is depicted on Figure 7-11. The refined risk evaluation for SWMU 56 groundwater 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 an insufficient number of detections (a minimum of eight detected results are necessary for derivation of reliable 95% UCL of the mean concentrations). As such, the refined risk evaluation for these chemicals (copper and vanadium) was limited to a statistical comparison to available background data.

As discussed above, the non-detected VOC acrolein and the non-detected SVOCs hexachlorocyclopentadiene and pentachloronitrobenzene were identified as ecological COPCs in Step 2 of the SERA because maximum MDLs exceeded groundwater screening values. Hexachlorocyclopentadiene and pentachloronitrobenzene were not detected in surface or subsurface soil collected during the 2008 CMS field investigation (see Tables 7-13 and 7-14). The absence of detections in SWMU 56 surface and subsurface soil indicate that these two SVOCs are not site-related and are not likely to be present in SWMU 56 groundwater. High log K_{ow} values for hexachlorocyclopentadiene and pentachloronitrobenzene (5.39 and 4.64, respectively; see Table 7-3) also indicate that these two SVOCs have a high affinity for adsorption to soil particles. Therefore, even if hexachlorocyclopentadiene and pentachloronitrobenzene are present in SWMU 56 surface or subsurface soil, vertical migration with infiltrating precipitation to SWMU 56 groundwater and subsequent migration to downgradient surface water and sediment within the estuarine wetland system south of Forrestal Drive does not represent a likely transport pathway. In summary, based on the absence of detections in SWMU 56 surface and subsurface soil and their physical characteristics (i.e., log K_{ow} values), hexachlorocyclopentadiene and pentachloronitrobenzene are not identified as ecological COCs for SWMU 56 groundwater, and no additional evaluation is recommended.

The surface and subsurface soil analytical data for acrolein were rejected during data validation activities (see Section 4.10). Therefore, the absence of detections in SWMU 56 soil cannot be used as a 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 56 and is not identified as an ecological COC for groundwater.

Copper and vanadium were identified as ecological COPCs in Step 2 of the SERA because maximum detected total recoverable concentrations exceed groundwater screening values. To determine if these two metals are site-related, the SWMU data (total recoverable and dissolved data) were compared to the background total recoverable and dissolved groundwater data presented and contained within the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010). Due to the low frequency of detection of copper in the total and dissolved fractions of SWMU 56 groundwater (see Appendix D), the statistical evaluation of this metal was limited to a comparison of the descriptive statistics presented in Table 7-29. For consistency with copper, the statistical evaluation of vanadium also was limited to a comparison of descriptive statistics.

Total recoverable copper was detected in one of eight (1/8) groundwater samples (8.3 μg/L in 56GW08), while total recoverable vanadium was detected in seven of eight (7/8) groundwater samples at concentrations ranging from 7.9 μg/L (56GW06) to 20 μg/L (56GW04). Copper was not detected within the dissolved fraction of SWMU 56 groundwater; however, vanadium was detected in five of eight (5/8) dissolved groundwater samples at concentrations ranging from 8 μg/L (56GW01) to 14 μg/L (56GW03). The single detected total recoverable copper concentration (8.3 μg/L) and the maximum detected total recoverable vanadium concentration (20 μg/L) are less than maximum total recoverable background concentrations (352 μg/L for copper and 549 μg/L for vanadium) and ULM background concentrations (324 μg/L for copper and 485 μg/L for vanadium). The maximum dissolved copper MDL (2.5 μg/L) and the maximum detected dissolved vanadium concentration (14 μg/L) also are less than maximum detected dissolved background concentrations (496J μg/L for copper and 265 μg/L for vanadium) and dissolved background ULM concentrations (29 μg/L for copper and 20.96 μg/L for vanadium). These data indicate that copper and vanadium concentrations in SWMU 56 groundwater are consistent with background concentrations and are not likely to be migrating with SWMU 56 groundwater to the estuarine wetland system south of Forrestal Road at concentrations that would present ecological risks above background levels. Based on the descriptive statistics presented in Table 7-29, copper and vanadium are not identified as ecological COCs for SWMU 56 groundwater, and no additional evaluation is recommended.

In summary, although copper and vanadium were detected and identified as ecological COPCs in Step 2 of the SERA for SWMU 56 groundwater, they are not considered ecological COCs based on the discussion presented in the preceding paragraphs, and no additional evaluation is recommended. These two metals are not recommended for additional evaluation based on the descriptive statistics presented in Table 7-29. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA (including acrolein, hexachlorocyclopentadiene, and pentachloronitrobenzene).

7.9.1.4 Drainage Ditch Surface Water

Section 7.6.2.4 presented the results of the Step 2 screening level risk calculation for SWMU 56 drainage ditch surface water. Screening level risk estimates also were provided in Table 7-16. Cadmium, copper, lead, vanadium, and zinc were detected in drainage ditch surface water and identified as ecological COPCs in Step 2 of the SERA because maximum detected total recoverable concentrations exceed surface water screening values. Although not detected, benzo(a)pyrene also was identified as an ecological COPC because the maximum MDL for this PAH compound exceeds the surface water screening value. The spatial extent of detected ecological COPC concentrations greater than surface water screening values is depicted on Figure 7-12. The refined risk evaluation for SWMU 56 surface water is presented and discussed within the paragraphs that follow. As discussed in Section 7.9, refined risk calculations for detected ecological COPCs using 95 percent UCL of the mean concentrations could not be calculated based on the small size of the surface water data set (n = 5).

As discussed above, the non-detected PAH benzo(a)pyrene was identified as an ecological COPC in Step 2 of the SERA because the maximum MDL (0.024 μg/L) exceeds the surface water screening value (0.014 μg/L). The screening value used in the Step 2 screening level risk calculation represents a SCV, which was presented in Suter II, G.W. and Tsao (1996) and selected by the USEPA Region 5 as an ecological screening level. A more recent Tier II value, derived in accordance with Great Lakes Initiative (GLI) methodology is available from USEPA (2009b). This chronic Tier II value (0.06 μg/L), derived by the OEPA, is greater than the maximum MDL reported for benzo(a)pyrene (0.024 μg/L). Based on the OEPA chronic Tier II value, benzo(a)pyrene is not identified as an ecological COPC, and no additional evaluation is recommended.

Cadmium, copper, lead, vanadium, and zinc were detected in a single surface water sample (56SW01) at concentrations greater than their respective surface water screening value. Maximum HQ values, derived using total recoverable surface water concentrations and screening values expressed in terms of the total recoverable metal in the water column, ranged from 1.03 for zinc to 22.02 for lead (see Table 7-16). Literature sources indicate that the filtered fraction of metals more closely approximates the bioavailable fraction in the water column (USEPA, 1999c, 2002a, and 2006). One reason is that a primary mechanism for water column toxicity is adsorption at the gill surface, which requires metals to be in the dissolved form. Therefore, a comparison of maximum dissolved concentrations in drainage ditch surface water to screening values expressed in terms of the dissolved metal in the water column is more appropriate.

The surface water screening values used in the Step 2 screening level risk calculation for cadmium, copper, lead, and zinc were total recoverable PRWQS for Class SD surface waters. PRWQS expressed in terms of the dissolved metal in the water column are not available from the PRWQSR. However, the PRWQSR has adopted USEPA NAWQC as PRWQS for cadmium, copper, and lead (the PRWQSR regression equations listed in Section 7.4.1.3 for cadmium, copper, and zinc are identical to the regression equations listed in National Recommended Water Quality Criteria [USEPA, 2009a]). Therefore, cadmium, copper, and lead NAWQC (i.e., CCC values) expressed in terms of the dissolved metal in the water column were derived by multiplying the total recoverable CCC values by the freshwater conversion factors listed below (USEPA, 2009a):

- Cadmium: 1.101672-[(*ln* hardness)(0.041838)]
- Copper: 0.960
- Lead: 1.46203-[(*In* hardness)(0.145712]
- Zinc: 0.986

Based on a surface water hardness of 31.35 mg/L as $CaCO_3$ (see Section 7.4.1.3), the freshwater conversion factors for cadmium and lead are 0.958 and 0.960, respectively. Use of the freshwater conversion factors give dissolved CCC values of 0.11 μg/L for cadmium, 3.32 μg/L for copper, 0.70 μg/L for lead, and 44.2 for zinc. As evidenced by the table below, maximum dissolved copper, lead, and zinc concentrations are less than CCC values expressed in terms of the dissolved metal in the water column, indicating acceptable risk. Cadmium was not detected within the dissolved fraction of any drainage ditch surface water sample. The maximum dissolved MDL for this metal (0.12 µg/L) is only slightly elevated above the dissolved CCC value (0.11 µg/L).

Chemical	Maximum Dissolved Concentration (µg/L)	Dissolved Criteria Continuous Concentration (µg/L)	Hazard Quotient
Cadmium	0.12U	0.11	1.09
Copper	2.6J	3.32	0.78
Lead	0.47J	0.74	0.64
Zinc	8.8J	44.2	0.20

The screening value used for vanadium in Step 2 of the SERA was 12.0 µg/L (USEPA Region 5 ESL). A conversion factor is not available from the literature for converting this total recoverable screening value to a screening value expressed in terms of the dissolved metal in the water column. However, as dissolved vanadium was not detected in any of the surface water samples collected from the drainage ditch (see Appendix D), there is no indication that this metal is present in drainage ditch surface water in its bioavailable form.

The single surface water sample with total cadmium, copper, lead, vanadium, and zinc concentrations greater than total recoverable screening values was collected within the portion of the drainage ditch lined with concrete. Because surface water samples collected downgradient from this sample location (56SW02 through 56SW05) did not contain total cadmium copper, lead, vanadium, or zinc concentrations greater than screening values expressed in terms of total recoverable concentrations in the water column or, in the case of cadmium, copper, lead, and zinc dissolved concentrations greater than screening values expressed in terms of dissolved concentrations, it can be concluded that these five metals are not migrating with drainage ditch surface water to the estuarine wetland system south of Forrestal Drive at ecologically important concentrations. For this reason, cadmium, copper, lead, vanadium, and zinc are not identified as ecological COCs for drainage ditch surface water, and no additional evaluation is recommended. The available analytical data for surface water samples collected during the Phase II ECP field investigation support this recommendation Although the Phase II ECP surface water samples were limited to three samples collected from the concrete-lined portion of the drainage ditch, ecological COPCs were either not detected or detected at concentrations less than screening values (see Table 6-8).

In summary, although cadmium, copper, lead, vanadium, and zinc were detected and identified as ecological COPCs for drainage ditch surface water in Step 2 of the SERA, no additional evaluation is recommended based on the discussion presented in the preceding paragraphs. In the case of cadmium, copper, lead, and zinc these metals are not recommended for additional evaluation based on the comparison of maximum dissolved concentrations to USEPA NAWQC (CCC values) expressed in terms of the dissolved metal in the water column. No additional evaluation of vanadium is recommended based on the lack of detections within the dissolved fraction of SWMU 56 surface water. Finally, no additional evaluation is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA (including benzo[a]pyrene).

7.9.1.5 Drainage Ditch Sediment

Section 7.6.2.5 presented the results of the Step 2 screening level risk calculation for SWMU 56 sediment. Screening level risk estimates also were provided in Table 7-17. Acetone, carbon disulfide, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, pyrene, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, tin, vanadium, and zinc were detected and identified as ecological COPCs for drainage ditch sediment because maximum detected concentrations exceed sediment screening values. Iodomethane and beryllium also were detected and identified as ecological COPCs based on the lack of sediment screening values. Although not detected, two VOCs (acrylonitrile, and xylenes [total]) and twenty-nine SVOCs were identified as ecological COPCs because maximum MDLs exceed sediment screening values. The spatial extent of detected ecological COPC concentrations greater than sediment screening values is depicted on Figure 7-13. The refined screening level risk calculation for SWMU 56 sediment is presented in Table 7-30. 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., arsenic, barium, chromium, cobalt, copper, lead, mercury, selenium, tin, 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. The refined risk evaluation for SWMU 56 sediment is presented and discussed within the paragraphs that follow.

As discussed above, two non-detected VOCs (acrylonitrile and xylenes) and twenty-nine non-detected SVOCs were identified as ecological COPCs because maximum MDLs exceed sediment screening values. None of these non-detected chemicals were detected in SWMU 56 surface soil, subsurface soil (all depth intervals), groundwater, or drainage ditch surface water collected during the 2008 CMS investigation (see Appendix D). The absence of detected concentrations in surface soil, subsurface soil, groundwater, and drainage ditch sediment indicates that these non-detected chemicals are not site-related and are not likely to be present in drainage ditch sediment. For this reason, none of the non-detected chemicals with maximum MDLs greater than sediment screening values are identified as ecological COCs for drainage ditch sediment.

Acetone was detected in each sediment sample at a concentration greater than the screening value of 9.88 µg/kg (200J µg/kg in 56SD03, 250J µg/kg in 56SD04, and 1,200J µg/kg in 56SD05). The sediment screening value used for acetone in the Step 2 screening level risk calculation was an EqP-based value derived in accordance with the procedures presented in Appendix E. As discussed in Appendix E, the EqP approach derives a sediment benchmark by setting the dissolved chemical concentration in pore water equal to the surface water benchmark and calculates a corresponding particle-sorbed chemical concentration. This approach is appropriate for highly sorptive chemicals (e.g., PAHs), but it produces overly conservative sediment quality benchmarks for VOCs (Fuchsman, 2003). To further evaluate the significance of acetone detections in drainage ditch sediment, alternative screening values were identified from the literature. Di Toro and McGrath (2000) developed a narcosis target lipid model that provides a method to evaluate the impact TOC has on the bioavailability of organic chemicals. Based on this model and an assumed TOC of one percent, Di Toro and McGrath (2000) report an SQG of 2,265 µg/kg. The maximum detected acetone concentration in drainage ditch sediment (1,200 µg/L) is less than the Di Toro and McGrath (2000) SQG. Furthermore, given that the minimum TOC concentration measured in drainage ditch sediment was 36,000 mg/kg (i.e., 3.6 percent), the Di Toro and McGrath (2000) target lipid model would predict even lower potential for bioavailability when site-specific TOC is considered (i.e., SQG of 8,154 µg/kg for acetone based on 3.6 percent TOC). Based on the comparison of maximum concentrations to the SQG value developed by Di Toro and McGrath (2000), acetone is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Iodomethane was detected in a single sediment sample (36J µg/kg in 56SD05) and identified as an ecological COPC based on the lack of a sediment screening value. An EqP-based sediment screening value could not be calculated for this VOC using the methodology presented in Appendix E based on the lack of a surface water screening value. A literature-based EqP value also is lacking from the literature. However, chronic-based, surface water toxicity values predicted by the USEPA (2009f and 2009g) ECOSAR Class Program (Version 1.00a) can be used to derive an EqP-based sediment screening value in accordance with USEPA methodology (USEPA, 1993a and 1996). The ECOSAR program predicts a chronic value of 25.4 mg/L for freshwater fish, 18.9 mg/L for freshwater green algae, and 14.5 mg/L for daphnids. Use of the minimum chronic value (14.5 mg/L) yields an EqP-based sediment screening value of 14,500 µg/kg. This value is approximately three orders of magnitude greater than single detected concentration of 36J µg/kg in SWMU 56 sediment. Based on the comparison of the single detected concentration to the EqP-based sediment screening value, iodomethane is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

Carbon disulfide was detected in two of three (2/3) sediment samples (19J µg/kg in 56SD04 and 800J µg/kg in 56SD05). This VOC was detected in a single SWMU 56 surface soil sample and a single subsurface soil sample collected during the 2008 CMS field investigation (1.9J µg/kg in 56SB07 and 56SB07-02). However, carbon disulfide was not detected in SWMU 56 groundwater (See Appendix B), nor was it detected in the single sediment sample collected from the concrete-lined portion of the drainage ditch system (i.e., Segment A-B) during the 2004 Phase Ii ECP field investigation (NAVFAC Atlantic, 2005). Based on the low frequency and magnitude of detection in SWMU 56 surface and subsurface soil, as well as the lack of detections in SWMU 56 groundwater and the Phase II ECP sediment sample, it can be concluded that the elevated detection at 56SD06 is not site-related. Therefore, carbon disulfide is not identified as an ecological COC, and no additional evaluation is recommended.

Benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and pyrene were detected in a single sediment sample (56SD03) at concentrations greater than their respective screening values. As evidenced by Table 7-7, screening values used in the Step 2 screening level risk calculation for these six PAHs were literature-based, bulk sediment screening values (i.e., TEC or LEL values). Bulk sediment screening values do not take into consideration site-specific factors that can influence bioavailability. For nonionic organic chemicals such as benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and pyrene, the primary factor affecting bioavailability is TOC (USEPA 1993a, Di Toro and McGrath, 2000, and Fuchsman, 2003). As previously discussed, Di Toro and McGrath (2000) developed a narcosis target lipid model that provides a method to evaluate the impact TOC has on the bioavailability of organic chemicals. Based on this model and an assumed organic carbon content of one percent, Di Toro and McGrath (2000) report SQGs of 14,222 µg/kg for benzo(a)anthracene, 16,324 µg/kg for benzo(a)pyrene, 16,603 µg/kg for benzo(k)fluoranthene, 14,268 µg/kg for chrysene, 18,983 µg/kg for dibenz(a,h)anthracene, and 11,792 µg/kg for pyrene. As maximum detected benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and pyrene concentrations in drainage ditch sediment (270J µg/kg, 300J µg/kg 630J µg/kg, 410J µg/kg, 52J µg/kg, and 570J µg/kg, respectively) are over an order of magnitude less than the Di Toro and McGrath (2000) SQGs, it is unlikely that individual PAH detections above bulk sediment screening values are ecologically relevant. Given that the minimum TOC concentration measured in drainage ditch sediment was 36,000 mg/kg (i.e., 3.6 percent), the narcosis target lipid model would predict even lower potential for bioavailability when site-specific TOC is considered. As shown in the following table, maximum detected concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and pyrene are less than SQGs based on the target lipid model and the minimum site-specific TOC value.

Chemical	Maximum Concentration (µg/kg)	Sediment Quality Guideline (µg/kg)	Hazard Quotient
Benzo(a)anthracene	270J	51,201	<0.01
Benzo(a)pyrene	300J	58,768	<0.01
Benzo(k)fluoranthene	630J	59,770	0.01
Chrysene	410J	51,365	<0.01
Dibenz(a,h)anthracene	52J	68,340	<0.01
Pyrene	570J	42,450	0.01

Because PAH toxicities in sediments are additive or nearly additive (USEPA 2003c), a comparison of the maximum total PAH concentration in drainage ditch sediment to a total PAH SQG would be more appropriate. In addition to individual PAH SQGs, Di Toro and McGrath (2000) used the narcosis target lipid model to developed a total PAH SQG based on one percent organic carbon (5.70 micromoles per gram organic carbon [µmol/g OC] or 9,861 µg/kg). The maximum total PAH concentration measured in drainage ditch sediment (2,880 µg/kg in 56SD03; maximum MDL used for non-detected PAHs) is less than the total PAH SQG. Based on the comparison of maximum detected concentrations to individual and total PAH SQGs developed by Di Toro and McGrath (2000), benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and pyrene are not identified as ecological COCs for drainage ditch sediment and no additional evaluation is recommended.
Identical to the PAHs discussed in the preceding paragraphs, bis(2-ethylhexyl)phthalate was detected in a single sediment sample (180J µg/kg in 56SD03). Bis(2-ethylhexyl)phthalate was not detected in SWMU 56 surface soil or subsurface soil collected during the 2008 CMS field investigation, indicating that this SVOC is not likely to be site-related. The screening value used in the Step 2 screening level risk calculation for bis(2-ethylhexyl)phthalate was a bulk sediment value (i.e., TEC). As discussed in the preceding paragraph, bulk sediment screening values do not take into consideration site-specific factors (i.e., TOC) that can influence the bioavailability of SVOCs. Although a SQG is not available from Di Toro and McGrath (2000), an EqP-based screening value can be derived using the procedures presented in Appendix E. The EqP-based value (45,010 µg/kg) is over two orders of magnitude greater than the single detected concentration in drainage ditch sediment. Based on the absence of detections in SWMU 56 surface and subsurface soil and the comparison of the single detected concentration to an EqP-based screening value, bis(2-ethylhexyl)phthalate is not identified as an ecological COPC for drainage ditch sediment, and no additional evaluation is recommended.

Beryllium was detected in four of 14 sediment samples at concentrations ranging from 0.21J mg/kg (56SD03) to 0.3J mg/kg (56SD14). 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 7-31, the statistical evaluation of the SWMU 56 and background data sets was impaired by the low frequency of detection in each data set (i.e., statistical evaluations on the mean/median of the distributions could not be performed). However, the descriptive statistics presented in Table 7-31 indicate that beryllium concentrations in SWMU 56 sediment are not elevated above background levels. The maximum detected concentration in SWMU 56 sediment (0.3J mg/kg) is less than the ULM background concentration (0.36 mg/kg) and is only slightly elevated above the maximum background concentration (0.28 mg/kg). These data indicate that beryllium concentrations in SWMU 56 drainage ditch sediment are consistent with background levels. Beryllium was not detected in SWMU 56 groundwater (total or dissolved fractions; see Appendix D), nor was this metal detected in SWMU 56 surface and subsurface soil at concentrations elevated above background airfield soil levels (see Tables 7-27 and 7-28), indicating that a beryllium release at SWMU 56 has not occurred. Although detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation, the detected concentration (0.36B mg/kg in 2E-SD01; see NAVFAC Atlantic, 2005) does not exceed the maximum background concentration. Based on the descriptive statistics presented in Table 7-31 and the lack of any indication that a release has occurred at the SWMU, beryllium is not identified as an ecological COC for SWMU 56 sediment and no additional evaluation is recommended.

Arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, tin, vanadium, and zinc were identified as ecological COPCs in Step 2 of the SERA because maximum detected concentrations exceed sediment screening values. To further evaluate the significance of potential risks presented by these metals, risk estimates were re-calculated using 95 percent UCL of the mean concentrations (see Table 7-30). It is acknowledged that aquatic plants are immobile and many aquatic 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. 95 percent UCL of the mean concentrations were not derived for cadmium and silver based on the low number of detected results in each data set (6/14 for each metal). In addition to the re-calculation of risk estimates using 95 percent UCL of the mean concentrations, the SWMU 56 sediment data for these twelve metals 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 7-31. The risk evaluation also took into consideration the magnitude and spatial distribution of arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, tin, vanadium, and zinc detections above sediment screening values and/or background concentrations. Finally, in the case of cadmium, copper, lead, nickel, silver, and zinc, consideration was given to SEM-to-AVS ratios for sediment collected during the 2009 supplemental field investigation. A summary of the AVS and SEM analytical data (total SEM concentrations), as well as SEM-to-AVS ratios for sediment collected during the 2009 supplemental field investigation is presented in Table 7-32. All data are presented as molar concentrations (µmole/gram). For a given sample, the total SEM molar concentration was derived by summing individual SEM metal concentrations using the following formula:

$$[SEM]_{Total} = [SEM]_{Cd} + [SEM]_{Cu} + [SEM]_{Pb} + [SEM]_{Ni} + [SEM]_{Zn} + (0.5)[SEM]_{Ag}$$

One-half the molar concentration of silver was added into the SEM totals because this metal is largely in a monovalent state. If an individual SEM metal was not detected in a given sediment sample, the total SEM molar concentration for that sample was derived using the non-detected result. If the AVS concentration for a given sediment sample was a non-detected result, the SEM-to-AVS ratio for that sample was derived using the non-detected AVS result.

Arsenic was detected in a single drainage ditch sediment sample at a concentration greater than the sediment screening value of 9.8 mg/kg (10.4J mg/kg in 56SD22; see Figure 7-13). The screening level risk estimate (HQ = 1.06; see Table 7-17), derived using the detected concentration in 56SD22, indicates that this metal may be presenting unacceptable risk to aquatic receptor groups (i.e., plants, invertebrates, fish, and amphibians) within the drainage ditch system downgradient from SWMU 56. However, the refined risk estimate (HQ = 0.44; see Table 7-30), derived using the 95 percent UCL of the mean concentration (4.34 mg/kg) indicates that arsenic is not presenting unacceptable risk to aquatic receptor group populations. The distributional statistics performed on the SWMU 56 and background data sets (Gehan test, quantile test, and slippage test; see Table 7-31) concluded that arsenic concentrations in SWMU 56 sediment are elevated above background levels.

An examination of the spatial distribution of arsenic detections within the drainage ditch system does not indicate that the detection at 56SD22 is site related. As evidenced by Figure 4-2, 56SD22 represents the furthest downgradient sample location within the drainage ditch system. Arsenic concentrations detected in sediment collected at sampling locations upgradient from 56SD22 during the 2008 CMS, 2008 pre-excavation, and 2009 supplemental field sampling investigations are less than the arsenic screening value. Furthermore, arsenic was not detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (3.4U in 2E-SD01; NAVFAC Atlantic, 2005). Although the distributional statistics summarized in Table 7-31 concluded that arsenic concentrations in drainage ditch sediment are elevated above background evaluations, arsenic is not identified as an ecological COC based on the low magnitude of the maximum detection above the sediment screening value (Step 2 risk estimate of 1.06), the Step 3a risk estimate (HQ = 0.44), which indicates that arsenic is not presenting unacceptable risk to aquatic receptor group populations, and the lack of any indication that the detection at 56SD22 is site-related.

Barium was detected in each sediment sample at a concentration greater than the sediment screening value of 20 mg/kg, with detected concentrations ranging from 42 mg/kg in 56SD19 to 571J mg/kg in 56SD22 (see Figure 7-13). The screening level risk estimate (HQ = 28.55; see Table 7-17) indicates that this metal may be presenting unacceptable risk to aquatic receptor groups within the drainage ditch system downgradient from SWMU 56. The refined risk estimate (HQ = 14.00; see Table 7-30), derived using the 95 percent UCL of the mean concentration (280 mg/kg), also indicates that barium is presenting unacceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-31 show that barium concentrations in SWMU 56 sediment are elevated above background levels. The maximum detection in SWMU 56 sediment (571J mg/kg) is elevated above maximum and ULM background concentrations (227J mg/kg and 214 mg/kg, respectively). The 95 percent UCL of the mean concentration for the SWMU 56 data set (280 mg/kg) also is elevated above the background 95 percent UCL of the mean concentration (132 mg/kg). Although the descriptive statistics indicate elevated barium concentrations in SWMU 56 sediment, distributional statistics performed on the SWMU 56 and background data sets (i.e., Wilcoxon rank sum test, quantile test, and slippage test; see Table 7-31) concluded that barium concentrations in SWMU 56 sediment are not elevated above background levels. However, it is important to note that non-parametric tests, such as the Wilcoxon rank sum test, evaluate data ranks and cannot detect the magnitude of detections, such as the “hot spot” at 56SD22.

An examination of the spatial distribution of barium concentrations within the drainage ditch system downgradient from SWMU 56 indicates that the detection at 56SD22 is not site-related. As discussed in the Step 3a risk evaluation for arsenic, 56SD22 represents the furthest downgradient sediment sampling location within the drainage ditch system. Barium concentrations detected in sediment collected at sampling locations upgradient from 56SD22 during the 2008 CMS, 2008 pre-excavation, and 2009 supplemental field sampling locations ranged from 42 mg/kg to 160J mg/kg (see Figure 7-13). These concentrations are less than maximum and ULM background concentrations. Analytical data for surface soil, subsurface soil (1.0 to 3.0 feet bgs), and groundwater collected during the 2008 CMS field investigation also suggest that the barium concentration detected in sediment collected at 56SD22 is not site related. As evidenced by Tables 6-1, 6-2, and 6-3, barium was not detected in these media at concentrations greater than ULM background concentrations. However, barium was detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system

(Segment A-B) during the 2004 Phase II ECP field investigation at a concentration elevated above the screening value, as well as maximum and ULM background concentrations (400 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005). Based on this detection, barium is identified as an ecological COC for sediment within the concrete-lined portion of the drainage ditch system (i.e., Segment A-B), and additional evaluation in the form of corrective measures is recommended. No additional evaluation is recommended for barium in drainage ditch sediment collected from Segments C-D, E-F, and G-H (including the location of the maximum detection), nor is additional evaluation recommended for sediment within Drainage Ditch Segment I-J and the estuarine wetland system south of Forrestal Drive based on the discussion presented above.

Cadmium was detected in two drainage ditch sediment samples at concentrations greater than the sediment screening value of 1.0 mg/kg (2.6J mg/kg in 56SD03 and 3.9J mg/kg in 56SD04; see Figure 7-13). The Step 2 screening level risk estimate (HQ = 3.94; see Table 7-17) indicates that this metal may be presenting unacceptable risk to aquatic receptor groups within the drainage ditch system downgradient from SWMU 56. A 95 percent UCL of the mean concentration for cadmium was not calculated due to the low number of detected results within the SWMU data set (6/14). Therefore, a refined risk estimated was not derived in Step 3a of the BERA. Statistical tests evaluating the mean/median and right-tail of the distributions also could not be performed due to the low frequency of detection within the background data set (6/14). The descriptive statistics presented in Table 7-31 indicate that cadmium concentrations in SWMU 56 sediment are elevated above background levels. The maximum detected concentration in SWMU 56 sediment (3.9 mg/kg in 56SD03) is over an order of magnitude greater than the maximum and ULM background concentrations (0.32 mg/kg and 0.23 mg/kg, respectively). The cadmium detection at 56SD03 (2.6 mg/kg) also is elevated relative to background levels. AVS and SEM analytical data are not available for sediment collected at 56SD03 and 56SD04; therefore, an evaluation of the bioavailability of this metal at these two locations cannot be performed. However, given that AVS was not detected in four of nine (4/9) sediment samples collected from Drainage Ditch Segment E-F during the 2009 supplemental field investigation (see Table 7-32), benthic invertebrates may be exposed to toxic concentrations of cadmium in sediment pore water at 56SD03 and 56SD04.

Cadmium analytical data for upgradient surface soil collected during the 2008 CMS field investigation and the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation indicate that cadmium concentrations in drainage ditch sediment at 56SD03 and 56SD04 may be site-related. The detected cadmium concentration in CMS surface soil sample 56SB01-00 (3.3J mg/kg) is elevated above maximum and ULM background airfield soil concentrations (0.92J mg/kg and 0.65 mg/kg, respectively), while the detected cadmium concentration in Phase II ECP sediment sample 2E-SD01 (15 mg/kg) exceeds the sediment screening value and background concentrations (maximum and ULM concentrations). Based on the indication that detections in drainage ditch sediment collected at 56SD03 and 56SD04 are site-related, cadmium is identified as an ecological COC, and additional evaluation in the form of corrective measures is recommended for Drainage Ditch Segments A-B and C-D. It is noted that the spatial distribution of cadmium concentrations in drainage ditch sediment does not indicate that this metal has migrated beyond 56SD04 at ecologically important concentrations. Cadmium was not detected in sediment collected from Drainage Ditch Segments E-F at concentrations greater than the sediment screening value, nor was this metal detected in sediment collected from two locations within Drainage Ditch Segment G-H (0.11UJ in 56SD21 and 56SD22).

Chromium was detected in two drainage ditch sediment samples at concentrations greater than the sediment screening value of 43.4 mg/kg (46J mg/kg in 56SD04 and 51J mg/kg in 56SD14; Figure 7-13). The Step 2 screening level risk estimate (HQ = 1.18; see Table 7-17) indicates that this metal may be presenting unacceptable risk to aquatic receptor groups within the drainage ditch system downgradient from SWMU 56. However, the refined risk estimate (HQ = 0.84; see Table 7-30), derived using the 95 percent UCL of the mean concentration (36.6 mg/kg), indicates that chromium is not presenting unacceptable risk to aquatic receptor group populations. The descriptive and distributional statistics presented in Table 7-31 also show that chromium concentrations in SWMU 56 sediment are not elevated above background levels. The maximum, arithmetic mean, and 95 percent UCL of the mean chromium concentrations in SWMU 56 sediment (51J mg/kg, 32.6 mg/kg, and 36.6 mg/kg) are less than maximum, mean, and 95 percent UCL of the mean chromium concentrations in background sediment (68.8J mg/kg, 36.4 mg/kg, 42.3 mg/kg, respectively). The distributional statistics performed on the SWMU 56 and background data sets (two sample t-test, quantile test, and slippage test) also concluded that chromium concentrations in SWMU 56 sediment are not elevated above background levels. However, chromium was detected at an elevated concentration relative to the screening value and background concentrations in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (140 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005). For this reason, chromium is identified as an ecological COC for sediment within Drainage Ditch Segment A-B, and additional evaluation in the form of corrective measures is recommended. No additional evaluation is recommended within Drainage Ditch Segments C-D, E-F, G-H, and the estuarine wetland system south of Forrestal Drive based on the discussion presented above.

Cobalt was detected in four sediment samples at concentrations greater than the sediment screening value of 50.0 mg/kg (59J mg/kg in 56SD14, 58.8J mg/kg in 56SD18, 50.8J mg/kg in 56SD20, and 91.4J mg/kg in 56SD22; see Figure 7-13). The Step 2 screening level risk estimate (HQ = 1.83; see Table 7-17) indicates this metal may be presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. The refined risk estimate (HQ = 1.01; see Table 7-31), derived using the 95% UCL of the mean concentration (50.3 mg/kg) also indicates that cobalt may be presenting unacceptable risk to aquatic receptor group populations. The descriptive and distributional statistics presented in Table 7-31 show that cobalt concentrations in SWMU 56 sediment are elevated above background concentrations. The maximum cobalt concentration (91.4J mg/kg) exceeds the maximum background concentration (65.8 mg/kg) and background ULM concentration (46.54 mg/kg). Distributional statistics performed on the SWMU 56 and background data sets (i.e., two sample t-test, quantile test, and slippage test) had conflicting results. The two sample t-test and quantile test concluded that cobalt concentrations in SWMU 56 sediment are elevated above background levels, while the slippage test concluded that SWMU 56 cobalt concentrations were not elevated.

The spatial distribution of cobalt concentrations in drainage ditch sediment does not indicate that the elevated detections at 56SD14, 56SD18, 56SD20, and 56SD22 are site-related. This metal was not detected in drainage ditch sediment collected upgradient from these four sample locations (i.e., 56SD03, 56SD04, 56SD12, 56SD13, 56SD15, 56SD16, and 56SD17) at concentrations greater than the maximum background concentration. The descriptive and distributional statistics presented in Table 7-27 also show that SWMU 56 surface soil concentrations are not elevated above background airfield soil levels. In addition, cobalt was not detected in any subsurface soil or groundwater sample at a concentration greater than maximum background concentrations. Finally, the detected cobalt concentration in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (27 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005) is less than the maximum background concentration (65.8 mg/kg). Based on the lack of any indication that elevated cobalt concentrations at 56SD14, 56SD18, 56SD20, and 56SD22 are site-related, cobalt is not identified as an ecological COC, and additional evaluation is not recommended.

Copper was detected in each sediment sample at a concentration greater than the screening value of 32 mg/kg. Detected concentrations ranged from 75.1J mg/kg in 56SD20 to 130J mg/kg in 56SD03 and 56SD04 (see Figure 7-13). The Step 2 screening level risk estimate (HQ = 4.11; see Table 7-17) indicates that this metal may be presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. The refined risk estimate (HQ = 3.42; see Table 7-31), derived using the 95% UCL of the mean concentration (108 mg/kg), also indicates that copper may be presenting unacceptable risk to aquatic receptor group populations. As evidenced by the descriptive statistics presented in Table 7-31, the maximum detected copper concentration in drainage ditch sediment 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 56 data set (100 mg/kg and 108 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 56 and background data sets (i.e., Satterthwaite t-test, quantile test, and slippage test) had conflicting results. The Satterthwaite t-test and the quantile test concluded that copper concentrations in SWMU 56 sediment are elevated above background levels, while the slippage test concluded that SWMU 56 copper concentrations are not elevated. Copper was not detected in SWMU 56 surface and subsurface soil at concentrations greater than background airfield soil ULM concentrations (see Tables 6-1 and 6-2, respectively). Although this metal was detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation at a concentration greater than the sediment screening value (130 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005), the detected concentration is less than maximum and ULM background airfield drainage ditch sediment concentrations. These data indicate that copper detections in drainage ditch sediment downgradient from SWMU 56 greater than the sediment screening value are not site-related. Based on the descriptive statistics presented in Table 7-31 and the lack of any indication that copper concentrations in drainage ditch sediment downgradient from SWMU 56 are site-related, copper is not identified as an ecological COC, and no additional evaluation within the drainage ditch system downgradient from SWMU 56 is recommended.

Lead was detected in seven of fourteen (7/14) sediment samples at concentrations greater than the sediment screening value of 35.8 mg/kg (280J mg/kg in 56SD03, 160J mg/kg in 56SD04, 48J mg/kg in 56SD13, 54 mg/kg in 56SD14, 39.4J mg/kg in 56SD16, 45.7J mg/kg in 56SD17, and 73.1 mg/kg in 56SD19; see Figure 7-13). The screening level risk estimate (HQ = 7.82; see Table 7-17) indicates that this metal may be presenting unacceptable risk to aquatic receptor groups within the drainage ditch system downgradient from SWMU 56. The refined risk estimate (HQ = 2.74; see Table 7-30), derived using the 95 percent UCL of the mean concentration (98.1 mg/kg), also indicates that lead is presenting unacceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-31 show 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 56 data set (280J mg/kg, 60.9 mg/kg, and 98.1 mg/kg, respectively) are elevated above background levels. The distributional statistics performed on the SWMU 56 and background data sets (Satterthwaite t-test, quantile test, and slippage test) concluded that lead concentrations in SWMU 56 sediment are elevated above background levels. The AVS and SEM analytical data for SWMU 56 sediment are summarized in Table 7-32. AVS/SEM data are available for three of the seven samples that have lead concentrations exceeding the sediment screening value (56SD16, 56SD17, and 56SD19). As evidenced by the table, AVS was not detected in these three samples, resulting in SEM-to-AVS ratios greater than 1.0 (5.74 for 56SD16, 4.40 for 56SD17, and 8.75 for 56SD19). SEM data for individual metals indicate that benthic invertebrates may be exposed to toxic concentrations of lead in sediment pore water at 56SD19 (molar concentration of lead [0.31J µmole/g] exceeds the non-detected AVS result [0.17U µmole/g]).

Analytical data for upgradient surface soil collected during the 2008 CMS field investigation and the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation indicate that elevated lead concentrations in drainage ditch sediment downgradient from SWMU 56 are site-related. The detected lead concentration in CMS surface soil sample 56SB01-00 (210 mg/kg) is elevated above the soil screening value, as well as maximum and ULM background airfield soil concentrations (021J mg/kg and 16.9 mg/kg, respectively; see Section 7.9.1.1), while the detected cadmium concentration in Phase II ECP sediment sample 2E-SD01 (1,500 mg/kg) exceeds the sediment screening value and background concentrations (maximum and ULM concentrations). Based on the refined risk estimate (HQ = 2.74), the descriptive and distributional statistics presented in Table 7-31, the AVS and SEM data presented in Table 7-32, and the indication that detections in drainage ditch sediment are site-related, lead is identified an ecological COC, and additional evaluation in the form of corrective measures is recommended for Drainage Ditch Segments A-B, C-D, and E-F. The spatial distribution of lead concentrations in sediment indicates that this metal has not migrated to Drainage Ditch Segment G-H at ecologically important concentrations (lead concentrations detected in 56SD21 and 56SD22 [19.7J and 22J mg/kg, respectively, are less than sediment screening values). Therefore, additional evaluation of lead in sediment beyond Segment E-F, including sediment within the estuarine wetland system south of Forrestal Drive, is not warranted.

Mercury was detected in one sediment sample at a concentration greater than the sediment screening value of 0.18 mg/kg (0.38J mg/kg in 56SD16; see Figure 7-13). The screening level risk estimate (HQ = 2.11; see Table 7-17), derived using the detected concentration in 56SD16, indicates that this metal is presenting unacceptable risk to aquatic receptor groups within the drainage ditch system downgradient from SWMU 56. The refined risk estimate (HQ = 1.14; see Table 7-30), derived using the 95% UCL of the mean concentration (0.21 mg/kg), also indicates that mercury may be presenting unacceptable risk to aquatic receptor group populations. The descriptive statistics presented in Table 7-31 (maximum, arithmetic mean, and 95 percent UCL of the mean values) show that mercury concentrations in SWMU 56 sediment are slightly elevated above background concentrations. However, the distributional statistics performed on the SWMU 56 and background data sets (two sample t-test and slippage test) concluded that mercury concentrations in drainage ditch sediment are not elevated above background concentrations. Analytical data for SWMU 56 surface soil, subsurface soil, and groundwater indicate that the elevated mercury concentration at 56SD16 is not site-related. Mercury detections in SWMU 56 surface soil do not exceed the maximum background concentration for airfield soil, nor is this metal present in SWMU 56 surface soil at concentrations statistically elevated above background (see Table 7-27). The subsurface soil and groundwater data presented in Tables 6-2 and 6-3 also do not indicate that a release of mercury has occurred at SWMU 56. Although mercury was detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (0.11 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005), the detected concentration is less than the sediment screening value and maximum background concentration for airfield drainage ditch sediment. Based on the low magnitude of the Step 2 and Step 3a risk estimates (HQs = 2.11 and 1.14, respectively), the descriptive and distributional statistics presented in Table 7-31, and the lack of any indication that concentrations in drainage ditch sediment are site-related, mercury is not identified as an ecological COC, and no additional evaluation within the drainage ditch system downgradient from SWMU 56, including sediment within the estuarine wetland south of Forrestal Drive, is recommended.

Selenium was detected in nine of fourteen (9/14) SWMU 56 sediment samples at concentration ranging from 0.99J mg/kg (56SD14) to 4.2J mg/kg (56SD04). However, only one detected concentration (4.2J mg/kg in 56SD04) exceeds the sediment screening value of 2.0 mg/kg (see

Figure 7-13). The Step 2 screening level risk estimate (HQ = 2.10; see Table 7-17, derived using the detected concentration at 56SD04, indicates that this metal is presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. However, the refined risk estimate (HQ = 0.97; see Table 7-30), derived using the 95 percent UCL of the mean concentration (1.94 mg/kg) does not indicates that selenium is presenting unacceptable risks to aquatic receptor group populations. The descriptive and distributional statistics presented in Table 7-31 indicate that selenium concentrations in drainage ditch sediment are not elevated above background levels. Maximum, arithmetic mean, and 95 percent UCL of the mean concentrations in drainage ditch sediment (4.2J mg/kg, 1.33 mg/kg, and 1.94 mg/kg) are less than maximum, arithmetic mean, and 95 percent UCL of the mean concentrations for background airfield drainage ditch sediment (4.3J mg/kg, 1.53 mg/kg, and 1.95 mg/kg, respectively). The distributional statistics performed on the SWMU 56 and background data sets (Gehan test, quantile test, and slippage test) concluded that selenium concentrations in drainage ditch sediment downgradient from SWMU 56 are not statistically elevated above background concentrations. Based on the refined risk estimate derived using the 95 percent UCL of the mean concentration (HQ = 0.97), the descriptive and distributional statistics presented in Table 7-31, selenium is not identified as an ecological COC, and no additional evaluation within the drainage ditch system downgradient from SWMU 56, including sediment within the estuarine wetland south of Forrestal Drive, is recommended. This recommendation includes Drainage Ditch Segment A-B (the concrete-lined portion of the drainage ditch system) since selenium was not detected within the sediment sample collected from this segment during the 2004 Phase II ECP field investigation (3.4U mg/kg in 2E-SD01; NAVFAC Atlantic, 2005).

Silver was detected in six of fourteen (6/14) sediment samples, with detected concentrations ranging from 0.18 J (56SD03) to 4.6J mg/kg (56SD15). Only the maximum detected concentration exceeds the sediment screening value of 1.0 mg/kg (see Figure 7-13). The Step 2 screening level risk estimate (HQ = 4.60; see Table 7-17, derived using the detected concentration at 56SD04, indicates that this metal is presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. A 95 percent UCL of the mean concentration for cadmium was not calculated due to the low number of detected results within the SWMU data set (6/14). Therefore, a refined risk estimated was not derived in Step 3a of the BERA. As evidenced by Table 7-31, silver was not detected in the background data set. As such, statistical evaluations comparing the SWMU 56 and background analytical data could not be performed. AVS and SEM analytical data are available for sediment collected at SWMU 56. As evidenced by Table 7-32, the molar concentration of SEM metals at 56SD15 (1.5858 μmole/g) is less than the molar concentration of AVS (2.3J μmole/g). Therefore, it can be concluded that benthic invertebrates are not exposed to toxic concentrations of silver in sediment pore water at this location.

As evidenced by Appendix D, silver was detected in two of nine (2/9) surface soil samples at 0.24J mg/kg (56SB01) and 0.032 mg/kg (56SB02) and eight of seventeen (8/17) subsurface soil samples collected during the 2008 CMS field investigation at concentrations ranging from 0.028J mg/kg (56SB08-01) to 0.11J mg/kg 956SB07-03). However, all detected surface soil concentrations are less than the maximum concentration reported in the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Chemicals (Baker, 2010) for background airfield soil (0.16B mg/kg). Although silver was detected in the sediment sample collected from this segment during the 2004 Phase II ECP field investigation (0.77B mg/kg in 2E-SD01; NAVFAC Atlantic, 2005), the detected concentrations is less than the sediment screening value. These data indicate that the detected concentration at 56SD15 is not site-related. Based on the SEM-to-AVS ratio for sediment collected at 56SD15 and the lack of any indication that this silver is site related, this metal is not identified as an ecological COC, and no additional evaluation within the drainage ditch system downgradient from SWMU 56, including sediment within the estuarine wetland south of Forrestal Drive, is recommended.

Vanadium was detected in each sediment sample at concentrations ranging from 147J mg/kg (56SD20) to 260J mg/kg 956SD14). Detected concentrations at each location exceed the sediment screening value of 57 mg/kg (see Figure 7-13). The Step 2 screening level risk estimate (HQ = 4.56; see Table 7-17, derived using the maximum detected concentration, indicates that this metal is presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. The refined risk estimate (HQ = 3.72; see Table 7-30), derived using the 95 percent UCL of the mean concentration (212 mg/kg) also indicates that vanadium is presenting unacceptable risks to aquatic receptor group populations. The descriptive statistics presented in Table 7-31 are elevated above background levels. Two detected concentrations (250J mg/kg in 56SD04 and 260J mg/kg in 56SD14) exceed maximum and ULM background concentrations (230 mg/kg and 244 mg/kg, respectively). The distributional statistics performed on the SWMU 56 and background data sets (two sample t-test, quantile test, and slippage test) were contradictory. The two sample t-test and quantile test concluded that vanadium concentrations in SWMU 56 sediment are elevated above background levels, while the slippage test concluded that concentrations in SWMU 56 sediment are not elevated above background. Vanadium was not detected in SWMU 56 surface soil at concentrations statistically elevated above background airfield soil levels (see Table 7-27). This metal also was not detected within the total recoverable and dissolved fractions of SWMU 56 groundwater at concentrations greater than ULM background concentrations (see Table 6-3). Although vanadium was detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (110 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005), the detected concentration did not exceed maximum and ULM background concentrations. These data indicate that vanadium detections at 56SD04 and 56SD14 are not site-related. Based on the low magnitude of the maximum detected sediment concentration (260J mg/kg) above maximum and ULM background concentrations (230 mg/kg and 244 mg/kg, respectively) and the lack of any indication that vanadium is site-related, this metal is not identified as an ecological COC, and no additional evaluation within the drainage ditch system downgradient from SWMU 56, including sediment within the estuarine wetland south of Forrestal Drive, is recommended.

Zinc was detected in a single drainage ditch sediment sample at a concentration greater than the sediment screening values of 121 mg/kg (140J mg/kg in 56SD04). The Step 2 screening level risk estimate (HQ = 1.16; see Table 7-17, derived using the detected concentration at 56SD04, indicates that this metal is presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. However, the refined risk estimate (HQ = 0.87; see Table 7-30), derived using the 95 percent UCL of the mean concentration (105.6 mg/kg) does not indicates that zinc is presenting unacceptable risks to aquatic receptor group populations. Although arithmetic mean and 95 percent UCL of the mean concentrations in SWMU 56 sediment are slightly elevated above background levels (see Table 7-31), the maximum zinc concentration (140J mg/kg) is less than the maximum and ULM background concentrations (203J mg/kg and 152 mg/kg, respectively). Distributional statistics performed on the SWMU 56 and background data sets (i.e., Satterthwaite t-test, quantile test, and slippage test; see Table 7-31) had conflicting results. The Satterthwaite t-test concluded that the arithmetic mean zinc concentration in SWMU 56 sediment exceeds the arithmetic mean background concentration, while the right-tailed tests (quantile test and slippage test) concluded that concentrations in SWMU 56 sediment are not elevated relative to background. AVS and SEM analytical data are not available for sediment collected at 56SD04; therefore, an evaluation of the bioavailability of zinc at this location cannot be performed. However, given that AVS was not detected in four of nine (4/9) sediment samples collected from Drainage Ditch Segment E-F during the 2009 supplemental field investigation (see Table 7-32), benthic invertebrates may be exposed to toxic concentrations of zinc in sediment pore water at 56SD03 and 56SD04.

Analytical data for upgradient surface soil, surface soil, and groundwater collected during the 2008 CMS field investigation indicate that the zinc concentration at 56SD04 is not site-related. As evidenced by Tables 6-1, 6-2, and 6-3, zinc was not detected in SWMU 56 surface soil, subsurface soil, or groundwater at concentrations greater than ULM background concentrations. The distributional statistics presented in Table 7-27 also show that zinc concentrations in SWMU 56 surface soil are not elevated above background levels. However, zinc was detected at an elevated concentration relative to the screening value and background levels in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (1,200 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005). For this reason, zinc is identified as an ecological COC for sediment within Drainage Ditch Segment A-B, and additional evaluation in the form of corrective measures is recommended. No additional evaluation is recommended for this metal within Drainage Ditch Segments C-D, E-F, G-H, as well as the estuarine wetland system south of Forrestal Drive, based on the refined risk estimate (HQ = 0.87) and the distributional statistics presented in Table 7-31 (i.e., range of detections and maximum concentration within the SWMU 56 and background data sets).

Tin was detected in eight of 14 sediment samples at concentrations ranging from 4.6J mg/kg (56SD19) to 16J mg/kg (56SD22). Each of the detected concentrations exceed the sediment screening value (3.4 mg/kg). The Step 2 screening level risk estimate (HQ = 4.71; see Table 7-17 indicates that this metal is presenting unacceptable risk to aquatic receptor groups within the drainage system downgradient from SWMU 56. The refined risk estimate (HQ = 3.41; see Table 7-30), derived using the 95 percent UCL of the mean concentration (11.6 mg/kg) also indicates that tin is presenting unacceptable risks to aquatic receptor group populations. Although, the descriptive and distributional statistics presented in Table 7-31 show that tin concentrations in SWMU 56 sediment are elevated above background concentrations, analytical data for upgradient media do not indicate that detected concentrations in drainage ditch sediment are site-related. As evidenced by Appendix D, this metal was not detected in SWMU 56 surface soil, subsurface soil, or groundwater (total and dissolved fraction).

The sediment screening value used in the Step 2 screening level risk calculation for tin was an AET value from Buchman (2008). The AET value, reported as >3.4 mg/kg, is a marine value based on tributyltin toxicity to *Neanthes sp*. Use of this value 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 effect-based 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 detected concentration in SWMU 56 sediment (16 mg/kg [40.2 mg/kg when expressed at tributyltin)] is over an order magnitude 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 group populations within drainage ditch surface sediment. It is noted that tin was detected at an elevated concentration relative to the screening value (>3.54 mg/kg) and background levels in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (17B mg/kg in 2E-SD01; NAVFAC Atlantic, 2005). However, this concentration, when expressed as tributyltin (42.7 mg/kg) also is over an order of magnitude greater than the IC_{50} reported by Kristin et al. (1998) for *Hexagonia* sp. Based on the comparison of maximum concentrations expressed as tributyltin to the effect-based toxicity values reported by Kristin et al. (1998), tin is not identified as an ecological COC for drainage ditch sediment, and no additional evaluation is recommended.

In summary, barium, cadmium, chromium, lead, and zinc are identified as ecological COCs for SWMU 56 sediment. Barium, chromium, and zinc are identified as ecological COCs for sediment within Drainage Ditch Segment A-B, cadmium is identified as an ecological COC for sediment within Drainage Ditch Segments A-B and CD, and lead is identified as an ecological COC for sediment within Drainage Ditch Segments A-B, C-D, and E-F. Although acetone, carbon disulfide, iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, pyrene, arsenic, beryllium, cobalt, copper, mercury, selenium, silver, and vanadium 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. In the case of acetone, iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, pyrene no additional evaluation is recommended based on a comparison of maximum detected concentrations to EqP-based screening values reported by Di Toro and MCGrath (2000). A recommendation of no additional evaluation for arsenic, beryllium, cobalt, copper, mercury, selenium, silver, and vanadium, are 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, descriptive and distributional statistics, and/or the lack of any indication that concentrations in drainage ditch sediment are site related. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA (including acrylonitrile, xylenes, and the twenty-nine SVOCs with maximum non-detected results greater than sediment screening values).

7.9.1.6 Step 3a Risk Evaluation for Avian Food Web Exposures

Tables 7-18, 7-19, and 7-20 presented the results of the Step 2 screening level risk calculation for avian food web exposures to chemicals in surface, subsurface soil, and drainage ditch sediment, respectively. HQ values for the refined risk calculations are summarized in Tables 7-33 (surface soil), 7-34 (subsurface soil, and 7-35 (drainage ditch sediment). A discussion of the refined risk evaluation is presented and discussed within the subsections that follow.

7.9.1.6.1 Avian Food Web Exposures: Surface Soil

Section 7.6.2.6.1 presented the results of the Step 2 screening level risk calculation for avian food web exposures to chemicals in surface soil. Screening level risk estimates also were provided in Table 7-18. Nine detected metals (cadmium, chromium, copper, lead, mercury, nickel, selenium, 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 SVOC (butyl benzyl phthalate) and one detected metal (beryllium) also were identified as ecological COPCs based on the lack of TRVs. The results of the refined risk calculation for SWMU 56 surface soil (i.e., NOAEL-, MATC-, and LOAEL-based HQ values) are presented in Table 7-33 and discussed in the sections that follow.

As indicated above, butyl benzyl phthalate and beryllium were detected in SWMU 56 surface soil and identified as ecological COPCs for avian food web exposures based on the lack of TRVs. Butyl benzyl phthalate was detected at a low magnitude in a single surface soil sample (10J µg/kg in 56SB03-00). This SVOC is not identified as an important bioaccumulative chemical by the USEPA (2000b) and therefore, has low potential to bioaccumulate in terrestrial food items. Based on the low magnitude of the single detection and the low potential for this SVOC to bioaccumulate in terrestrial food items, butyl benzyl phthalate is not identified as an ecological COC for terrestrial food web exposures, and no additional evaluation is recommended.

Beryllium was detected in each surface soil sample at concentrations ranging from 0.053J µg/kg (56SB04-00) to 0.34 mg/kg (56SB06-00). As evidenced by the descriptive statistics presented in Table 7-27, maximum, arithmetic mean, and 95 percent UCL of the mean beryllium concentrations in SWMU 56 surface soil (0.34 mg/kg, 0.19 mg/kg, and 0.26 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 56 and background data sets (i.e., Gehan test, quantile test, and slippage test; see Table 7-27) also show that beryllium concentrations in SWMU 56 surface soil are not elevated above background levels. Based on the descriptive and distributional statistics presented in Table 7-27, beryllium is not identified as an ecological COC for avian food web exposures to chemicals in SWMU 56 surface soil, and additional evaluation is not recommended.

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 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 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, 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 each of the avian receptors (see Table 7-33), indicating acceptable risk to avian herbivore, omnivore, and carnivore populations. The descriptive and/or distributional statistics presented in Table 7-27 for these six metals also show that concentrations in SWMU 56 surface soil are not elevated above background levels. Based on refined HQ values less than 1.0 and the descriptive and distributional statistics presented in Table 7-27, chromium, copper, mercury, nickel, selenium, and zinc are not identified as ecological COCs for terrestrial food web exposures, and no additional evaluation is recommended.

Refined American robin dietary exposure doses for cadmium, lead, and vanadium exceed NOAEL-based TRVs established for this receptor (HQs = 1.52 for cadmium, 1.77 for lead, and 12.51 for vanadium; see Table 7-33). In addition, refined mourning dove dietary exposure doses for lead and vanadium exceed NOAEL-based TRVs (HQs = 1.25 for lead and 6.08 for vanadium; see Table 7-33). The descriptive and distributional statistics presented in Table 7-27 and discussed in Section 7.9.1.1 show that lead concentrations in SWMU 56 sediment are elevated above background levels. The statistical evaluation of the SWMU 56 and background cadmium data sets was impaired due to the low frequency of detection within the background data set. Specifically, an evaluation of the mean/median of the distributions could not be performed. However, the descriptive statistics presented in Table 7-27 indicate that cadmium is present in SWMU 56 surface soil at concentrations elevated above background levels (the maximum concentration detected in SWMU 56 surface soil [3.3J mg/kg] exceeds maximum and ULM background concentrations [0.92J mg/kg and 0.65 mg/kg, respectively]). Based on NOAEL-based HQ values greater than 1.0 for the American robin and mourning dove and the distributional and descriptive statistics presented in Table 7-27, lead is identified as an ecological COC for avian omnivore and herbivore dietary exposures. Cadmium also is identified as an ecological COC for avian omnivore dietary exposures based on a NOAEL-based HQ value greater than 1.0 and the descriptive statistics presented in Table 7-27. Additional evaluation in the form of corrective measures is recommended for both metals. Although American robin and mourning dove dietary exposure doses for vanadium exceed the NOAEL-based TRV, this metal is not identified as an ecological COC based on the descriptive and distributional statistics presented in Table 7-27, which show that vanadium concentrations in SWMU 56 surface soil are not elevated above background levels.

In summary, lead and cadmium are identified as ecological COCs for avian omnivore and/or herbivore dietary exposures to chemicals in SMWU 56 surface soil. Although detected and identified as ecological COPCs in Step 2 of the SERA, butyl benzyl phthalate, beryllium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc are not identified as ecological COCs, and additional evaluation is not recommended. In the case of butyl benzyl phthalate, no additional evaluation is recommended based on the low magnitude of the single detection and the low potential for this SVOC to bioaccumulate in terrestrial food items. In the case of beryllium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc, 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 7-27. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

7.9.1.6.2 Avian Food Web Exposures: Subsurface Soil

Section 7.6.2.6.2 presented the results of the Step 2 screening level risk calculation for avian food web exposures to chemicals in surface soil. Screening level risk estimates also were provided in Table 7-19. Five detected metals (chromium, copper, mercury, selenium, and vanadium) were identified as ecological COPCs in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for the American robin and/or mourning dove (i.e., maximum HQs exceed 1.0). One detected metal (beryllium) also was identified as an ecological COPC based on the lack of a TRV. The results of the refined risk calculation for SWMU 56 subsurface soil (i.e., NOAEL-, MATC-, and LOAEL-based HQ values) are presented in Table 7-34. Due to the limited sample size of the subsurface soil and surface water data sets, maximum detected concentrations were used in the refined HQ calculations rather than 95% 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, mean water ingestion rates, and BAFs based on, or modeled from, central tendency estimates.

As discussed in the preceding paragraph, chromium, copper, mercury, selenium, and vanadium were identified as ecological COPCs for terrestrial food web exposures in Step 2 of the SERA because maximum exposure doses exceed NOAEL-based TRVs for the American robin and/or mourning dove. Beryllium also was identified as an ecological COPC based on the lack of a TRV. 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 (see Table 7-34). Refined exposure doses for vanadium exceed NOAEL-, MATC-, and LOAEL-based ingestion screening values for the American robin and mourning dove. The maximum refined NOAEL-based HQ value was estimated for the American robin (HQ = 5.62). Distributional statistics could not be performed on the SWMU 56 and background subsurface soil data sets due to the low sample size of the SWMU 56 data set (n = 3). However, as evidenced by the descriptive statistics presented in Table 7-28, maximum beryllium, chromium, copper, mercury, selenium, and vanadium concentrations in SWMU 56 subsurface soil (0.17 mg/kg, 15 mg/kg, 75J mg/kg, 0.078J mg/kg, 2.9 mg/kg, 120 mg/kg, respectively) are less than maximum background concentrations and/or ULM background concentrations. These data indicate that concentrations in SWMU 56 subsurface soil collected from the 1.0 to 3.0-foot depth interval are consistent with background concentrations and are not likely to present ecological risks above background levels. Based on refined HQ values less than 1.0 and/or the descriptive statistics presented in Table 7-28, beryllium, chromium, copper, mercury, selenium, and vanadium are not identified as ecological COCs for avian food web exposures, and no additional evaluation is recommended.

In summary, although beryllium, chromium, copper, mercury, selenium, and vanadium were detected in SWMU 56 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs for avian food web exposures based on refined exposure doses less than NOAEL-based TRVs and/or the descriptive statistics presented in Table 7-28. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA.

7.9.1.6.3 Avian Food Web Exposures: Drainage Ditch Sediment

Section 7.6.2.6.3 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 7-20. Thirteen detected metals (barium, cadmium, chromium, cobalt, 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). Butyl benzyl phthalate was detected and identified as an ecological COPC based on the lack of an avian TRV. Although not detected, thallium and di-n-butyl phthalate were identified as ecological COPCs because maximum exposure doses for the American robin exceeded NOAEL-based TRVs. One detected metal (beryllium) also was identified as ecological COPC based on the lack of a TRV. The results of the refined risk calculation drainage ditch sediment (i.e., NOAEL-, MATC-, and LOAEL-based HQ values) are presented in Table 7-35. Refined dietary exposure doses for barium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, vanadium, and zinc were derived using 95% 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 AUFs of 1.0. A discussion of the refined risk calculation is presented within the paragraphs that follow.

Butyl benzyl phthalate was detected in SWMU 56 sediment and identified as ecological COPC based on the lack of a TRV. This SVOC was detected at a low magnitude in a single surface sediment sample (22J µg/kg in 56SD03). As discussed in Section 7.9.1.6.1, butyl benzyl phthalate is not identified as an important bioaccumulative chemical by the USEPA (2000b) and therefore, has low potential to bioaccumulate in drainage ditch food items. Based on the low magnitude of the single detection and the low potential for this SVOC to bioaccumulate in food items, butyl benzyl phthalate is not identified as an ecological COC for avian omnivore dietary exposures, and no additional evaluation is recommended.

Beryllium was detected in SWMU 56 sediment and identified as an ecological COPC based on the lack of a TRV. Beryllium was detected in four of fourteen (4/14) sediment samples at concentrations ranging from 0.21J mg/kg (56SD03) to 0.3J mg/kg (56SD14). As evidenced by Table 7-31, the statistical evaluation of the SWMU 56 and drainage ditch sediment data sets was impaired by the low frequency of detection in each data set (distributional statistics evaluating the mean/median of the distributions could not be performed). However, as discussed in Section 7.9.1.5, the maximum detected beryllium concentration in SWMU 56 sediment (0.3J mg/kg) is less than the ULM background concentration (0.36J mg/kg) and is only slightly elevated above the maximum background concentration (0.36 mg/kg). These data indicate that beryllium concentrations in SWMU 56 sediment are consistent with background levels. Section 7.9.1.5 also included an evaluation of SWMU 56 surface soil, subsurface soil, and groundwater data, as well as data for a sediment sample collected from Drainage Ditch Segment A-B during the 2004 Phase II ECP field investigation, which showed that beryllium is not likely to be site-related. Based on these considerations, beryllium is not identified as an ecological COC for avian omnivore dietary exposures, and no additional evaluation is recommended.

Although thallium and di-n-butyl phthalate were not detected in SWMU 56 sediment, these two chemicals were identified as ecological COPCs in Step 2 of the SERA because maximum exposure doses exceed the NOAEL-based TRVs established for the American robin. The refined risk estimates (NOAEL-based HQs = 0.62 for both chemicals) indicates that thallium and di-n-butyl phthalate are not presenting unacceptable risks to avian omnivore populations. Therefore, these two non-detected chemicals are not identified as ecological COCs for avian omnivore dietary exposures, and no additional evaluation is recommended.

Barium, cadmium, chromium, cobalt, 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 for one or more of the terrestrial avian receptors. Refined exposure doses (derived using 95% UCL of the mean chemical concentrations, mean body weight, mean food ingestion rate, mean water 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 barium, cadmium, chromium, cobalt, copper, nickel, selenium, silver, and zinc are less than NOAEL-, MATC-, and LOAEL-based TRVs (see Table 7-35), indicating acceptable risk to avian omnivore populations. In addition, the descriptive and distributional statistics presented in Table 7-31 demonstrate that chromium, copper, nickel, selenium, and zinc concentrations in SWMU 56 sediment are not elevated above background levels. Based on refined HQ values less than 1.0 and/or the descriptive statistics presented in Table 7-31, barium, cadmium, chromium, cobalt, copper, nickel, selenium, silver, and zinc are not identified as ecological COCs for avian omnivore dietary exposures, and no additional evaluation is recommended. It is acknowledged that the evaluation of American robin dietary exposures to chemicals in SWMU 56 sediment was limited to analytical data for sediment samples collected within Drainage Ditch Segments C-D, E-F, and G-H. As discussed in Section 7.2, a singles sediment samples was collected from Drainage Ditch Segment A-B during the 2004 Phase II ECP field investigation. However, because analytical data for this sediment sample was not subjected to independent, third party data validation, these data were deemed unacceptable for use in the ERA (data were not used in the derivation of risk estimates). The refined risk evaluation for aquatic receptor group exposures to chemicals in drainage ditch sediment (Section 7.9.1.5) showed that barium, cadmium, chromium, copper, and zinc were detected in the Phase II ECP sediment sample at concentrations elevated above background levels. Because a recommendation for corrective measures was made for aquatic receptor group exposures to chemicals in sediment within Drainage Ditch Segment A-B, any potential risks to avian omnivores from dietary exposures within this segment also will be addressed.

As evidenced by Table 7-35, refined exposure doses for mercury and lead exceed NOAEL-based TRVs (HQ = 1.62 for mercury and 1.02 for lead). MATC- and LOAEL-based risk estimates for both metals are less than 1.0. As discussed in Section 7.9.1.5, the descriptive and distributional statistics presented in Table 7-31 show that mercury concentrations in SWMU 56 sediment are not elevated above background concentrations. Therefore, it can be concluded that mercury is not present in drainage ditch sediment at concentrations that would present risks to avian omnivores above background risks. Distributional statistics performed on the SWMU 56 and background sediment data sets (Satterthwaite t-test, quantile test, and slippage test) show that lead concentrations in SWMU 56 sediment are elevated above background concentrations. The descriptive statistics presented in Table 7-31 support this conclusion. Based on the descriptive and distributional statistics presented in Table 7-31, mercury is not identified as an ecological COC for avian omnivore dietary exposures, and no additional evaluation is recommended.

However, lead is identified as an ecological COC based on a dietary exposure dose greater than the NOAEL-based TRV and elevated concentrations in SWMU 56 sediment. Additional evaluation in the form of corrective measures is recommended for this metal.

The refined exposure dose for vanadium exceeds NOAEL-, MATC-, and LOAEL-based TRVs (HQs = 9.93, 7.02, and 4.97, respectively), indicating unacceptable risk to avian omnivore populations. The descriptive statistics presented in Table 7-31 indicate that vanadium concentrations in SWMU 56 sediment are elevated above background levels. Two detected concentrations (250J mg/kg in 56SD04 and 260J mg/kg in 56SD14) exceed maximum and ULM background concentrations (230 mg/kg and 244 mg/kg, respectively). The distributional statistics performed on the SWMU 56 and background data sets (two sample t-test, quantile test, and slippage test) were contradictory. The two sample t-test and quantile test concluded that vanadium concentrations in SWMU 56 sediment are elevated above background levels, while the slippage test concluded that concentrations in SWMU 56 sediment are not elevated above background. The refined risk evaluation for aquatic receptor groups (Section 7.9.1.5) included an evaluation of vanadium. As discussed in Section 7.9.1.5, vanadium was not detected in SWMU 56 surface soil at concentrations statistically elevated above background airfield soil levels (see Table 7-27). This metal also was not detected within the total recoverable and dissolved fractions of SWMU 56 groundwater at concentrations greater than ULM background concentrations (see Table 6-3). Finally, the vanadium concentration detected in the sediment sample collected from the concrete-lined portion of the drainage ditch system (Segment A-B) during the 2004 Phase II ECP field investigation (110 mg/kg in 2E-SD01; NAVFAC Atlantic, 2005) is less than maximum and ULM background concentrations. These data indicate that vanadium detections at 56SD04 and 56SD14 are not site-related. Based on the low magnitude of the maximum detected sediment concentration (260J mg/kg) above maximum and ULM background concentrations (230 mg/kg and 244 mg/kg, respectively) and the lack of any indication that vanadium is site-related, this metal is not identified as an ecological COC for avian omnivore dietary exposures, and no additional evaluation is recommended.

In summary, lead is identified as ecological COC 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 butyl benzyl phthalate, beryllium, barium, cadmium, chromium, cobalt, copper, mercury, nickel, selenium, silver, and zinc were detected in SWMU 56 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs for terrestrial food web exposures based on the discussion presented in the preceding paragraphs, and no additional evaluation is recommended. Butyl benzyl phthalate was not identified as an ecological COC because this SVOC was detected a concentration and has low potential to bioaccumulate in food items. Barium, beryllium, cadmium, chromium, cobalt, copper, mercury, nickel, selenium, silver, vanadium, and zinc were not identified as ecological COCs based on refined risk estimates, descriptive and/or distributional statistics, and, in the case of vanadium, the lack of any indication that elevated concentrations in drainage ditch sediment are site-related. No additional evaluation also is recommended for the non-detected chemicals identified as ecological COPCs in Step 2 of the SERA (including thallium).

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 56 are listed below.

- Due to the low sample size of the subsurface soil and drainage ditch surface water data sets (n = 3 and n = 5 respectively), risk estimated for these two media were not refined using 95% UCL of the mean concentrations. The low frequency of ecological COPC detections in groundwater also prevented a refinement of risk estimates using 95% 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, low frequency of detection, and/or the absence of a background data set (in the case of surface water), statistical evaluations performed on the SWMU 56 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

Table 7-36 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 food web 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, lead was identified as ecological COC for SWMU 56 surface soil (see Table 7-36). The maximum and 95 percent UCL of the mean concentrations in SWMU 56 surface soil exceed the soil screening values (see Tables 7-13 and 7-26, respectively). The distributional statistics presented in Table 7-27 also show that lead concentrations in SWMU 56 surface soil are statistically elevated above background levels. Based on the identification of lead as ecological COC for terrestrial invertebrate and plant populations, a CAO for this metal was developed using the methodology presented in Section 7.10.1.

Although acetone, carbon disulfide, chloromethane, iodomethane, cobalt, copper, selenium, and vanadium were detected and identified as ecological COPCs in Step 2 of the SERA (see Section 7.6.2.1 and Table 7-21), these eight chemicals were not identified as ecological COCs in Step 3a of the BERA. Acetone, carbon disulfide, chloromethane, and iodomethane were eliminated from further evaluation based on their predicted toxicity to earthworms using SARs, while cobalt, copper, selenium, and vanadium were eliminated from further evaluation based on statistical evaluations performed on the SWMU 56 and background airfield soil data sets, which showed that SWMU 56 surface soil concentrations for these four metals are not elevated above background levels (see Table 7-27).

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 56 subsurface soil (see Table 7-36). Although acetone, iodomethane, copper, selenium, and vanadium were detected in SWMU 56 subsurface soil and identified as ecological COPCs in Step 2 of the SERA (see Section 7.6.2.2

and Table 7-21), these five chemicals were eliminated from further evaluation in Step 3a of the BERA. Acetone, and and iodomethane were eliminated from further evaluation based on their predicted toxicity to earthworms using SARs, while copper, selenium, and vanadium were eliminated from further evaluation based on descriptive statistics, which showed that SWMU 56 subsurface soil concentrations for these three metals are not elevated above background levels (see Table 7-29).

Based on the refined risk evaluation presented in Section 7.9.1.3, no chemicals were identified as ecological COCs for SWMU 56 groundwater in Step 3a of the BERA (see Table 7-36). Although copper and vanadium were detected and identified as ecological COPCs in Step 2 of the SERA (see Section 7.6.2.3 and Table 7-21), these two metals were eliminated from further evaluation in Step 3a of the BERA. Copper and vanadium were eliminated from further evaluation based on descriptive statistics, which showed that total recoverable and dissolved SWMU 56 groundwater concentrations are not elevated above background levels (see Table 7-28).

7.9.3.4 Drainage Ditch Surface Water

Based on the refined risk evaluation presented in Section 7.9.1.4, no chemicals were identified as ecological COCs for drainage ditch surface water. Although cadmium, copper, lead, and vanadium were detected in drainage ditch surface water and identified as ecological COPCs in Step 2 of the SERA (see Section 7.6.2.4 and Table 7-21), these four metals were eliminated from further evaluation in Step 3a of the BERA. Cadmium, copper, and lead were eliminated from further evaluation based on the comparison of maximum dissolved concentrations to NAWQC expressed in terms of the dissolved concentration in the water column. Vanadium was eliminated from further evaluation based on the lack of detections within the dissolved fraction.

7.9.3.5 Drainage Ditch Sediment

Based on the refined risk evaluation presented in Section 7.9.1.5, barium, cadmium, chromium, lead, and zinc were identified as ecological COCs for sediment (see Table 7-36):

- Barium: Drainage Ditch Segment A-B
- Cadmium: Drainage Ditch Segments A-B and C-D
- Chromium: Drainage Ditch Segment A-B
- Lead: Drainage Ditch Segments A-B, C-D, and E-F
- Zinc: Drainage Ditch Segment A-B

In the case of cadmium and lead, maximum and 95 percent UCL of the mean concentrations exceed sediment screening values (see Tables 7-17 and 7-30, respectively). The descriptive and/or distributional statistics presented in Table 7-31 also showed that drainage ditch concentrations are elevated above background levels. Finally, analytical data for SWMU 56 surface soil and the single sediment sample collected from Drainage Ditch Segment A-B during the 2004 Phase II ECP field investigation indicate that elevated concentrations in drainage ditch sediment (Segment A-B and C-D for cadmium and Segments A-B, C-D, and E-F for lead) are site-related. In the case of chromium and barium, these two metals were identified as ecological COCs for Drainage Ditch Segment A-B based on analytical data for the Phase II ECP sediment sample. Specifically, detected concentrations in this sediment sample exceed sediment screening values, as well as maximum background airfield drainage ditch sediment concentrations. Based on the identification of barium, cadmium, chromium, lead, and zinc as ecological COCs for aquatic receptor group populations, CAOs for these five metals were developed using the methodology presented in Section 7.10.1.

Although acetone, carbon disulfide, iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, pyrene, arsenic, beryllium, cobalt, copper, mercury, selenium, silver, and vanadium were detected in drainage ditch sediment and identified as ecological COPCs in Step 2 of the SERA, these chemicals were eliminated from further evaluation in Step 3a of the BERA. In the case of acetone, iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, and pyrene, no additional evaluation is recommended based on a comparison of maximum detected concentrations to EqP-based screening values. A recommendation of no additional evaluation for carbon disulfide, arsenic, beryllium, cobalt, copper, mercury, selenium, silver, and vanadium, are 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 (see Table 7-30), descriptive and distributional statistics (see Table 7-31), and/or the lack of any indication that concentrations in drainage ditch sediment downgradient from SWMU 56 are site related.

7.9.3.6 Avian Dietary Exposures: Surface Soil

Based on the refined risk evaluation presented in Section 7.9.1.6.1, cadmium and lead were identified as ecological COCs for avian dietary exposures to chemicals in SWMU 56 surface soil (see Table 7-36). Maximum detected lead and cadmium concentrations exceed maximum background and background ULM concentrations (see Table 7-31). In the case of lead, the distributional statistics presented in Table 7-31 also indicate that lead concentrations in SWMU 56 surface soil are elevated above background levels. Finally, refined exposure doses exceed NOAEL-based ingestion screening values for the American robin and, in the case of lead, the mourning dove. Based on their identification as ecological COCs for avian dietary exposures, CAOs were developed using the methodology presented in Section 7.10.1.2.

Although butyl benzyl phthalate, beryllium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc were detected in SWMU 56 surface soil and identified as ecological COPCs in Step 2 of the SERA, these chemicals were eliminated from further evaluation in Step 3a of the BERA. In the case of butyl benzyl phthalate, no additional evaluation is recommended based on the low magnitude of the single detection and the low potential for this SVOC to bioaccumulate in terrestrial food items. In the case of beryllium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc, a recommendation of no additional evaluation is based on refined exposure doses less than NOAEL-based TRVs (see Table 7-33) and/or the descriptive and distributional statistics presented in Table 7-27.

7.9.3.7 Avian Dietary Exposures: Subsurface Soil

Based on the refined risk evaluation presented in Section 7.9.1.6.2, no detected chemicals were identified as ecological COCs for avian dietary exposures to chemicals in SWMU 56 subsurface soil. Although beryllium, chromium, copper, mercury, selenium, and vanadium were detected in SWMU 56 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs for avian food web exposures based on refined exposure doses less than NOAEL-based TRVs (see Table 7-34) and/or the descriptive statistics presented in Table 7-28.

7.9.3.8 Avian Dietary Exposures: Drainage Ditch Sediment

Based on the refined risk evaluation presented in Section 7.9.1.6.3, lead was identified as an ecological COC for avian dietary exposures to chemicals in drainage ditch sediment based on a refined exposure dose greater than the NOAEL-based TRV (see Table 7-35) and the descriptive and distributional statistics presented in Table 7-31. Based on the identification of lead as an ecological COC for avian dietary exposures, a CAO was developed using the methodology presented in Section 7.10.1.

Although butyl benzyl phthalate, beryllium, barium, cadmium, chromium, cobalt, copper, mercury, nickel, selenium, silver, and zinc were detected in SWMU 56 subsurface soil and identified as ecological COPCs in Step 2 of the SERA, they are not identified as ecological COCs for avian food web exposures based on the discussion presented in the preceding paragraphs, and no additional evaluation is recommended. Butyl benzyl phthalate was not identified as an ecological COC because this SVOC was detected at a low concentration and has low potential to bioaccumulate in food items. Barium, beryllium, cadmium, chromium, cobalt, copper, mercury, nickel, selenium, silver, vanadium, and zinc were not identified as ecological COCs based on refined risk estimates (see Table 7-35), descriptive and/or distributional statistics (see Table 7-31), and, in the case of vanadium, the lack of any indication that elevated concentrations in drainage ditch sediment are site-related.

7.10 Development of Ecological Corrective Action Objectives

This section presents the methodology used to develop surface soil and drainage ditch sediment CAOs protective of ecological receptors. Because ecological COCs were not identified for subsurface soil, groundwater, or drainage ditch surface water (see Table 7-36), CAOs were not developed for these three media.

7.10.1 Methodology for CAO Development

Lead was identified as an ecological COC for invertebrate and plant exposures to chemicals in SWMU 56 surface soil. Lead and cadmium also were identified as ecological COCs for avian omnivore and herbivore dietary exposures to chemicals in SWMU 56 surface soil. In addition, barium, cadmium, chromium, lead, and zinc were identified as ecological COCs for aquatic plant and invertebrate exposures to chemicals in drainage ditch sediment:

- Barium: Drainage Ditch Segment A-B
- Cadmium: Drainage Ditch Segments A-B and C-D
- Chromium: Drainage Ditch Segment A-B
- Lead: Drainage Ditch Segments A-B, C-D, and E-F
- Zinc: Drainage Ditch Segment A-B

Finally, lead was identified as an ecological COC for avian omnivore dietary exposures to chemicals in drainage ditch sediment. The sections that follow present the methodology used to develop risk- and background-based surface soil and drainage ditch sediment CAOs for these chemical-receptor-pathway dietary exposures. Final CAOs are identified in Section 7.10.2.

7.10.1.1 Risk-Based CAOs for Terrestrial Plant and Invertebrate Exposures to COCs in Surface Soil

Lead, was identified as an ecological COC for terrestrial plant and invertebrates. The soil screening value for lead (120 mg/kg; see Table 7-4) was selected as the surface soil CAO protective of these terrestrial receptor groups.

7.10.1.2 Risk-Based CAOs for Avian Dietary Exposures to COCs in Surface Soil

Lead was identified as an ecological COC for American robin and mourning dove dietary exposures to chemicals in SWMU 56 surface soil. Cadmium also was identified as an ecological COC for American robin dietary exposures to chemicals in surface soil. The Step 3a risk calculation presented in Table 7-33 showed that the American robin represents the most sensitive receptor for dietary exposures to lead in SWMU 56 surface soil (American robin HQ = 1.77; mourning dove HQ = 1.18). Therefore, a CAO specific to mourning dove dietary exposures to lead in surface soil was not derived (the CAO derived for avian omnivores also will be protective of avian herbivores). CAOs for American robin dietary exposures to lead and cadmium in surface soil were established through an iterative process using the dietary intake equation presented and discussed in Section 7.5.2.2.2:

$$DI_x = \frac{[[\sum_i [(FIR)(FC_{xi})(PDF_i)]] + [(FIR)(SC_x)(PDS)]][AUF]}{BW}$$

where:

DI_x	=	Dietary intake for chemical x (mg chemical/kg body weight/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 (dry weight basis)
PDF_i	=	Proportion of diet composed of food item i (dry weight basis)
$\mathrm{SC_x}$	=	Concentration of chemical x in surface soil (dry weight basis)
PDS	=	Proportion of diet composed of surface soil (dry weight basis)
AUF_j	=	Area Use Factor (unitless)

For a given ecological COC, the iterative process was conducted by entering values for SC_x into the equation until a dietary intake (DI_x) was calculated that equaled the NOAEL-based TRV listed in Table 7-8 (1.63 mg/kg-BW/day for lead and 1.47 mg/kg-BW/day for cadmium). The soil concentration that results in a dietary intake equal to the NOAEL-based TRV corresponds to an HQ value of 1.0.

Input parameters used for *BW*, PDF_i (earthworms and plants), *PDS, FIR*, 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.

- American robin body weight (*BW*): 0.0785 kg (USEPA, 1993; see Table 7-22)
- American robin food ingestion rate (*FIR*): 0.01033 kg/day-dry weight (Nagy, 2001; see Table 7-22)

- Proportion of American robin diet comprised of food item i (PDF_i): 0.83 for earthworms and 0.073 for plants (see Table 7-23)

- Proportion of American robin diet comprised of soil (*PDS*): 0.087 (see Table 7-23)
- Area use factor (*AUF*): 1.0 (see Table 7-22)

Cadmium and lead concentrations in each American robin food item (FC_{xi}) were derived using the uptake equations presented in Table 7-24. As such, each substitution of cadmium and lead surface soil concentrations into the dietary intake equation during the iterative process resulted in new plant and invertebrate tissue concentrations (American robin food items). It is noted that chemical intakes via surface water ingestion were not considered when calculating surface soil CAOs due to the extremely low contribution that this exposure route has to the total risk (i.e., exclusion of drinking water exposures from the Step 2 and Step 3a risk calculations has a negligible effect on risk estimates). This approach also is consistent with the USEPA's guidance for developing wildlife Eco-SSLs for upper trophic level receptors (USEPA, 2003a). Based on the iterative process, the CAOs developed for cadmium and zinc are 1.8 mg/kg and 96 mg/kg, respectively.

7.10.1.3 <u>Risk-Based CAOs for Aquatic Receptor Group Exposures to COCs in SWMU 56 Sediment</u>

Barium, cadmium, chromium, lead, and zinc were identified as ecological COCs for plants, invertebrates, fish, and amphibians within the drainage ditch system downgradient from SWMU 56. Sediment screening values for these five metals (20 mg/kg for barium, 0.99 for cadmium, 43.4 mg/kg for chromium, 35.8 mg/kg for lead, and 121 mg/kg for zinc; see Table 7-7) were selected as sediment CAOs protective of these aquatic receptor groups.

7.10.1.4 <u>Risk-Based CAOs for Avian Dietary Exposures to COCs in SWMU 56 Sediment</u>

Lead was identified as an ecological COC for American robin dietary exposures to chemicals in SWMU 56 sediment. The dietary intake equation and iterative process described in Section 7.10.1.2, as well as the equation input parameters for *BW*, PDF_i, *PDS, FIR*, FC_{xi}, and *AUF* noted in that section, were used to derive the sediment CAO for lead. Based on the iterative process, the sediment CAO developed for lead is 98.1 mg/kg.

7.10.1.5 <u>Background-Based CAOs for Surface soil and Drainage Ditch Sediment</u>

ULM concentrations presented in Addendum B of the <u>Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds</u> (Baker, 2010) for airfield soil were used as background-based CAOs for cadmium and lead in surface soil (0.65 mg/kg for cadmium and 16.9 mg/kg for lead). The ULM concentration presented in Addendum C of the above referenced document for airfield drainage ditch sediment was used as the background-based CAO for lead in SWMU 56 sediment (19.4 mg/kg).

7.10.2 Identification of Final Corrective Action Objectives

Table 7-37 presents the CAOs developed for SWMU 56 surface soil. As evidenced by Table 7-37, the risk-based CAO for cadmium (1.8 mg/kg for avian omnivores), as well as risk-based CAOs for lead (i.e., 120 mg/kg for plants and invertebrates and 96 mg/kg avian omnivores), exceed background-based CAOs (0.65 mg/kg for cadmium and 16.9 mg/kg for lead). Therefore, minimum risk-based CAOs for each metal (1.8 mg/kg for cadmium and 96 mg/kg for lead) were selected as final CAOs for SWMU 56 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 7-38 provides a summary of the barium, cadmium, chromium, lead, and zinc CAOs developed for SWMU 56 sediment. As evidenced by Table 7-38, the cadmium and lead risk-based CAOs established for aquatic receptor groups (aquatic plants, invertebrates, fish, and amphibians) and, in the case of lead, avian omnivores exceed their respective background-based CAOs. Therefore, for these two metals, minimum risk-based CAOs were selected as final CAOs (0.99 mg/kg for cadmium and 35.8 mg/kg for lead). Background-based CAOs for barium, lead, and zinc exceed their respective risk-based CAOs. Therefore, background-based CAOs for these three metals were selected as final CAOs (214 mg/kg for barium, 65 mg/kg for chromium, and 152 mg/kg for zinc). As discussed in the preceding paragraph, this approach is consistent with Navy policy.

7.11 References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Acrolein. Public Health Service, U.S. Department of Health and Human Services. August, 2007

Ankley, G.T., D.M. Di Toro, D.J. Hansen, and W.J. Berry. 1996. Technical Basis and Proposal for Deriving Sediment Quality Criteria for Metals. Environ. Toxicol. Chem. 15:2056-2066.

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.

Baker. 2007. Final Additional Data Collection Work Plan in Support of the Ecological Risk Assessment for SWMU 14, naval activity Puerto Rico, ceiba, Puerto Rico. November 2007.

Baker. 2006a. Final Steps 3b and 4 of the Baseline Ecological Risk Assessment at SWMUs 1 and 2, Naval Activity Puerto Rico, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. January 10, 2007.

Baker. 2006b. Final Steps 3b and 4 of the Baseline Ecological Risk Assessment for SWMU 45, Naval Activity Puerto Rico, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. July 26, 2006.

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.

Berry, W.J., M.G. Cantwell, P.A. Edwards, J.R. Serbst, and D.J. Hansen. 1999. Predicting Toxicity of Sediments Spiked with Silver. Environ. Toxicol. Chem. 18(1):40-48.

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

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. Available at: http://www.ccme.ca/assets/pdf/rev_soil_summary_tbl_7.0_e.pdf.

CCME. 2002. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Updated 2002. In: Canadian Environmental Quality Guidelines, 1999, CCME, Winnapeg. Availalble at: http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=124.

Chief of Naval Operations (CNO). 2004. Navy Policy on the Use of Background Chemical Levels. Memorandum from Chief of Naval Operations to Commabder, Naval Facilities Engineering Command. Ser N45C/N4U7322212.

CNO. 1999. Navy Policy for Conducting Ecological Risk Assessments. Memorandum from Chief of Naval Operations to Commander, Naval Facilities Engineering Command. Ser. N453E/9U595355. April 5, 1999.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79-31. Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior, Washington, DC.

Department of Navy (DoN). 2007. Environmental Assessment for the Disposal of Naval Activity Puerto Rico (Formally Naval Station Roosevelt Roads). April 2007.

Di Toro, D.M. and J.A. McGrath. 2000. Technical Basis for Narcotic Chemicals and Polycyclic Aromatic Hydrocarbon Criteria. II. Mixtures and Sediments. Environ. Toxicol. and Chem. 19:1971-1982.

Dyer, S.D.,, C.E. hall, and B.K. Shephard. 2000. Assessments of Chemical Mixtures via Toxicity Reference Values Overpredict Hazard to Ohio Fish Communities. Environ. Sci. Tech. 34:2518-2524.

Efroymson, R.A., Will, M.E., and Suter II, G.W. 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. (ES/ER/TM-126/R2).

Efroymson, R.A., Will, M.E., Suter II, G.W., and Wooten, A.C. 1997b. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory. Oak Ridge, TN. (ES/ER/TM-85/R3).

Ewel, J.J., and J.L. Whitmore. 1973. The Ecological Life Zones of Puerto Rico and the U.S. Virgin Islands. Institute of Tropical Forestry, Rio Piedras, PR. (U.S. Forest Service Research Paper ITF-18).

Fuchsman, P.C. 2003. Modification of the Equilibrium Partitioning Approach for Volatile Organic Compounds in Sediment. Environ. Toxicol. Chem. 22(7):1532-1534.

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.
Geo-Marine, Inc. 2005. Draft Environmental Assessment for the Disposal of Naval Activity Puerto Rico (formerly Naval Station Roosevelt Roads). Geo-Marin, Inc., Plano, TX. December 2005.

Geo-Marine, Inc. 2000. Habitat Characterization of Solid Waste Management Units (SWMU) 1, SWMU 2, and SWMU 45, Naval Station Roosevelt Roads, Puerto Rico. Geo-Marine, Inc., Plano, TX. October 11, 2000.

Geo-Marine, Inc. 1998. Integrated Natural Resource Management Plan for U.S. Naval Station Roosevelt Roads: Plan Years 1998-2007. Geo-Marine, Inc., Plano, TX.

Global Raptor information network. 2010. Species Account: Red-Tailed Hawk (Buteo jamaicensis). Available at: http://www.globalraptors.org. Accessed on September 29, 2010.

Gorsuch, J.W., R.O. Kringle, and K.A. Robillard. 1990. Chemical Effects of the Germination and Early Growth of Terrestrial Plants. *In* W, Wnag, J.W. Gorsuch, and W.R. Lower (eds.), Plants for Toxicity Assessment. ASTM STP 1091. American Society of Testing Materiala, Philadelphia, PA. pp. 49-58.

Howard, P.H. 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume III. Lewis Publishers, Chelsea, MI.

Humphreys, D.J. 1988. Veterinary Toxicology, 3rd Edition. B. Tindall, London, England. 356 p. (ISBN 0702012491).

Kaplan, D. I., Sajwan, K. S., Adriano, D. C., and Gettier, S. 1990. Phytoavailability and Toxicity of Beryllium and Vanadium. Water Air Soil Pollut. 53[3/4]:203-212.

Kristin, E.D., R.J. Maguire, D. Milani, and S.P. Batchelor. 1998. Toxicity of Tributyltin to Four Species of Freshwater Benthic Invertebrates Using Spiked Sediment Bioassays. Water Qual. Res. J. of Can. 33(1):111-132.

Lewis, R.R., III. 1986. Status of Mangrove Forests, Roosevelt Roads Naval Station, Puerto Rico. Buffalo, New York: Ecology and Environment.

Little, E.L. and F.H. Wadsworth. 1964. Common Trees of Puerto Rico and the Virgin Islands. Agricultural U.S Department of Agriculture, Forest Department, Washington, D.C. Agricultural Handbook No. 249.

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.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environ. Manage. 19(1):81-97.

Mac, M.J., P.A. Opler, C.E. Puckett Haecker, and P.D. Doran, 1998. Status and Trends of the Nation's Biological Resources. 2 Vols. U.S. Department of the Interior, U.S. Geological Survey, Reston, Va. Available at: http://www.nwrc.usgs.gov/sandt/index.html.

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.

MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Waters: Volume 1 - Development and Evaluation of Sediment Quality Assessment Guidelines. Prepared for Florida Department of Environmental Protection, Tallahassee, Fl. November 1994.

Maki, A.W. and J.R. Duthie. 1978. Summary of Propose Procedures for the Evaluation of Aquatic Hazard. *In* Cairns, J., Jr., K.L Dickson, and A.W. Maki (eds.), Estimating the Hazard of Chemical Substances to Aquatic Life. ASTM STP 657. pp.153-163.

Martin, A.C., H.S. Zim, and A.L. Nelson. 1951. American Wildlife and Plants: A Guide to Wildlife Food Habits. Dover Publications, Inc. New York, NY. 500 pp.

Menzie, C.A., D.E. Burmaster, J.S. Freshman, and C.A. Callahan. 1992. Assessment of Methods for Estimating Ecological Risk in the Terrestrial Component: A Case Study at the Baird & McGuire Superfund Site in Holbrook, Massachusetts. Environ. Toxicol. and Chem. 11:245-260.

Ministry of Housing, Spatial Planning and Environment (MHSPE). 2000. Intervention Values. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, Netherlands.

Naval Facilities Engineering Command Atlantic (NAVFAC). 2006. Biological Assessment for the Disposal of Naval Station Roosevelt Roads/Naval Activity Puerto Rico (Final Report). Naval Facilities Engineering Command Atlantic, Norfolk, VA.

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 Facilities Engineering Service Center (NFESC). 2003. Guidance for Environmental Background Analysis, Volume II: Sediment. NFESC User's Guide UG-2054-ENV.

NFESC. 2002. Guidance for Environmental Background Analysis, Volume 1: Soil. NFESC User's Guide UG-2049-ENV.

NFESC. 1996. Survey of Potential Habitat for Yellow-Shouldered Blackbird on U.S. Naval Station Roosevelt Road, Puerto Rico. Naval Facilities Engineering Command, Atlantic Division, Norfolk, VA.

Norwood, W.P., U. Borgmann, D.G. Dixon, and A. Wallis. 2003. Effects of Metal Mixtures on Aquatic Biota: A Review of Observations and Methods. Hum. Ecol. Risk Assess. 9(4):795-811.

Organization for Economic Co-Operation and Development (OECD). 1999. Screening Information Dataset (SIDs) for High Volume Chemicals: Acetone. United Nations Environmental Program (UNEP) Publications. 118 pp.

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

Persaud, D.R., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment (OMOE).

Puerto Rico Department of Natural Resources (PRDNR). 2002. Memorandum from Eduardo A. Ventosa-Febles to Jose L. Chabert, Director of Wildlife Division. August 12, 2002.

Puerto Rico Environmental Quality Board (PREQB). 2010. Puerto Rico Water Quality Standards Regulation. Regulation No. 7837. March 31, 2010.

Raffaele, H.A. 1989. A Guide to the Birds of Puerto Rico and the Virgin Islands. Princeton University Press, Princeton, N.J. 254 pp.

Reid, J.P., D. Easton, W.J. Kenworthy. 2001. Manatee and Seagrass Habitat Characterization in Puerto Rico. Department of the Navy and US Geological Survey Interagency Report, Agreement No. 320723L87. September 2001. 34 pp.

Reid, J.P. and C.R. Kruer. 1998. Mapping and Characterization of Nearshore Benthic Habitats around Vieques Island, Puerto Rico, Report to Navy. U.S. Geological Survey Biological Resource Discipline, Sirenia Project, Gainsville, Florida.

Right Way Environmental Contractors, Inc. (RWEC). 2009. Functional Assessment and Supplemental Sampling and Analytical program Within the Drainage Ditch Downgradient from SWMU 56. December 9, 2009.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, and T.L. Ashwood. 1998a. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-220.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter II. 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-219.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter, II and C.J.E. Welsh. 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National laboratory, Oak Ridge TN. ORNL/TM-13391.

Sample, B.E., D.M. Opresko and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory, Health Sciences Research Division, Oak Ridge, Tennessee.

Sample, B.E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, TN.ES/ER/TM-125.

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

Simmons, G.J. and M.J. McKee. 1992. Alkoxyresorufin Metabolism in White-Footed Mice at Relevant Environmental Concentrations of Aroclor 1254. Fundam. Appl. Toxicol. 19:446-452.

Suter II, G.W., R.E. Efroymson, B.E. Sample, and D.S. Jones. 2000. Ecological Risk Assessment for Contaminated Sites. Lewis Publishers, Boca Raton, FL. 438 pp.

Sutter II, G.W. and C.L Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. Oak Ridge National Laboratory, Health Sciences Research Division, Oak Ridge, TN. ES/ER/TM-96/R2.

Suter II, G.W. 1995. Guide for Performing Screening Ecological Risk Assessments at DOE Facilities. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-153.

Suter II, G.W. 1993. Ecological Risk Assessment. Lewis Publishers, Chelsea, MI. 538 pp.

Suter II, G.W. 1990. Endpoints for Regional Ecological Risk Assessment. Environ. Manage. 14:9-23.

Suter II, G.W. 1989. Ecological Endpoints. Chapter 2 *In* Warren-Hicks, W., B.R. Parkhurst, and S.S. Baker, Jr. (eds), Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference. EPA/600/3-89/013.

Tetra Tech Inc. 1986. Development of Sediment Quality Values for Puget Sound. Vol. 1. Bellevue, WA, 128 pp.

Tolson, P.J. 2004. Surveys for the Puerto Rican Boa, *Epicrates inornatus*, and the Virgin Islands Boa, *Epicrates monenis granti*, at the U.S. Naval Base, Roosevelt Roads, Puerto Rico. Prepared for Geo-Marine, Inc., Plano, Texas.

United Nations Environmental Program (UNEP). 1995. Regional Management Plan for the West Indian Manatee, *Trichechus manata*. Caribbean Environment Programme Technical Report No. 35. Kingston, Jamaica. Available at: http://www.cep.unep.org/pubs/Techreports/tr35en/index.html.

United States Army Corps of Engineers (USACE). 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). 2010. The PLANTS Database. National Plant Data Center, Baton Rouge, LA. Available at: http://plants.usda.gov. Accessed September 29, 2010.

United States Environmental Protection Agency (USEPA)/USACE. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual; ITM). Washington, D.C. EPA-823-B-98-004. February 1998.

United States Environmental Protection Agency (USEPA). 2010. Ecological Risk Assessment Frequently Asked Questions: Ecological Receptors. Available at: http://www.epa.gov/reg3hwmd/risk/eco/faqs/ecorecept.htm.

USEPA, 2009a. National Recommended Water Quality Criteria. Office of Water and Office of Science and Technology, Washington, D.C. Available at: http://www.epa.gov/waterscience/criteria/wqctable/.

USEPA. 2009b. Great Lakes Inititiative Toxicity Data Clearinghouse. Available at: http://www.epa.gov/gliclearinghouse/. Accessed June 29, 2010.

USEPA. 2009c. USEPA 2009. Scout 2008 Version 1.0 Users Guide, Second Edition, December 2008. EPA/600/R-08/038. February 2009. http://www.epa.gov/nerlesd1/databases/scout/abstract.htm

USEPA. 2009d. ProUCLVersion 4.00.04. Available at: http://www.epa.gov/esd/tsc/software.htm

USEPA. 2009e. ProUCLVersion 4.00.04 User Guide. EPA/600/R-07/038. February 2009. Available at: http://www.epa.gov/esd/tsc/ProUCL_v4.00.04_user_guide.pdf.

USEPA. 2009f. User's Guide for the ECOSAR Class Program: MS-Windows Version 1.00. February 2009.

USEPA. 2009g. Technical Reference Manual for the ECOSAR Class Program: MS-Windows Version 1.00. September 2009.

USEPA. 2008. Ecological Soil Screening Levels for Chromium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-66.
USEPA. 2007a. ECOTOX User Guide: Ecotoxicology Database System. Version 4.0. Available at: http:/www.epa.gov/ecotox/. Accessed August 28, 2009.

USEPA. 2007b. ProUCLVersion 4.00.02 User Guide. EPA/600/R-07/038. April 2007. Available at: http://www.epa.gov/esd/tsc/images/proucl-4-0-02-user.pdf.

USEPA. 2007c. 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.

USEPA. 2007d. 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.

USEPA. 2006. National Recommended Water Quality Criteria. Office of Water and Office of Science and Technolocgy, Washington, D.C. Available at: http://www.epa.gov/waterscience/criteria/wqctable/.

USEPA. 2005a. Guidance for Developing Ecological Soil Screening Levels. Office of Solid Waste and Emergency Response. Washington, D.C. OSWER Directive 9285.7-55.

USEPA. 2005b. Ecological Soil Screening Levels for Vanadium (Interim final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-75.

USEPA. 2004. Superfund Chemical Data Matrix. Available at: http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

USEPA, 2003a. 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.
USEPA. 2003b. USEPA Region 5 Ecological Screening Levels Table. Avaialble at: http://www.epa.gov/reg5rcra/ca/ESL.pdf.

USEPA. 2003c. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. Office of Research and Development, Washington, D.C. EPA-600-R-02-013.

USEPA. 2002a. National Recommended Water Quality Criteria: 2002. Office of Water. EPA 822-R-02-047.

USEPA. 2002b. Ambient Aquatic Life Water Quality Criteria for Tributyltin (TBT) - Draft. Office of Water. EPA 822-B-02-001.

USEPA. 2001a. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001. Available at: http://www.epa.gov/region4/waste/ots/ecolbul.htm.

USEPA. 2001b. Water Quality Criteria for the Protection of Human Health: Methylmercury. Office of Science and Technology, Office of Water, Washington, D.C. EPA-823-R-01-001.

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

USEPA. 2000b. 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).

USEPA. 1999a. Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish. Office of Water, Washington, D.C. EPA 841-B-99-02.

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

USEPA. 1999c. National Recommended Water Quality Criteria - Correction. 1999. Office of Water. EPA 822-Z-99-001.

USEPA. 1998. Guidelines for Ecological Risk Assessment. Risk Assessment Forum, Washington, DC. EPA/630/R-95/002B.

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.

USEPA. 1996. Ecotox Thresholds. ECO Update, Volume 3, Number 2. Office of Solid Waste and Emergency Response, Washington, D.C. EPA 540/F-95/038.

USEPA. 1993a. 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.

USEPA. 1993b. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

USEPA. 1992. Framework for Ecological Risk Assessment. USEPA, Risk Assessment Forum, Washington, DC. EPA/630/R92/001.

USEPA. 1991. Criteria for Choosing Indicator Species for Ecological Risk Assessments at Superfund Sites. EPA/101/F-90/051.

USEPA. 1990. Assessment of Risks from Exposure of Humans, Terrestrial and Avian Wildlife, and Aquatic Life to Dioxins and Furans from Disposal and Use of Sludge from Bleached Kraft and Sulfide Pulp and Paper Mills. EPA/560/5-90/013.

United States Fish and Wildlife Service. (USFWS), 2010. Threatened and Endangered Animals and Plants. Species Information. Available at: http://www.fws.gov/endangered/wildlife.html. Accessed: August 25, 2010.

USFWS. 1996a. Recovery Plan for the Yellow-Shouldered Blackbird (*Agelaius xanthomus*). USFWS, Southeast Region, Atlanta, GA.

USFWS. 1996b. Revised Recovery Plan for the Atlantic Coast Population of the Piping Plover (*Charadrius melodus*). USFWS, Region 5, Hadley, MA.

USFWS. 1987. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Puerto Rican Crested Toad. Federal Register, 52 (149):28828-28831.

USFWS. 1984. Recovery Plan for the Golden Coqui (*Eleutherodactylus jasperi*). USFWS, Southeast Region, Atlanta, GA.

USFWS. 1983. Yellow-Shouldered Blackbird Recovery Plan. USFWS, Southeast Region, Atlanta, GA.

Van Gestel, C. A. M., Dirven-Breemen, E. M., and Baerselman, R. 1993. Accumulation and Elimination of Cadmium, Chromium and Zinc and Effects on Growth and Reproduction in *Eisenia andrei* (Oligochaeta, Annelida). Sci. Total Environ. Part 1:585-597.

Van Gestel, C. A. M., Dirven-Van Breemen, E. M., Baerselman, R., Emans, H. J. B., Janssen, J. A. M., Postuma, R., and Van Vliet, P. J. M. 1992. Comparison of Sublethal and Lethal Criteria for Nine Different Chemicals in Standardized Toxicity Tests Using the Earthworm *Eisenia andrei*. Ecotoxicol. Environ. Saf. 23(2):206-220 (OECDG Data File)

Washington State Department of Ecology. 1995. Sediment Management Standards. Chapter 173-204 WAC. Olympia, Washington.

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.

Wheelwright, N.T. 1986. The Diet of American Robins: An Analysis of U.S. Biological Survey Records. Auk. 103:710-725.

Woods, C.A., G.B. Rathbun, T. Carr, and N. Carr. 1984. Distribution and Abundance of Manatees and Sea Turtles at Roosevelt Roads Naval Station, Puerto Rico, Progress Report. U.S. Navy Facilities Planning and Real Estate Division, Norfolk, Virginia.

8.0 HUMAN HEALTH RISK ASSESSMENT AND DEVELOPMENT OF CAOs

8.1 Introduction

This section presents the human health risk assessment (HHRA) for SWMU 56 – Hangar 200 Apron, 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, 2009a). The HHRA considers the most likely routes of potential human exposure for both current and future risk scenarios at SWMU 56. Should the results of the HHRA conclude that potential exposure to environmental media at SWMU 56 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.

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 United States Department of Defense (Longuemare, 1997) direct that CAOs should reflect the reasonably anticipated land use.

SWMU 56 (Hangar 200 Apron) covers an area of approximately 1.3 acres and is located on the south side of Ofstie Field, just off of the aircraft apron on the northwest side of Hangar 200, as shown on Figures 2-2 and 2-3. The Phase I ECP (LANTDIV, 2004) records review confirmed that Hangar 200 has historically been used for aircraft maintenance. As shown on Figure 2-3 of this report, areas of disturbance are represented by the 1958, 1961 and 1964 polygons. It was noted in the APA that there were stains/liquid observed extending off the edge of the hardstand to a surrounding drainage ditch from 1958-1965. A concrete channel is estimated to have been constructed between 1985 and 1995, in the area of the stained soil adjacent to the concrete apron. The physical site inspections conducted during the ECP investigations did not observe any significant stains or stressed vegetation. However, interviews confirmed numerous past spills of petroleum, oils, and lubricant (POL) and hazardous materials from the 1950s to the 1990s, and the former use of the concrete apron as an aircraft wash down area is considered likely.

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 56 and the potential human receptors/exposure pathways listed in Attachment II of the RCRA §7003 Administrative Order on Consent for NAPR (USEPA, 2007a), 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), ingestion of groundwater as a potable source (Note that the Consent Order [USEPA, 2007a] states groundwater at NAPR is not used for potable purposes. However, Puerto Rico considers all of its groundwater as a potential potable source. As such, ingestion of groundwater is conservatively evaluated for the industrial receptor.), and volatiles in groundwater emitted through soil into buildings in the vicinity of SWMU 56. 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 56. It should be noted that the concrete channels/culverts are currently overgrown with vegetation and there are no maintenance activities occurring at the SWMU. However, it is assumed an on-site worker (individual who performs various maintenance and manual labor activities at the SWMU) could be exposed to contaminated soil, surface water, and sediment. It is also conservatively assumed that adult and/or youth trespassers may gain access to the site and could be exposed to contaminated soil, surface water, and sediment.

Future residential land use is conservatively assumed for SWMU 56, although it is not included in the RCRA §7003 Administrative Order on Consent (USEPA, 2007a) 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. Potential exposures to all media (soil, groundwater, surface water, and sediment) were conservatively assumed for future residents.

8.3 Human Health Risk Assessment

This section presents the results of the HHRA prepared for this CMS. The baseline HHRA considers the most likely routes of potential human exposure for both current and future risk scenarios. The baseline 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 HHRA. Additionally, Section 8.4 presents the development of CAOs, as applicable, and Section 8.5 presents the references.

8.3.1 Selection of Chemicals of Potential Concern

8.3.1.1 Data Evaluation

The data used in the revised HHRA are presented in full in Appendix H. A statistical analysis, including the minimum, maximum, mean, standard deviation and 95% upper confidence limit (UCL), was run for applicable data sets (i.e., surface soil, total soil, groundwater, surface water, and sediment COPCs). The statistical summary of data used in the HHRA is located in Appendix I. Data utilized in the HHRA is discussed in the paragraphs below. For duplicate samples, the higher of the two concentrations (environmental versus duplicate) was used, not both. The total and dissolved metals analytical results from groundwater samples were included in the COPC selection. However, only the analytical results for total metals were used to estimate exposure concentrations. The dissolved metals data are presented to indicate that the observed metals in the groundwater samples could be associated with suspended particles in the water samples. Further, RAGS Part A (USEPA, 1989) guidance states that filtered groundwater data can provide useful information for understanding chemical transport within an aquifer. As appropriate, dissolved groundwater data will be qualitatively evaluated in relationship to corresponding total groundwater data. The following paragraphs describe the data used in the HHRA for SWMU 56.

Sampling activities at SWMU 56 were conducted under four separate investigations. A Phase II ECP field investigation was conducted in 2004 and involved the collection of two surface water samples (designated 2E-SW01 and 2E-SW02) and one sediment sample (designated 2E-SD01). Each of the surface water and sediment samples were analyzed at a fixed-base analytical laboratory for Appendix IX VOCs, Appendix IX SVOCs, TPH DRO and GRO, as well as Appendix IX total metals. 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 water and sediment data were deemed unacceptable for use in the HHRA. However, these data are presented in Tables 6-7 through 6-10 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, groundwater, surface water, and sediment samples. A total of eight surface soil samples were collected from the 0.0 to 1.0-foot depth interval and designated 56SB01 through 56SB08. Two subsurface soil samples were collected from each of the eight sol borings for a total of 16 subsurface soil samples (56SB01-01, 56SB01-04, 56SB02-02, 56SB02-04, 56SB03-02, 56SB03-04, 56SB04-03, 56SB04-04, 56SB05-03, 56SB05-05, 56SB06-01, 56SB06-03, 56SB07-02, 56SB07-03, 56SB08-01, and 56SB08-02). The sampling depths were selected based on the field geologist's discretion to represent the variability in the predominantly clayey soil type in the shallower depths and observations of moisture, dampness or saturated soil in the deeper depths. Five surface water samples (56SW01, 56SW02, 56SW03, 56SW04, and 56SW05) were collected along with three sediment samples (56SD03, 56SD04, and 56SD05). Eight groundwater wells were installed at each of the soil boring locations as referenced above. Sampling locations are depicted on Figures 4-1 and Figure 4-2. Each surface soil, subsurface soil, and sediment sample was analyzed for Appendix IX VOCs, SVOCs (including LLPAHs), and metals. Groundwater samples were analyzed for Appendix IX VOCs and SVOCs (including LLPAHs), as well as total (unfiltered) and dissolved Appendix IX metals. Surface water sample analysis included SVOCs (including LLPAHs), as well as total (unfiltered) and dissolved Appendix IX metals. All analytical data for surface soil, subsurface soil, groundwater, surface water, and sediment samples collected during CMS field investigation were quantitatively evaluated in the HHRA.

A pre-excavation field investigation was conducted from September 24, 2008 to September 25, 2008 and involved the collection of surface soil and drainage ditch sediment. A total of twelve surface soil samples (designated 56SS01 through 56SS12; collected from the 0.0 to 1.0-foot depth interval) and three drainage ditch sediment samples (designated 56SD12 through 56SD14) were collected. As depicted on Figure 4-2, sediment was collected from Drainage Ditch Segment E-F. Surface soil samples 56SS01 through 56SS06 were analyzed for lead and selenium and surface soil samples 56SS07 through 56SS12 were analyzed for selenium and vanadium, while each drainage ditch sediment sample was analyzed for Appendix IX metals. All additional surface soil and sediment data collected in September 2008 were quantitatively evaluated in the HHRA.

A supplemental field investigation was conducted on June 27, 2009 and involved the collection of eight sediment samples (designated 56SD15 through 56SD22). Sediment samples 56SD15, 56SD16, 56SD17, 56SD18, 56SD19, and 56SD20 were collected from Drainage Ditch Segment E-F, while sediment samples 56SD21 and 56SD22 were collected from Drainage Ditch Segment G-H (Figure 4-2). Each sediment sample was analyzed for Appendix IX metals, AVS, and SEM. Additional sediment data (Appendix IX metals only) collected in June 2009 were quantitatively evaluated in the HHRA.

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., polynuclear aromatic hydrocarbons (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 56 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 56. 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 by the USEPA 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 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 RSLs 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 hazard quotient (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 May 2010 version of the RSL table (USEPA, 2010a) was used in this HHRA.

In this HHRA, chemicals detected in groundwater are compared to tap water RSLs. Chemicals detected in soil are compared to residential soil RSLs. Chemicals detected in surface water were conservatively compared to tap water RSLs, while those detected in sediment were conservatively compared to residential soil RSLs. It should be noted that although residential screening criteria were conservatively used in this HHRA, residential land use is not likely to occur at SWMU 56.

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 tables, the constituent was evaluated using the screening values for a surrogate chemical, if appropriate and available. Soil and water screening values for total chromium were not available from the RSL table. Soil screening values for benzo(g,h,i)perylene and phenanthrene were not available from the RSL tables. Pyrene was selected as a surrogate chemical for these compounds during the COPC selection process because of its structural similarity.

Trivalent chromium was selected as a surrogate chemical since there is no history of hexavalent chromium production operations at SWMU 56. It should be noted that chromium will be present predominantly in the trivalent chromium oxidation state in most soils. While hexavalent chromium contamination is generally associated with industrial activity, it can occur naturally. Oxidation of trivalent chromium to hexavalent chromium can occur in the soil environment. The relation between trivalent chromium and hexavalent chromium strongly depends on pH (the process is enhanced at pH values greater than 6) and oxidative properties of the location, but in most cases, the trivalent chromium is the dominating species (Kotaś and Stasicka, 2000). Most trivalent chromium in soil is immobilized due to adsorption and complexation with soil materials. As such, due to the lack of availability of mobile trivalent chromium, a large portion of chromium in soil will not be oxidized to hexavalent chromium even with favorable oxidation and pH conditions (ATSDR, 2008).

8.3.1.2.3 Selection of COPCs

The following paragraphs present the rationale for selection of COPCs. Tables 8-1 through 8-5 present the selection of COPCs. 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. The background data referenced in this section are taken from the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010), for NAPR. The criterion used for screening is the ULM, which is calculated as the mean plus two times the standard deviation of the mean. 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 surface soil, subsurface soil, groundwater, surface water, and sediment are presented in Section 6.0 and in the appendices of this CMS Investigation Report.

Surface Soil

The data and COPC selection summary for surface soil samples collected at SWMU 56 are presented in Table 8-1.

There were no VOCs detected in the surface soil at concentrations above corresponding residential soil RSLs. Iodomethane currently has no screening criteria available; therefore, it was retained as a surface soil COPC as a conservative measure.

The carcinogenic PAH benzo(a)pyrene was detected in the surface soil at a maximum concentration above its residential soil RSL and was retained as a COPC for residential soil. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene 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.

Arsenic, cobalt, and vanadium were detected in surface soil at concentrations exceeding corresponding residential soil RSLs and were retained as surface soil COPCs. Thallium currently has no screening criteria available; therefore, it was retained as a surface soil COPC as a conservative measure. Four of eight concentrations of arsenic and one of eight concentrations of vanadium exceeded corresponding background screening concentrations. All detected concentrations of cobalt and thallium were less than background.

Total Soil

The existing SWMU 56 surface soil (0-1 foot bgs) and subsurface soil (1-10 feet bgs) data sets were combined to create one total soil column (0-10 feet bgs) data set. The data and COPC selection summary for total soil samples collected at SWMU 56 are presented in Table 8-2.

There were no VOCs detected in the total soil at concentrations above corresponding residential soil RSLs. Iodomethane currently has no screening criteria available; therefore, it was retained as a total soil COPC as a conservative measure.

The carcinogenic PAH benzo(a)pyrene was detected in the total soil at a maximum concentration above its residential soil RSL and was retained as a COPC for total soil. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene 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.

Arsenic, cobalt, mercury, and vanadium were detected in total soil at concentrations exceeding corresponding residential soil RSLs and were retained as total soil COPCs. Thallium currently has no screening criteria available; therefore, it was retained as a total soil COPC as a conservative measure. Seven of twenty-two concentrations of arsenic, one of twenty-four detections of cobalt, two of eighteen detections of mercury, and four of twenty-nine concentrations of vanadium exceeded corresponding background screening concentrations. All detected concentrations of thallium were less than background.

Groundwater

Table 8-3 summarizes the COPC selection performed for constituents detected in groundwater samples collected at SWMU 56. It is noted here that groundwater data were not collected during the Phase II ECP investigation.

There were no VOCs detected in the groundwater at concentrations above corresponding tap water RSLs. Therefore, VOCs were not retained as COPCs for groundwater.

There were no SVOCs detected in the groundwater at concentrations above corresponding tap water 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 corresponding tap water RSLs. Arsenic, cobalt, and vanadium were all detected at concentrations below corresponding background screening concentrations. Of the filtered (dissolved) inorganic constituents detected in groundwater, dissolved arsenic, cobalt, and vanadium were of similar concentrations as those found in the total fraction. Mercury was detected in the dissolved fraction but not total.

Surface Water

Table 8-4 summarizes the COPC selection performed for constituents detected in surface water samples collected at SWMU 56. There were no SVOCs detected in the surface water at SWMU 56.

Arsenic, cobalt, lead, and vanadium were detected in surface water at concentrations exceeding corresponding screening values (tap water RSLs and drinking water Action Level for lead) and were retained as surface water COPCs. As previously mentioned, there are no background screening concentrations established for surface water at SWMU 56.

Sediment

Table 8-5 summarizes the COPC selection performed for constituents detected in sediment samples collected at SWMU 56.

There were no VOCs detected in the sediment at concentrations above corresponding screening criteria (residential soil RSLs). Iodomethane currently has no screening criteria available; therefore, it was retained as a sediment COPC as a conservative measure.

The carcinogenic PAHs benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene were detected in the sediment at maximum concentrations above corresponding screening criteria and were retained as COPCs for sediment. Benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected at concentrations below corresponding screening criteria. However, these carcinogenic PAHs were re-included as COPCs for sediment because of the potential additive toxic effects of carcinogenic PAHs.

Arsenic, cobalt, and vanadium were detected in sediment at concentrations exceeding corresponding screening criteria and were retained as sediment COPCs. Seven of thirteen concentrations of arsenic, four of fourteen detections of cobalt, two of eighteen detections of mercury, and two of fourteen concentrations of vanadium exceeded corresponding airfield freshwater drainage ditch background screening concentrations.

8.3.1.2.3 Summary of COPCs

- *Surface Soil*: Iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic, cobalt, thallium, and vanadium.

- *Total Soil*: Iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic, cobalt, mercury, thallium, and vanadium.

- *Groundwater*: Total arsenic, cobalt, and vanadium.

- *Surface Water*: Total arsenic, cobalt, lead, and vanadium.

- *Sediment*: Iodomethane, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic, cobalt, and vanadium.

8.3.2 Exposure Assessment

An exposure assessment was performed to evaluate the potential exposure of the identified human receptors to the site media based on current and anticipated future land use for SWMU 56. The exposure assessment includes potential exposure pathways for human receptors, potential routes of exposure, exposure factor assumptions, and estimated exposure concentrations. In order to establish a complete exposure pathway, the following four elements were considered (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, 2009a), 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 8-6.

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
- Future Adult Resident
- Future Young Child (1-6 years) Resident
- Future Industrial/Commercial Adult Worker
- Future Construction Worker
- Current/Future On-site 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, 2007a) 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. Therefore, potential exposures to surface soil (0 to 1 foot bgs), total soil (0 to 10 feet bgs), ingestion of groundwater as a potable source (Note that the Consent Order [USEPA, 2007a] states groundwater at NAPR is not used for potable purposes. However, Puerto Rico considers all of its groundwater as a potential potable source. As such, ingestion of groundwater is conservatively evaluated for the industrial receptor.), and inhalation of 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 56 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 56 is relatively shallow at some locations. It should be noted that the concrete channels/culverts are currently overgrown with vegetation and there are no maintenance activities occurring at the SWMU. However, it is assumed an on-site worker (individual who performs various maintenance and manual labor activities at the SWMU) could be exposed to contaminated surface soil, total soil, surface water, and sediment. Additionally, it is conservatively assumed that adult and/or youth trespassers may gain access to the site now or in the future and could be exposed to surface soil, total soil, surface water, and sediment. Trespasser receptors are listed in the RCRA §7003 Administrative Order on Consent (USEPA, 2007a).

Future residential land use is conservatively assumed for SWMU 56. 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, 2007a). Additionally, the industrial setting of the SWMU (i.e., airport property) precludes its use as a residential site. However, a future residential exposure scenario was included for conservative comparison with other exposure scenarios. A residential land use scenario is also incorporated to evaluate unrestricted land use and provide the most conservatively protective risk estimation. Future residents may be exposed to surface soil, total soil, groundwater, surface water, and sediment.

The two VOCs detected in groundwater (acetone and chloromethane) were evaluated against the generic screening levels presented in USEPA's Draft Subsurface Vapor Intrusion Guidance (USEPA, 2002b). The detected concentration of acetone (7.1 µg/L) was well below its generic screening level of 220,000 µg/L (based on a target hazard index of 1.0). The detected concentration of chloromethane (1.8 µg/L) was also below its generic screening level of 6.7 µg/L (based on target risk of 1 x 10^{-06}). (Note: A review of the current toxicity criteria available from IRIS indicates that the RfD for acetone has been revised since the 2002 vapor intrusion screening levels were developed (from 0.1 mg/kg-day to 0.9 mg/kg-day in 2003). However, this change in the RfD would not impact the magnitude of the vapor intrusion screening level such that the acetone concentration in SWMU 56 groundwater would exceed this level.) Furthermore, the VOCs did not exceed corresponding Regional tap water RSLs, which indicates that potential exposure to vapors volatilizing directly from water into a shower or trench is not of concern. Therefore, it is not necessary to quantitatively evaluate the inhalation of VOCs in groundwater (either directly or indirectly) in this HHRA.

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, Surface Water, and Sediment
- Dermal Contact with Soil, Surface Water, and Sediment
- Inhalation of Fugitive Dusts/Volatiles Emanating from Soil

Future Adult and Young Child (Ages 1-6 Years) Residents

- Ingestion of Soil, Groundwater, Surface Water, and Sediment
- Dermal Contact with Soil, Groundwater, Surface Water, and Sediment
- 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
- Ingestion of Groundwater

Future Construction Workers

- Ingestion of Soil
- Dermal Contact with Soil
- Inhalation of Fugitive Dusts/Volatiles from Soil
- Ingestion of Groundwater
- Dermal Contact with Groundwater

Current/Future On-Site Workers

- Ingestion of Soil, Surface Water, and Sediment
- Dermal Contact with Soil, Surface Water, and Sediment
- Inhalation of Fugitive Dusts/Volatiles Emanating 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 56 are summarized in the conceptual site model in Figure 8-1 of this HHRA. A current receptor exposure scenario at SWMU 56 may consist of trespassers and on-site workers. Future receptor exposure scenarios at this site may consist of trespassers, residents, adult industrial/commercial workers, construction workers, and on-site workers.

Potential contaminant release mechanisms from affected media include transport of chemicals associated with surface releases in the form of spills to the surface of the Hangar 200 concrete apron via surface run-off to downgradient surface soil and drainage ditch surface water and sediment, storm water runoff of chemicals in surface soil via surface runoff to downgradient surface soil and drainage ditch surface water and sediment, leaching to underlying groundwater, and advective transport in the direction of groundwater flow. Potentially affected media at SWMU 56 may include one or more of the following: surface and subsurface soil (i.e., total soil), groundwater, surface water, and sediment.

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 56 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, 2009b and 2009c), to calculate UCLs for use in risk assessments. ProUCL Version 4.00.04 (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 4.00.04. ProUCL 4.00.04 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). Note that the 95% UCLs were calculated in the "with NDs" mode, as applicable.

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 56, COPCs were selected from both surface soil (0 to 1 foot bgs) and total soil (0 to 10 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. In the surface soil, total soil, and groundwater COPC data sets, there were instances in which the maximum concentration was used because of low frequencies of detection (refer to Tables 8-1 through 8-3). The maximum concentration was also selected as the EPC for thallium in total soil because the the 95% UCL was greater than the maximum. However, thallium was not quantitatively evaluated in the HHRA due to lack of toxicity criteria. The surface water COPC data sets had five sample points in them (refer to Table 8-4), and the sediment SVOC COPC data sets had three sample points in them (refer to Table 8-5). 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.

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 2.5 acre aerial extent of site contamination (based on the area immediately surrounding the former power plant) were used in the site-specific PEF calculation.

The computational output from the ProUCL calculations performed for each COPC is presented in Appendix I. The equations for estimating intakes due to direct exposures to site-related chemicals for the various identified pathways are presented in Appendix J. The calculation of the site-specific PEF is included in Appendix K (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 6.6 of this report.

8.3.2.5 Exposure Input Parameters

Table 8-6 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, surface water, and sediment at SWMU 56. Therefore, these receptors were evaluated for potential exposure to soil, surface water, and sediment via ingestion and dermal contact, as well as inhalation of volatiles and/or fugitive dust in soil. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-6.

A 70 kilogram (kg) adult and a 45 kg youth (USEPA, 1997a) were assumed to have exposure durations (EDs) of 24 years and 11 years, respectively (USEPA, 1991). Exposure times (ETs) were estimated to be 2 hours per day (USEPA, 1997a) in relationship to inhalation of fugitive dusts and surface water exposure. An ingestion rate (IR) of 100 milligrams per day (mg/day) for surface soil and sediment 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). An IR of 0.05 liter per hour (L/hour) was used for surface water for both the adult and youth assuming a wading scenario (USEPA, 1989). The exposure frequency (EF) was assumed to be 52 events/year (professional judgment), based on anticipated exposures of one day/week/year. Averaging times 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). An AF of 0.3 mg/cm^2 was used for sediment for both adult and youth trespassers and is based on contact with wet sediment (VDEQ, 2010). Dermal absorption values were applied as previously discussed. 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) (USEPA, 1997a) and 5,700 cm^2 for the adult (USEPA, 2004) were assumed for the soil, surface water, and sediment 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 (VDEQ, 2010) 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.

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, groundwater, surface water, and sediment at SWMU 56. Therefore, these receptors were evaluated for potential exposure to soil, surface water, and sediment 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, 2007a), Puerto Rico classifies its groundwater as a drinking water source and as such, it is also 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 for the adult receptor since the only VOCs detected in groundwater (acetone and chloromethane) did not exceed their Regional Tap Water RSLs. 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 8-6.

Future adult and young child residents could contact soil and sediment 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. An IR of 0.05 L/hour (USEPA, 1989) was used for surface water along with an ET of two hours/day (USEPA, 1997a) for both the adult and young assuming a swimming scenario. The EF was assumed to be 52 events/year (professional judgment) for surface water and sediment exposure. Averaging times 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, 2010). 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, surface water, 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. The exposure times to groundwater 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 groundwater exposure scenario. Most of the same assumptions used for estimating exposures to soil (i.e., exposure duration, exposure frequency, body weight, inhalation rates, and carcinogenic and noncarcinogenic averaging time) were also applied to the evaluation of ingestion and dermal 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 56. Therefore, this receptor was evaluated for potential exposure to soil via ingestion, dermal contact, and inhalation of volatiles and/or fugitive dust. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-6.

The IR for a 70 kg adult industrial/commercial worker exposed to soil was assumed to be 100 mg/day (USEPA, 2002a) for the RME scenario, and the fraction ingested was assumed to be 100 percent. An EF of 250 days per year (USEPA, 2004) for soil was used in conjunction with an ED of 25 years (USEPA, 2004) for the RME scenario. An ET of 8 hours/day (professional judgment) assuming a typical 8 hour work day was also used. An averaging time (AT) of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds while an averaging time 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 50^{th} 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.

A groundwater ingestion rate of 1 liter per day (L/day) was used for industrial/commercial workers (USEPA, 1991). This value assumes that all drinking water is obtained from the same source for the exposure duration. Most of the same assumptions used for estimating exposures to soil (i.e., exposure duration, exposure frequency, body weight, and carcinogenic and noncarcinogenic averaging time) were also applied to the evaluation of ingestion exposure to groundwater.

As previously discussed, the VOCs detected in groundwater (acetone and chloromethane) were evaluated against the generic screening levels presented in USEPA's Draft Subsurface Vapor Intrusion Guidance (USEPA, 2002b). The detected concentration of acetone (7.1 µg/L) was well below its generic screening level of 220,000 µg/L (based on a target hazard index of 1.0). The detected concentration of chloromethane (1.8 µg/L) was also below its generic screening level of 6.7 µg/L (based on target risk of 1×10^{-06}). Therefore, the inhalation of VOCs in groundwater via the vapor intrusion exposure pathway was not quantitatively evaluated for this receptor.

Future Adult Construction Workers

Potential exposures to soil COPCs may occur to construction workers while performing soil excavation and construction activities at SWMU 56. Exposure pathways evaluated include ingestion, dermal contact, and inhalation of fugitive dust of soil. Exposure to groundwater at SWMU 56 was also evaluated as a conservative measure. The shallow groundwater aquifer was measured approximately 6 feet bgs as noted in Section 5.0. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-6.

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. A soil to skin adherence factor of 0.3 mg/cm^2 (USEPA, 2002a) was used for soil, and dermal absorption values were applied as previously discussed. The averaging time of 365 days for noncarcinogens and 25,550 days for carcinogens, respectively, were also used (USEPA, 1989). A site-specific PEF of 5.6×10^{06} was calculated for the construction worker scenario.

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, inhale volatiles emitted from the water, and be immersed from the waist down for an assumed duration of one hour. An ingestion rate of 0.02 L/day (VDEQ, 2010) 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).

As previously discussed, the only VOC detected in groundwater was acetone and chloromethane, which were detected at concentrations below their Regional tap water RSLs. This indicates that potential exposure to vapors volatilizing directly from water into a shower or trench is not of concern. Therefore, the inhalation of VOCs in groundwater present in a trench was not quantitatively evaluated for this receptor.

Current/Future On-Site Workers

This scenario assumes that current on-site workers could come into contact with soil, surface water, and sediment at SWMU 56. It is possible that maintenance activities may include mowing and facilities maintenance and as such, would have the potential for direct or indirect contact with soil. Additionally, based on the presence of the channels/culverts, it was conservatively assumed that an on-site worker could potentially contact surface water and sediment. Therefore, this receptor was evaluated for potential exposure to soil, surface water, and sediment via ingestion and dermal contact, as well as inhalation of fugitive dust in soil. A summary of the exposure parameters is discussed in the following paragraphs and presented on Table 8-6.

The IR for a 70 kg adult on-site worker exposed to surface soil and sediment was assumed to be 100 mg/day (USEPA, 2002a), and the fraction ingested was assumed to be 100 percent (professional judgment). An IR of 0.05 liter per hour (L/hour) was used for surface water exposure assuming a wading scenario (USEPA, 1989). An EF of 250 days per year (USEPA, 2004) for surface soil and sediment was used in conjunction with an ED of 25 years (USEPA, 2004) for the RME scenario. An ET of 8 hours/day (professional judgment assuming a typical 8 hour work day) in relationship to inhalation of fugitive dusts, and an ET of 2 hours/day in relationship to surface water exposure were also used. An AT of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds while an averaging time of 9,125 days was used for noncarcinogenic exposures.

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 surface soil, surface water, and sediment. An soil to skin AF of 0.2 mg/cm^2 was used for soil and is based on the 50^{th} percentile weighted AF for utility workers, which is the activity determined by USEPA to represent a reasonable, high-end contact activity (USEPA, 2004). An AF of 0.3 mg/cm^2 was used for sediment and is based on contact with wet sediment (VDEQ, 2010).

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).

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 8-7 for the identified COPCs.

The hierarchy (USEPA, 2003) for choosing these toxicity values was:

- Tier 1 – Integrated Risk Information System (IRIS) (USEPA, 2010b)

- 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 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 56 soil and sediment. 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 K.

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 56. 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, 2009a), 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 8-8 through 8-13. All calculation spreadsheets used for estimating potential carcinogenic and noncarcinogenic risks for receptors are presented in Appendix K. RAGS Part D tables are presented in Appendix L.

Current/Future Adult and Youth Trespassers

As shown in Tables 8-8 and 8-9, the total site ILCRs calculated for the adult and youth trespassers were 2.4 x 10^{-06} and 1.5 x 10^{-06}, respectively. Therefore, carcinogenic risks were calculated that fall within USEPA's acceptable risk range of 1 x 10^{-06} to 1 x 10^{-04} for the current/future adult and youth trespasser upon exposure to environmental media (soil, surface water, and sediment) at SWMU 56. It is noted that no individual chemicals exceeded the point of departure risk of 1 x 10^{-06}.

The total site HIs (6.9 for the adult trespasser and 9 for the youth trespasser) exceeded USEPA's acceptable hazard level of 1.0. These exceedances were due primarily to potential exposure to vanadium in soil and sediment (approximately 94% combined risk contribution to the total site HI). For the adult trespasser, the soil HI was 1.99, and the HI for vanadium in soil was 1.97. Similarly, the sediment HI was 4.63, and the HI for vanadium in sediment was 4.58. The surface water HI (0.3) was below USEPA's acceptable hazard level of 1.0. For the youth trespasser, the soil HI was 4.22, and the HI for vanadium in soil was 4.18. The sediment HI was 4.49, and the HI for vanadium in sediment was 4.41. The surface water HI (0.31) was below USEPA's acceptable hazard level of 1.0.

Future Adult and Young Child Residents

As shown in Tables 8-10 and 8-11, the total site ILCRs calculated for adult and young child residential exposures (2.8×10^{-05} and 2.5×10^{-05}, respectively) to soil, groundwater, surface water, and sediment at SWMU 56 were within USEPA's acceptable target risk range of 1×10^{-06} to 1×10^{-04}. It follows that the total lifetime risk (5.3×10^{-05}) falls within USEPA's acceptable target risk range. It is noted that the following chemicals exceeded the point of departure risk of 1×10^{-06} : arsenic in soil and groundwater for the future adult and child residents, arsenic in sediment for the future child resident, and benzo(a)pyrene in sediment for the future adult and child residents.

The total site HIs (29 for the adult and 144 for the child) exceeded USEPA's acceptable hazard level of 1.0. The exceedances of the site HIs were primarily due to vanadium in soil, groundwater, and sediment (approximately 86% and 92% combined risk contributions to the total site HIs for the adult and child, respectively). Total cobalt in groundwater also contributed to the HI exceedances (approximately 12% and 6% risk contributions to the total site HIs for the adult and child, respectively). The individual HQs for adult and young child exposure to all other noncarcinogenic COPCs in soil, groundwater, and sediment were less than 1.0. It should be noted that cobalt and vanadium concentrations in SWMU 56 groundwater were below corresponding background screening values.

Future Industrial/Commercial Worker

As shown in Table 8-12, the total site carcinogenic risk for the future industrial/commercial worker was 4.7×10^{-06}, which is within the USEPA's acceptable target risk range of 1×10^{-06} to 1×10^{-04}. It is noted that only arsenic in soil and groundwater slightly exceeded the point of departure risk of 1×10^{-06}. However, risks presented from arsenic in soil and groundwater fall below 1×10^{-06} when accounting for contribution of background levels of arsenic (refer to Appendix M, Background Risk Calculations). The difference between the site-specific risk from arsenic in soil (1.8×10^{-06}) and background risk from arsenic in airfield soil (7.4×10^{-07}) equals 1.06×10^{-06}. The background risk from arsenic in groundwater (4.7×10^{-05}) is greater than the site-specific risk from arsenic in groundwater (2.7×10^{-06}).

The total site HI (16.9) exceeded USEPA's acceptable hazard level of 1.0. The exceedance of the site HI was due primarily to potential exposure to vanadium in soil and groundwater (approximately 92% risk contribution to the total site HI). The soil HI was 13.4, while the HI for vanadium in soil was 13.3. The groundwater HI was 3.45, while the HI for vanadium in groundwater was 2.19. Total cobalt in groundwater also contributed to the HI exceedance (approximately 7% to the total site HI). The individual HIs for industrial/commercial worker exposure to all other noncarcinogenic COPCs in soil and groundwater were less than 1.0.

Future Construction Worker

As shown in Table 8-13, the total site carcinogenic risk for the future construction worker was 3.98×10^{-07}, which falls below the USEPA's acceptable target risk range of 1×10^{-06} to 1×10^{-04}. However, the total site HI (27) exceeded USEPA's acceptable hazard level of 1.0. The exceedance of the site HI was due primarily to potential exposure to vanadium in soil (approximately 97% risk contribution to total site HI). The soil HI was 26.9, while the HI for vanadium in soil was 26.53. The individual HQs for construction worker exposure to all other noncarcinogenic COPCs in soil were less than 1.0.

Current/Future Adult On-Site Worker

As shown on Table 8-14, the total site carcinogenic risk for the adult on-site worker was 1.1×10^{-05}, which is within the USEPA's acceptable target risk range of 1×10^{-06} to 1×10^{-04}. It is noted that only arsenic in soil, surface water, and sediment exceeded the point of departure risk of 1×10^{-06}. However, risks presented from arsenic in soil and sediment fall below 1×10^{-06} when accounting for contribution of background levels of arsenic (refer to Appendix M, Background Risk Calculations). The difference between the site-specific risk from arsenic in soil (1.8×10^{-06}) and background risk from arsenic in airfield soil (7.4×10^{-07}) equals 1.06×10^{-06}. Risks from background concentrations of arsenic (1.0×10^{-06}) account for 100% of site-specific risks from arsenic in sediment (1.0×10^{-06}).

The total site HI (28.9) exceeded USEPA's acceptable hazard level of 1.0. The exceedance of the site HI was due primarily to potential exposure to vanadium in soil and sediment (approximately 95% risk contribution to the total site HI) with vanadium in surface water contributing a minor amount (approximately 4% risk contribution to the total site HI). The soil HI was 13.4, while the HI for vanadium in soil was 13.3. The sediment HI was 14.3, while the HI for vanadium in sediment was 14.1. The surface water HI was 1.12, while the HI for vanadium in surface water was 1.1. The individual HQs for on-site worker exposure to all other noncarcinogenic COPCs in soil, surface water, and sediment were less than 1.0.

8.3.5 Comparison to Background Levels

As part of the COPC selection process, the maximum detected concentrations of metals in environmental media (with the exception of surface water due to lack of appropriate background data for comparison) sampled at SWMU 56 (specifically, soil, groundwater, and sediment) were compared to NAPR-specific background concentrations (ULM for each inorganic) established in 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 presented from 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 56) that is attributable to background concentrations can be seen and used in risk management decisions. Estimated risks associated with metals within background levels are presented in Appendix M, Background Risk Calculations.

Vanadium was detected in all media sampled at SWMU 56, and contributed predominantly to the total site HIs for all receptors. Vanadium was detected at maximum concentrations above its background screening values in surface soil, total soil, and sediment, while it was detected at concentrations below background in groundwater. Table 8-15 presents a comparison of the estimated HIs for vanadium associated with background to those specific to SWMU 56.

8.3.5.1 Soil

COPCs were selected from both surface soil (0 to 1 foot bgs) and total soil (0 to 10 feet bgs) for the soil exposure pathway evaluation for SWMU 56. 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 surface soil (since the 95% UCL for vanadium in surface soil was greater than that in total soil). The airfield soil background data set for vanadium was used for comparison of site-specific risks to background risks from vanadium in the surface soil.

As shown in Table 8-1, the maximum detected vanadium concentration in surface soil exceeded its background screening value. Vanadium was detected at concentrations above its background screening value (367 mg/kg) in one sample locations (specifically, 430 mg/kg at 0 to 1 foot in 56SS09). This site-related surface soil vanadium concentration exceeded maximum background by less than 5%. All remaining surface soil concentrations, including those in the vicinity of the pad, were less than background.

As discussed in Section 8.3.4.3 and shown in Tables 8-8 through 8-14, the 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 56 soil. However, as shown in Table 8-15, potential exposure to background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil.

As shown on Table 8-15, the site-specific vanadium HI for the adult trespasser receptor scenario is 1.97, while the background vanadium HI is 1.53. Therefore, the difference between the site-specific HI and background vanadium HI is 0.44, which is below USEPA's acceptable hazard value of 1.0. Similarly, for the youth trespasser, the difference between the site-specific HI (4.18) and background vanadium HI (3.24) is 0.94, which is below USEPA's acceptable hazard value of 1.0. Therefore, the contribution of risks from vanadium in SWMU 56 soil to overall risk from site-related activities is below the acceptable hazard level for the current/future adult and youth trespasser receptors.

In the case of the future residential receptor scenarios, the site-specific vanadium HI for the adult resident is 13.24, while the background vanadium HI is 10.3. Therefore, the difference between the site-specific HI and background vanadium HI is 2.94. Similarly, for the young child receptor, the difference between the site-specific HI (101.29) and background vanadium HI (78.5) is 22.79. As such, the remaining vanadium HIs for both residential receptor scenarios exceed USEPA's acceptable hazard value of 1.0.

In the case of the future industrial receptor scenarios, the site-specific vanadium HI for the industrial/commercial worker is 13.3, while the background vanadium HI is 10.2. Therefore, the difference between the site-specific and background vanadium HIs is 3. Similarly, for the construction worker, the difference between the site-specific HI (26.53) and background vanadium HI (20.6) is 5.93. For the on-site worker, the difference between the site-specific HI (13.3) and background vanadium HI (10.3) is 3. As such, the remaining vanadium HIs for both industrial receptor scenarios exceed USEPA's acceptable hazard value of 1.0.

8.3.5.2 Groundwater

As shown in Table 8-3, the maximum detected vanadium concentration in total groundwater (20 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, 8-10, and 8-12, the groundwater HIs exceeded USEPA's acceptable hazard level of 1.0 for the future residential and industrial/commercial worker receptor scenarios. These exceedances were due primarily to potential exposure to total vanadium in groundwater.

As shown in Table 8-15, the site-specific vanadium HI for the adult resident receptor scenario is 7.16, while the background vanadium HI is 106. The site-specific vanadium HI for the young child resident receptor scenario is 17.33, while the background vanadium HI is 256. Therefore, 100% of the HI for vanadium in SWMU 56 groundwater can be attributed to background.

As shown in Table 8-15, the site-specific vanadium HI for the industrial/commercial worker receptor scenario is 2.19, while the background vanadium HI is 32.4. Therefore, 100% of the HI for vanadium in SWMU 56 groundwater can be attributed to background.

Cobalt in groundwater also contributed slightly to the elevated HI for the future residents and industrial/commercial worker. However, the maximum detected cobalt concentration in total groundwater (38 µg/L) was well below its background screening value (633 µg/L). Therefore, risks from cobalt in SWMU 56 groundwater would also be well below those from background.

8.3.5.3 Surface Water

As shown in Table 8-3, background surface water data were not available for comparison with SWMU 56 surface water data. However, as discussed in Section 8.3.4.3 and shown in Tables 8-8 through 8-14, there were no unacceptable risks calculated from potential exposure to SWMU 56 surface water with the exception of the on-site worker receptor. However, elevated noncarcinogenic risks calculated for the on-site worker receptor were only slightly above 1.0 (by 0.1) and entirely attributed to vanadium.

8.3.5.4 Sediment

As shown in Table 8-4, the maximum detected vanadium concentration in sediment (260J mg/kg) exceeded its background screening value (241 mg/kg). Vanadium was detected at concentrations above its background screening value in two sample locations (specifically, 250J mg/kg in 56SD04 and 260J mg/kg in 56SD14).

As discussed in Section 8.3.4.3 and shown in Tables 8-8 through 8-14, the sediment 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 56 sediment. However, as shown in Table 8-15, potential exposure to background levels of vanadium contributed approximately 80% of the risk from exposure to SWMU 56 sediment.

As shown on Table 8-13, the site-specific vanadium HI for the adult trespasser receptor scenario is 4.58, while the background vanadium HI is 3.66. Therefore, once the background-specific HI is subtracted out the remaining vanadium HI that can be considered site-specific is 0.9, which is below USEPA's acceptable hazard value of 1.0. Similarly, for the youth trespasser, the difference between the site-specific HI (4.41) and background vanadium HI (3.52) is also 0.9. Therefore, the contribution of risks from vanadium in SWMU 56 sediment to overall risk from site-related activities is below the acceptable hazard level for the current/future adult and youth trespasser receptors.

In the case of the future residential receptor scenarios, the site-specific vanadium HI for the adult resident is 4.58, while the background vanadium HI is 3.66. Therefore, the difference between the site-specific HI and background vanadium HI is 0.9. For the young child receptor, the difference between the site-specific HI (14.76) and background vanadium HI (11.8) is 3. For the on-site worker, the difference between the site-specific HI (14.1) and background vanadium HI (11.25) is 2.85. As such, the remaining vanadium HIs for the young child residential and on-site worker receptor scenarios exceed USEPA's acceptable hazard value of 1.0.

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 56:

- Sampling and analysis
- Selection of COPCs
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Comparison to background levels

Table 8-16 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 56, 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, groundwater, surface water, and sediment COPCs were selected based on comparisons of the maximum detected concentration with USEPA RSLs for residential soil (surface soil, total soil, and sediment) and tap water (groundwater and surface water). The application of the residential RSL values to COPC selection provides a list of COPCs that are very conservative for NAPR and specifically, SWMU 56. Although future on-site residential land use was conservatively used for screening criteria, it is not considered reasonably anticipated at

SWMU 56. 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.

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 56, arsenic in all media and vanadium in groundwater and surface water have maximum detection limits in excess of the RSLs (refer to Tables 2.1 through 2.5 found in Appendix L). In the case of arsenic, conventional analytical techniques cannot produce detection levels less than the RSL for this analyte. However, arsenic was detected in all but one sample in the total soil and sediment data sets. Arsenic was also detected in two of eight groundwater samples and one of five surface water samples. In the case of vanadium in groundwater and surface water, vanadium was detected in all but one sample in each data set. Although it cannot be ascertained if arsenic or vanadium were in fact present or not in some of the samples, the uncertainty added to the HHRA is minimized by the fact that arsenic and vanadium were 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 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 indicated in Section 5.0, groundwater was encountered at six feet in some locations. However, groundwater was not encountered during drilling. In fact, well 56SB01 was installed at a total depth of 16 feet below ground surface, but the initial borehole was advanced to a depth of 28 feet in search of groundwater. This borehole was left open for more than 24 hours, and the boring filled with water to approximately 3.4 feet bgs. Water production at SWMU 56 appears to be derived from the clays and silty clays encountered at varying depths, which is most likely controlled by fracturing in the surficial clay (refer to Section 5.3.2). These fractures are predominantly vertical and exhibit varying degrees of interconnectivity, and fracture frequency tends to decrease with depth. Given the uncertainty of the actual depth to the water table, a conservative approach was taken to include the analytical results of soil samples from six to ten feet bgs in the HHRA. As such, this approach included the maximum concentrations of vanadium (the primary risk driver), which were at depth. Removing the soil data in question from the quantitative risk evaluation would remove two of the four highest concentrations (one being the maximum) and leave two vanadium concentrations exceeding the background screening value (410 mg/kg at 5 to 7 feet bgs in 56SB06 and 430 mg/kg at 0 to 1 foot in 56SS09). A cursory review of the remaining data indicates that the calculated vanadium EPC would be less conservative. Additionally, the evaluation of the organic data would not change (i.e., maximum concentrations in surface soil selected as EPCs for carcinogenic PAHs). Therefore, this approach is likely an overestimate of true risk and errs on the side of conservativeness.

It is acknowledged that industrial/commercial worker and construction worker exposures to surface water and sediment at SWMU 56 are potentially complete pathways. However, they are considered insignificant in relationship to soil exposures. The source of surface water and sediment at SWMU 56 is a series of drainage ditches, and it is assumed that the amount of time spent in the ditches for these receptors would be minimal. Also, future residential receptor exposures are evaluated the HHRA and include evaluation of surface water/sediment exposure pathways as a conservative upper bound estimate of site risks from these media. As such, it is not expected that the lack of quantitative evaluation of risk and hazard to industrial workers resulting from surface water and sediment exposures significantly underestimates potential human health risks.

As discussed in Section 8.3.1.2.3, lead was retained as a surface water COPC for SWMU 56. Only the maximum detected concentration of lead (16 µg/L in sample 56SW01) slightly exceeded the drinking water Action Level of 15 µg/L. However, risk from lead exposure was not calculated for the following reasons. Dissolved lead was not detected in sample 56SW01, indicating that the presence of lead in that sample was likely due to sedimentation. The drinking water Action Level (Federal MCL) was conservatively used as the screening criterion, which is highly conservative. It is unlikely that SWMU 56 surface water would become a drinking water source, as the surface water source at SWMU 56 is the system of drainage ditches that directs water away from the aircraft apron. As discussed in Section 8.3.4.3 and shown in Tables 8-7 through 8-10, estimated risks from surface water exposure contribute minimally to the total site risk. It is not likely that risks would be underestimated because the majority of COPCs have very conservative toxicity criteria and were evaluated quantitatively.

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 and sediment. 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 Toxicity 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, 2010). It is important to note that there are no toxicity criteria for vanadium published in IRIS (USEPA, 2010b). 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. Although 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 56 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.

Iodomethane (in total soil and sediment) and thallium (in total soil) were also retained as COPCs for SWMU 56 because there were no screening criteria for those chemicals. There were also no toxicity criteria with which to quantitatively evaluate potential exposure to these chemicals. 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, vanadium in soil is the primary risk driver for the future industrial/commercial worker, future construction worker, and current/future on-site worker at SWMU 56. Vanadium was detected in 29 of 29 soil samples with concentrations ranging from 29J mg/kg to 470J mg/kg. Examination of the vanadium data shows that the concentrations are randomly distributed geographically with no apparent concentration gradients indicating that the occurrence is due to natural variations in the soil and rock rather than a release from the site. All but four of the soil detections for vanadium are below the background screening value and are considered representative of background. The four detections at or above the background screening value include 470 mg/kg at 7 to 9 feet bgs in 56SB03, 380 mg/kg at 7 to 9 feet bgs in 56SB04, 410 mg/kg at 5 to 7 feet bgs in 56SB06, and 430 mg/kg at 0 to 1 foot in 56SS09. These four detections also are considered representative of background, as discussed below.

The vanadium concentrations at two locations (specifically, 380 mg/kg at 7 to 9 feet bgs in 56SB04 and 410 mg/kg at 5 to 7 feet bgs in 56SB06) exceed the background screening value of 367 mg/kg, but are less than or equal to the maximum background concentration of 410 mg/kg for total soil. Although these concentrations exceed the screening value, they are within the range of detected background values for soil and are therefore considered representative of background rather than site contamination.

Hangar 200 has historically been used for aircraft maintenance, and former use of the concrete apron as an aircraft wash down area is considered likely. While interviews confirmed past spills of POL and hazardous materials from the 1950s to the 1990s, there are no records indicating potential sources of vanadium were released at the SWMU. Based on the site history of SWMU 56, it is expected that any contamination related to former site activities would be the result of surface runoff from the apron to downgradient surface soil and the drainage ditch system.

All of the surface soil concentrations in the vicinity of the apron are less than background. However, one downgradient surface soil sample slightly exceeded the background screening concentration. Concentrations of vanadium in other surface soil samples downgradient from the apron vary from 55 mg/kg to 320 mg/kg (specifically, locations 56SB01 through 56SB06, 56SS07, and 56SS08), which does not demonstrate a concentration gradient indicative of a surface release. Additionally, surface soil vanadium concentrations in sample locations immediately surrounding 56SS09 are less than background (160 mg/kg in 56SS07, 55 mg/kg in 56SS08, and 320 mg/kg in 56SB06). These observations indicate that the detection of vanadium in sample 56SS09, although slightly exceeding background, is due to natural variations in the soil and rock in the vicinity of the site rather than a release from the site.

Similarly, vanadium was detected in excess of the screening criteria in the 7 to 9 foot depth interval at sample location 56SBS03. Vanadium concentrations from the other sampling intervals at this location were less than background and did not increase with depth (specifically, 200J mg/kg at 0 to 1 foot and 29J mg/kg at 3 to 5 feet bgs). These observations also indicate that the detection of vanadium at sample location 56SB03, although slightly exceeding background is due to natural variations in the soil and rock in the vicinity of the site rather than a release from the site.

As previously noted, there are no background surface water data available for comparison with SWMU 56 surface water data. However, there were no risks calculated above USEPA's acceptable levelsfrom exposure to surface water for the future residential and current/future trespasser receptor scenarios. Elevated noncarcinogenic risks calculated for the on-site worker receptor were only slightly above 1.0 (by 0.1) and entirely attributed to vanadium. Based on the argument presented above, vanadium concentrations in surface water are also considered to be naturally occurring rather than from a release from the site.

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 HHRA

The risk assessment evaluated the exposure of potential receptor populations including adult and youth trespassers, adult and child residents, construction workers, on-site workers, and industrial/commercial workers.

The estimated carcinogenic risks from all media were within the target risk range for the future residential receptors, although arsenic (total soil, groundwater, and sediment) and benzo(a)pyrene (sediment) exceeded the point of departure risk of 1×10^{-06}. Future residential land use was conservatively evaluated for SWMU 56 for conservative comparison with other exposure scenarios and to estimate the worst-case exposure conditions, although it is highly unlikely that housing would be built on this site. The Puerto Rico Ports Authority has developed the airfield into a regional airport, which would preclude residential development. In particular, potable use of SWMU 56 groundwater is a very conservative risk estimation measure. Although Puerto Rico classifies its groundwater as a drinking water source, groundwater at SWMU 56 is unlikely to be used as a potable supply. As stated in the Consent Order, groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007a), and this is not expected to change in the future. Therefore, consumption of this groundwater is not expected to occur.

Noncarcinogenic risks were above the target limits for the residential adult and child primarily due to vanadium in soil and sediment. Although SWMU 56 total site HIs were in excess of USEPA's acceptable levels of 1.0 after refinement of total site risks addressing the contribution of background vanadium levels, it is important to note that potential exposure to background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil. Although vanadium slightly exceeded background in two locations, examination of the spatial distribution of vanadium concentrations in SWMU 56 soil indicate that vanadium concentrations at SWMU 56 are due to natural variations in the soil and rock in the vicinity of the site rather than a release from the site. Furthermore, as previously discussed in Section 8.5.3.3 and 8.5.3.4, the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) (i.e., the used of a default ABS of 0.01 for vanadium) and the vanadium RfD (a conservative, second-tier PPRTV value used primarily for the calculation of screening levels) used in this HHRA. As such, risks calculated from potential exposure to vanadium in site soil, as well as sediment, are likely overestimated. Vanadium in groundwater also contributed to the elevated total site HI. However, vanadium concentrations in SWMU 56 groundwater are representative of background and site groundwater is not potable (USEPA, 2007a). For these reasons and the fact that the site will remain industrial, no further actions in the form of corrective measures are recommended for site media based on risk to future residential receptors.

The estimated carcinogenic risks from all media were also within the target risk range for the remaining receptors (i.e., current/future trespassers, future construction workers, future industrial/commercial workers, current/future on-site workers). It is noted that only arsenic in soil slightly exceeded the point of departure risk of 1×10^{-06} for the future industrial/commercial worker and current/future on-site worker. However, risks presented from arsenic in soil fall below 1×10^{-06} when accounting for contribution of background levels of arsenic. Chemicals presenting noncarcinogenic hazards to these receptors were inorganics (in particular, vanadium). Potential exposure to vanadium in soil and sediment was the only driver for risk to the adult and youth trespassers and on-site workers. After refinement of total site risks addressing the contribution of background vanadium levels to SWMU 56 soil and sediment, risks from vanadium in SWMU 56 soil and sediment are comparable those from background for the trespasser receptors. Although SWMU 56 total site HIs were in excess of USEPA's acceptable levels of 1.0 after refinement of total site risks addressing the contribution of background vanadium levels, it is important to note that potential exposure to background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil and 80% of the risk from exposure to SWMU 56 sediment. Potential exposure to vanadium in soil was the only driver for risk to the construction workers and industrial/commercial worker. As previously discussed, vanadium does not present an unacceptable human exposure-related health risk that is likely related to SWMU 56. Specifically, vanadium concentrations at SWMU 56 are attributed to natural variations in the soil and rock in the vicinity of the site rather than a release from the site, background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil, and the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) (i.e., the used of a default ABS of 0.01 for vanadium) and the vanadium RfD (a conservative, second-tier PPRTV value used primarily for the calculation of screening levels) used in this HHRA. As such, risks calculated from potential exposure to vanadium in site soil and sediment are likely overestimated. Vanadium in groundwater contributed to the elevated total site HI for the industrial/commercial worker receptor. However, vanadium concentrations in SWMU 56 groundwater are representative of background and site groundwater is not potable (USEPA, 2007a). Vanadium in surface water contributed to the elevated HI for the on-site worker receptor. However, vanadium concentrations in SWMU 56 surface water are representative of background. For these reasons, no further actions in the form of corrective measures are recommended for site media based on risk to trespassers, on-site workers, construction workers, and industrial/commercial workers.

8.4 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.

8.4.1 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.

Noncarcinogenic risks exceeding target limits were calculated for the trespasser receptor and industrial receptor (i.e., construction workers, industrial/commercial workers, and on-site workers) scenarios due to concentrations of vanadium in soil and/or sediment. However, vanadium does not present an unacceptable human exposure-related health risk that is likely related to SWMU 56 for the following reasons. After refinement of total site risks addressing the contribution of background vanadium levels to SWMU 56 soil and sediment, risks from vanadium in SWMU 56 soil and sediment are comparable those from background for the trespasser receptors. Additionally, vanadium concentrations at SWMU 56 are attributed to natural variations in the soil and rock in the vicinity of the site rather than a release from the site, background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil for all industrial receptors and 80% of the risk from exposure to SWMU 56 sediment for the on-site worker, and the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) (i.e., the used of a default ABS of 0.01 for vanadium) and the vanadium RfD (a conservative, second-tier PPRTV value used primarily for the calculation of screening levels) used in this HHRA. As such, risks calculated from potential exposure to vanadium in site soil, as well as sediment, are likely overestimated. No unacceptable risks were identified for surface water or groundwater exposures based on the trespasser or construction worker receptor scenarios, respectively. While unacceptable risks were calculated for the on-site worker and industrial/commercial worker from potential exposures to vanadium in surface water and groundwater, respectively, vanadium concentrations in SWMU 56 surface water and groundwater are representative of background. Therefore, qualitative CAOs for soil, groundwater, surface water, and sediment for the protection of human health assuming continued industrial use were not developed for SWMU 56.

8.4.2 Quantitative CAOs

It is acknowledged that risk estimates exceeded target limits for future residential receptors evaluated for exposure to environmental media at SWMU 56. However, quantitative CAOs were not developed based on a residential scenario for these reasons. Future land use of SWMU 56 is expected to remain industrial (USEPA, 2007a). The future residential scenario was conservatively evaluated for SWMU 56 for conservative comparison with other exposure scenarios and to estimate the worst-case exposure conditions. Noncarcinogenic risks exceeded the target value of 1.0 due to vanadium in all site media (except surface water). Noncarcinogenic risks were above the target limits for the residential adult and child primarily due to vanadium in soil and sediment. However, vanadium does not present an unacceptable human exposure-related health risk that is likely related to SWMU 56. Specifically, vanadium concentrations at SWMU 56 are attributed to natural variations in the soil and rock in the vicinity of the site rather than a release from the site, background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil and sediment, and the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) (i.e., the used of a default ABS of 0.01 for vanadium) and the vanadium RfD (a conservative, second-tier PPRTV value used primarily for the calculation of screening levels) used in this HHRA. As such, risks calculated from potential exposure to vanadium in site soil, as well as sediment, are likely overestimated. Additionally, vanadium concentrations in SWMU 56 groundwater are representative of background and potable use of groundwater is not considered a complete exposure pathway because groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007a). No unacceptable risks were identified for surface water exposures based on a residential scenario. Therefore, quantitative CAOs for soil, groundwater, surface water, and sediment for the protection of human health assuming residential land use were not developed for SWMU 56.

It is also acknowledged that noncarcinogenic risks exceeding target limits were calculated for trespasser and industrial (i.e., construction workers, industrial/commercial workers, and on-site workers) receptor scenarios due to concentrations of vanadium in soil and/or sediment. However, quantitative CAOs were not developed based on trespasser or industrial scenarios for these reasons. Vanadium does not present an unacceptable human exposure-related health risk that is likely related to SWMU 56. Specifically, after refinement of total site risks addressing the contribution of background vanadium levels to SWMU 56 soil and sediment, risks from vanadium in SWMU 56 soil and sediment are comparable those from background for the trespasser receptors. Additionally, vanadium concentrations at SWMU 56 are attributed to natural variations in the soil and rock in the vicinity of the site rather than a release from the site, background levels of vanadium contributed approximately 78% of the risk from exposure to SWMU 56 soil for all industrial receptors and 80% of the risk from exposure to SWMU 56 sediment for the on-site worker, and the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) (i.e., the used of a default ABS of 0.01 for vanadium) and the vanadium RfD (a conservative, second-tier PPRTV value used primarily for the calculation of screening levels) used in this HHRA. No unacceptable risks were identified for surface water or groundwater exposures based on the trespasser or construction worker receptor scenarios, respectively. While unacceptable risks were calculated for the on-site worker and industrial/commercial worker from potential exposures to vanadium in surface water and groundwater, respectively, vanadium concentrations in SWMU 56 surface water and groundwater are representative of background. Therefore, quantitative CAOs for soil, groundwater, surface water, and sediment for the protection of human health assuming continued industrial use were not developed for SWMU 56.

8.5 References

Agency for Toxic Substances and Disease Registry (ATSDR), 2008. Draft Toxicological Profile for Chromium. September 2008.

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Vanadium. U.S. Department Of Health And Human Services. September 2009.

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.

Kotaś, J. and Z. Stasicka. 2000. "Chromium occurrence in the environment and methods of its speciation". *Environmental Pollution* 107 (3): 263–283.

Longuemare, R. N., 1997. Responsibility for Additional Environmental Cleanup after Transfer of Real Property, Office of Under Secretary of Defense, July 25, 1997.

Naval Facilities Engineering Command, Atlantic Division (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, 2010a. Regional Screening Levels Table. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm May 2010.

USEPA, 2010b. Integrated Risk Information System. Environmental Criteria and Assessment Office, Cincinnati, Ohio. http://www.epa.gov/iris/index.html.

USEPA, 2009a. Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual Part F, Supplemental Guidance for Inhalation Risk Assessment. Final. OSWER 9285.7-82. January 2009.

USEPA, 2009b. ProUCLVersion 4.00.04. http://epa.gov/nerlesd1/tsc/TSC_form.htm Accessed October 2009.

USEPA, 2009c. ProUCLVersion 4.00.04 User Guide. EPA/600/R-07/038.

USEPA, 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. EPA/630/R-03/003F. March 2005.

USEPA, 2004. Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual Part E Supplemental Guidance for Dermal Risk Assessment. Interim. Final. Office of Emergency and Remedial Response. Washington, DC. July 2004. EPA 540/R/99/005.

USEPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5, 2003.

USEPA, 2002a. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December 2002.

USEPA, 2002b. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). EPA530-D-02-004. November 2002.

USEPA, 2002c. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-010. December 2002.

USEPA, 2001. Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manuel (Part D, Standardizing Planning, Reporting, and Review of Superfund Risk Assessments), Interim. Office of Emergency and Remedial Response. Publication 9285.7-01D. December 2001.

USEPA, 1997a. Exposure Factors Handbook. Office of Research and Development. Washington, D.C. August 1997. EPA/600/P-95/002F.

USEPA, 1997b. Health Effects Summary Tables FY 1997. Office of Solid Waste and Emergency Response, Washington, D.C. June 1997. OERR 9200.6-303(95-1).

USEPA, 1995. Land Use in the CERCLA Remedy Selection Process, Office of Solid Waste and Emergency Response Directive 9355.7-04, Washington, D.C., May 25, 1995.

USEPA, 1991. Risk Assessment Guidance for Superfund Volume I. Human Health Evaluation Manual Supplemental Guidance: "Standard Default Exposure Factors" Interim Final. Office Solid Waste and Emergency Response. Washington, D.C. March 25, 1991. OSWER Directive 9285.6-03.

USEPA, 1990. National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule. Federal Register, 40 Code of Federal Regulations Part 300, March 8, 1990.

USEPA, 1989. Risk Assessment Guidance for Superfund Volume I. Human Health Evaluation Manual (Part A) Interim Final. Office of Solid Waste and Emergency Response. Washington, D.C. December 1989. EPA/540/1-89-002.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, OSWER Directive 9335.3-01, Office of Solid Waste and Emergency Response, Washington, D.C.

Virginia Department of Environmental Quality (VDEQ), 2010. Virginia Voluntary Remediation Program Risk Assessment Guidance (http://www.deq.state.va.us/vrprisk/raguide.html). Accessed July 2010.

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 receptors. Ecological COPCs identified in the Step 2 SERA for the various media and receptor groups and the ecological COCs recommended for corrective action in the refined risk evaluation in Step 3a are summarized in Table 7-36. The COCs and CAOs for each media for SWMU 56 are summarized in the following sections. The extent of contamination in each media requiring cleanup based on the CAOs also is established.

Typically, human health and ecological CAOs would be combined to provide a comprehensive list of contaminants requiring cleanup and their associated cleanup levels in each media. However, the human health risk assessment did not recommend development of quantitative CAOs for SWMU 56; only COCs and CAOs developed from the ecological risk assessment will be presented. 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 noncarcinogenic risk was identified due to exposure to site soil, sediment and potential groundwater. Consequently, since residential risk estimates exceeded target limits, unrestricted land use cannot be recommended for SWMU 56. Therefore, an institutional control restricting future residential land and groundwater use will be developed as a human health qualitative CAO for the SWMU 56 property.

9.1 Surface Soil

A summary of CAOs for surface soil (representing a depth range of 0.0 to 1.0 feet below ground surface) for terrestrial invertebrates and plants, terrestrial avian receptors and background is presented in Table 7-32. When more than one CAO is developed, such as the terrestrial invertebrate and plant CAO and the American Robin CAO, the minimum value is typically selected as the CAO. If the CAO is less than the NAPR background surface soil screening value, then the background value is typically selected as the final CAO (refer to Table 7-32 for a derivation of the final CAO for surface soil).

Two chemicals (lead and cadmium) were the only identified COCs in surface soil exceeding the CAOs, as shown on Table 9-1. Sampling location 56SB01 was identified as the only area of surface soil contamination, as shown on Figure 9-1. The lateral extent of this contamination to the south is bounded by the drainage ditch and by samples 56SB03. Similarly, the west extent of this contamination is bounded by sample 56SB02, and the eastern extent is bounded by the concrete apron. The lateral extent of this contamination to the north is bounded by 56SS01 and 56SS02.

By definition, surface soil is limited to the top one foot of soil. The maximum depth of surface soil requiring cleanup is 1.0 foot below the ground surface.

9.2 Subsurface Soil

The ecological risk evaluation did not indicate an adverse risk to ecological receptors from exposure to site contaminants detected in the subsurface soil (1.0 to 3.0 feet below the ground surface); consequently ecological CAOs were not developed for the subsurface soil for SWMU 56. The distinction between surface and subsurface soil was combined in a total soil zone (0 to 10 feet below the ground surface) for the evaluation of human health. The human health risk assessment did not recommend development of CAOs for subsurface soil.

Different criteria are used to evaluate potential adverse risk in different media (surface soil and shallow subsurface soil are considered different media from a risk perspective). Although the contaminant concentrations of lead and cadmium in the shallow subsurface soil may in some cases be of similar magnitude to the concentrations in the surface soil, there are reduced levels of exposure with increasing depth and consequently less risk is posed by the shallow subsurface soil than by the surface soil. At sample 56SB01 the vertical extent of soil contamination requiring cleanup is in the surface soil depth interval from 0.0 to 1.0 feet below the ground surface.

9.3 Groundwater

The ecological risk evaluation did not indicate an adverse risk to receptors exposed to site contaminants detected in the groundwater; consequently ecological CAOs were not developed for the groundwater for SWMU 56.

The human health risk evaluation did not indicate an adverse risk to construction worker receptors to chemicals detected in the groundwater. The human health risk evaluation did indicate noncarcinogenic risks exceeding target limits for future industrial worker and residential receptor scenarios. Noncarcinogenic risks exceeded the target value of 1.0 due to metals. However, potable use of groundwater is not considered a complete exposure pathway because groundwater at NAPR is not used for drinking water or other potable uses (USEPA, 2007a). Since the metals driving risk in groundwater (i.e., vanadium) are representative of background and potable use of groundwater is considered an incomplete exposure pathway, quantitative CAOs were not developed for groundwater at SWMU 56. However, because risk estimates exceeded target limits for future residential receptors, unrestricted land use cannot be recommended. Therefore, establishment of an institutional control restricting potable use of groundwater and future residential land use will be developed as a qualitative human health CAO for the SWMU 56 property.

9.4 Surface Water

The ecological and human health risk evaluation did not indicate an adverse risk to receptors from exposure to site contaminants detected in the surface water; consequently ecological and human health CAOs were not developed for the surface water for SWMU 56.

9.5 Sediment

A summary of CAOs for sediment for aquatic invertebrates and plants, avian omnivores, and background are presented in Table 9-1. Five chemicals (barium, cadmium, chromium, lead and zinc) were identified as COCs in sediment in excess of the CAOs (refer to Table 7-38 for a derivation of the final CAOs for sediment). The drainage ditch was divided into segments to assist with characterization of the ditch (Figure 9-2). Multiple sediment samples were collected within each open channel section of the drainage ditch segment (interior of closed culverts not sampled) the sampling results by segment are presented on Figure 9-2. The distribution of these COCs in the sediment in excess of the final CAOs were used to determine the extent of sediment contamination present along the entire length of the drainage ditch from Point A to Point F.

Segment A-B is the furthest upgradent drainage ditch segment and contains sediment with barium, cadmium, chromium, lead and zinc in excess of the CAOs. It is bounded at the beginning of the ditch segment (Point A) by the Hanger 200 concrete apron. Surface water runoff from the concrete apron and surrounding drainage area is directed into the ditch at Point A. Segment A-B is approximately 248 feet in length with the down gradient end of the ditch segment (Point B) terminating at the inlet to a 2 foot diameter closed culvert. The bottom of the ditch is lined with an 18 inch wide impermeable concrete barrier. The barrier allows flow through the ditch without creating soil erosion. Sediment has accumulated on the concrete barrier to a depth of approximately one inch.

Segment B-C is a two foot diameter impermeable metal culvert approximately 133 feet in length connecting flow from the open ditch segment A-B to segment C-D under a concrete taxiway. No sediment samples were collected from the interior of the culvert to evaluate the sediment contamination. It is conservatively assumed that any culvert sediment will be contaminated, removed and treated in the same manner as the open ditch sediments from segment A-B. The depth of sediment was estimated at one inch over the culvert width.

Segment C-D is an approximately four foot wide, 533 foot long open drainage ditch segment containing sediment with lead and cadmium in excess of the CAOs. Segment C-D connects the outlet of culvert segment B-C to inlet of culvert segment D-E and collects surrounding surface water runoff. This ditch segment is lined with heavy vegetation and exhibits low to stagnate flow conditions and surface water pools. The depth of sediment requiring cleanup 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 56.

Segment D-E is a 3 foot diameter impermeable metal culvert approximately 181 feet in length connecting flow from the open ditch segment C-D to segment E-F under Bogue Street. No sediment samples were collected from the interior of the culvert to evaluate the sediment contamination. It is conservatively assumed that any culvert sediment will be contaminated, removed and treated in the same manner as the open ditch sediments from segment C-D. The depth of sediment was estimated at 2 inches over the culvert width.

Segment E-F is an approximately 527 foot long open drainage ditch segment with invert width increasing from 4 to 8 feet at the downgradient end. The segment contains sediment with lead in excess of the CAOs. Segment E-F connects the outlet of culvert segment D-E to inlet of culvert beneath Forrestal Drive at Point F and collects surrounding surface water runoff. This ditch segment is lined with heavy vegetation. Sediment is estimated at one foot in depth (the entire surface soil zone) along the entire length.

The evaluation conducted in Step 3a of the ecological risk assessment indicated that the maximum downstream extent of sediment contamination was defined by sample 56SW/SD05. The concentration of COCs detected at this sample location would not cause adverse impacts to ecological receptors in the downstream estuarine habitat. By combining analytical data from previous drainage ditch segment E-F sediment sampling events with existing analytical data the combined data set was evaluated and found that concentrations greater than sediment screening values and/or background concentrations did not occur in ditch sediments downstream from 56SW/SD05. Ditch segment down gradient of Point F receives drainage from a significant portion of the airfield, as well as drainage from areas outside of the airfield’s boundary. Based on these additional surface water runoff contributions, it is the Navy’s opinion that sediment quality down gradient of Point F (sample 56SD22) cannot be linked to SWMU 56.

The human health risk evaluation indicated noncarcinogenic risks exceeding target limits for future residential, current/future trespasser, and on-site worker receptor scenarios due to concentrations of metals in sediment. However, metals do not present an unacceptable human exposure-related health risk that is likely related to SWMU 56. Specifically for the trespasser receptors, after refinement of total site risks addressing the contribution of background metal levels to SWMU 56 sediment, risks from metals in SWMU 56 sediment are comparable those from background. For the residential and on-site worker receptors, background levels of metals contributed approximately 80% of the risk from exposure to SWMU 56 sediment, and the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway for metals RfD used in this HHRA. As such, risks calculated from potential exposure to vanadium in sediment are likely overestimated. However, because risk estimates exceeded target limits for the future child residential receptor, unrestricted land use cannot be recommended. Therefore, an institutional control restricting future residential use will be developed as a qualitative human health CAO for the SWMU 56 property.

10.0 JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURE

Site contaminants for which CAOs have been established through ecological risk evaluations include lead and cadmium for surface soil and barium, cadmium, chromium, lead and zinc for sediment. Surface soil contamination is limited to one area in the vicinity of 56SB01. Sediment contamination is present in the drainage ditch from its beginning at Point A downstream to sample 56SW/SD05 (Point F). Because of the limited nature of the contamination at this SWMU (i.e., metals contamination limited to areas of surface soil and the drainage ditch sediments) as well as the easy accessibility to the site by typical construction equipment, a presumptive remedy of excavation and off-site disposal was selected for evaluation as a corrective measure.

Although risk estimates exceeded target limits for residential, trespasser, and industrial receptors from exposure to environmental media at SWMU 56 quantitative human health CAOs were not developed for SWMU 56 as discussed in Section 8.4. However, an institutional control restricting future residential land and groundwater use will be developed as a human health qualitative CAO for the SWMU 56 property.

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 56 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 SWMU 56 located within 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 56. The Ports Authority has developed 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

Surface soil will be removed from area where metals contaminant concentrations exceed the established CAOs, as determined in Sections 7.0 through 9.0 of this document. The proposed cleanup levels are the following:

- Lead 96 mg/kg
- Cadmium 1.8 mg/kg

The extent of soil contamination in excess of the CAOs is limited to one area, as shown on Figure 10-1. Cadmium and lead were the only contaminants identified at location 56SB01 at concentrations in excess of the CAOs for soil. The lateral extent of this contamination to the south is bounded by the drainage ditch and by samples 56SB03 and 56SB05. Similarly, the western extent of this contamination is bounded by sample 56SB02, and the eastern extent is bounded by the concrete apron. The lateral extent of this contamination to the north is bounded by 56SS01 and 56SS02. Confirmation sampling of the excavation sidewalls will be utilized to verify extent of contamination delineated. Excavation depth is limited to a maximum of one foot as determined by ecological risk assessment. Based on the above, the maximum volume of soil requiring excavation at SWMU 56 is approximately 441 cubic yards. Since the lateral limits of the excavation will extend to a "clean" sample location, the need for post-excavation confirmation sampling is minimal. The contaminated soil will be transported to an on-island, permitted, disposal facility, unless characterization testing indicates levels exceeding landfill acceptance criteria. If the waste is characterized as hazardous, then it must be disposed of off-island at a facility in the continental United States thereby substantially increasing project costs. The on-island disposal facilities are located in Ponce and Penuelas. Licensed waste haulers are available and shall 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 the entire drainage ditch (segment point A to F on Figure 10-2) where metals contaminant concentrations exceed the established CAOs, (Figure 9-2) as determined in Sections 7.0 through 9.0 of this document.

The proposed cleanup levels for sediment are the following:

- Barium – 214 mg/kg
- Cadmium – 0.99 mg/kg
- Chromium – 65.0 mg/kg
- Lead – 35.8 mg/kg
- Zinc – 152 mg/kg

The extent of sediment contamination in excess of the CAOs is shown on Figure 10-2. The area for sediment excavation includes three segments of the drainage ditch and two culverts. A description of each segment and the associated volume of sediment are as follows:

- Drainage Ditch Segment A-B: As shown on Figure 10-2, drainage ditch segment A-B extends from the edge of the Hangar 200 Apron downstream approximately 248 feet to the first 24-inch diameter culvert under the taxiway. The drainage ditch along this reach is concrete lined and the depth of sediment is expected to be minimal (1 inch). Sediments will be removed to a depth required to expose the concrete liner. For the purpose of this CMS, the drainage ditch channel width is assumed to be 1.5 feet throughout the length of this reach and the sediment depth is assumed to be 1 inch resulting in a total volume of sediment for excavation of 1.1 cubic yards.

- Drainage Ditch Segment B-C: This reach consists of a 24-inch diameter culvert extending approximately 133 feet under the taxiway. The depth of sediment in this culvert is assumed to be minimal: approximately 6 inches wide by 1 inch deep over the length of the pipe. This results in a total volume of sediment for disposal of 0.2 cubic yards.

- Drainage Ditch Segment C-D: As shown on Figure 10-2, this segment extends 533 feet from the 24-inch culvert under the taxiway to the 36-inch culvert under Bogue Street. The channel width along this reach is assumed to be approximately 4 feet and the excavation depth is assumed to be 1 foot over the length of the reach resulting in a volume of sediment for removal of 2,132 cubic feet (79 cubic yards).

- Drainage Ditch Segment D-E: This segment consists of a 36-inch diameter culvert extending approximately 181 feet under Bogue Street. The depth of sediment in this culvert is assumed to be minimal: approximately 1 foot wide by 2 inches (0.17 feet) deep over the length of the pipe. This results in a total volume of sediment for removal of 1.1 cubic yards.

- Drainage Ditch Segment E-F: As shown on Figure 10-2, this segment extends approximately 527 feet from the 36-inch culvert under Bogue Street to the double four foot by eight foot box culverts under the Forrestal Drive access road. The channel width along this reach is assumed to be approximately four feet at the upstream end of the reach increasing to approximately eight feet at the downstream end (assume a conservative average channel width of eight feet). The excavation depth is assumed to be one foot over the length of the reach resulting is a volume of sediment for removal of 156.1 cubic yards.

Based on the above, the total volume of sediment requiring excavation at SWMU 56 is approximately 238 cubic yards.

For the sediment excavation it is assumed within the channel that only sediment will be excavated and the excavation depth will be to the top of the concrete liner or metal pipe invert or will not exceed one foot, which is of sufficient depth for protection of aquatic receptors. In September 2008 and June 2009 additional sediment samples were collected in segment E-F both upgradient and downgradient of segment E-F to define the limits of sediment removal. SWMU 56 CMS sediment removal will not extend beyond segment E-F. No confirmation samples are proposed for the sediment excavation since all sediment to a depth of one foot or to the top of the lined channel barrier will be removed. 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. Following excavation, ditch segments C-D and E-F will be lined with geotextile to prevent re-exposure of the excavated sidewalls and bottom. Ditch segments C-D and E-F will then be backfilled with one foot of copacted low permeability soil to eliminate the ecological exposure pathway and graded to promote positive drainage. The ditch invert will be armored with riprap to prevent future erosion. There are no long term restrictions, controls or monitoring associated with the sediment excavation and off-site disposal portion of this alternative.

10.2 Justification of the Corrective Measure

Justification for the selection of excavation and disposal of soils and sediments and institutional controls as the corrective measure for SWMU 56 is provided in this section. The corrective measure is evaluated based upon technical, human health and environmental considerations.

10.2.1 Technical Considerations

Excavation, off-site disposal and institutional controls are proven methods for protecting human health and the environment currently and in the future that can be applied to SWMU 56. Because the contamination will be removed and institutional controls will be placed on the SWMU 56 property in the form of deed restrictions, these actions combine as a permanent corrective measure.

In terms of reliability, the contaminated media will be disposed in a permitted landfill, which is an accepted treatment alternative. With respect to implementability, this corrective measure requires commonly used earth moving equipment and disposal facilities. If characterization 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 56 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 56 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 surface soil disturbance or 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 56 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

Although risk estimates exceeded target limits for residential, trespasser, and industrial receptors from exposure to vanadium detected in environmental media at SWMU 56, human health quantitative CAOs were not developed for SWMU 56. Quantitative CAOs were not developed based on a residential scenario for the following reasons: (1) future land use of SWMU 56 is expected to remain industrial; (2) potable use of groundwater at NAPR represents an incomplete exposure pathway; and (3) the future residential scenario evaluation was conducted in the HHRA for comparative purposes and to estimate worst-case exposure conditions. Quantitative CAOs were not developed based on trespasser or industrial scenarios because excess risks to these receptors were primarily due to vanadium concentrations in SWMU 56 subsurface soil. Vanadium does not present an unacceptable human exposure-related health risk that is likely related to SWMU 56 based on the following rationale. Specifically for the trespasser receptors, after refinement of total site risks addressing the contribution of background vanadium levels to SWMU 56 soil, risks from vanadium in SWMU 56 soil are comparable those from background. Additionally, vanadium concentrations at SWMU 56 are attributed to natural variations in the soil and rock in the vicinity of the site rather than a release from the site, background levels of vanadium contributed approximately 78% of the risk to industrial receptors from exposure to SWMU 56 soil, and the excess risks can be attributed to the conservative evaluation of the dermal contact exposure pathway (for metals) and the vanadium RfD used in this HHRA. Nevertheless, since residential risk estimates exceeded target limits and the planned future use of the site is industrial, unrestricted land use cannot be recommended for SWMU 56. Therefore, an institutional control restricting future residential land and groundwater use will be developed as a human health qualitative CAO for the SWMU 56 property.

Future property use of this site is expected to remain industrial, and potential human exposure is limited to industrial or commercial property use. Consequently, the proposed corrective measures including institutional controls restricting future residential land use will be protective of human health. 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 56 will provide an immediate benefit to the environment. Potential terrestrial or aquatic 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 selected remedy for mitigation of impacted soil and sediment at SWMU 56. The layout of the conceptual design, design considerations, planning documents and confirmation sampling are presented in Section 11.1. The reporting requirements are presented in Section 11.2.

11.1 Conceptual Design

The ecological and human health risk evaluations identified lead and cadmium as the COCs in surface soil at SWMU 56 requiring cleanup and established the cleanup objectives of 96 mg/kg for lead and 1.8 mg/kg for cadmium. Five metals (barium, cadmium, chromium, lead and zinc) were identified as the COCs in the sediment in the vicinity of SWMU 56 requiring cleanup; cleanup objectives for these metals were at 214 mg/kg for barium, 0.99 mg/kg for cadmium, 65.0 mg/kg for chromium, 35.8 mg/kg for lead and 152 mg/kg for zinc. The entire proposed length of the drainage ditch will be excavated to a maximum depth of 1.0 feet below ground surface or to the concrete ditch lining or the culvert invert. As discussed in the previous section, excavation and off-site disposal of approximately 441 cubic yards of contaminated soil and 238 cubic yards of contaminated 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 predetermined limits of soil excavation (Figure 11-1) will be excavated to a maximum depth of one foot below ground surface 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. No bottom samples will be collected as the excavation depths were 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 the cadmium and lead.

Confirmation samples are not required for the sediment excavation. The removal of the upper one foot of drainage ditch sediment removes the potential pathways to ecological receptors. Any contamination in excess of the CAOs that remain below the one foot excavation will not pose a risk to ecological receptors because the excavation will be lined with geotextile, backfilled with one foot of compacted low permeability soil, and armored with riprap. The location of sediment excavation is shown on Figure 11-2.

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 56 will be managed in accordance with applicable federal, commonwealth and local guidelines.

The processes to be followed for implementation of the surface soil excavation and disposal portion of this corrective measure include:

- 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

- Installation of erosion and sediment controls
- Survey location the excavation limits
- Excavation of surface soil to the proposed horizontal limits and maximum one foot depth
- Deposit the excavated surface soil into lined roll-off boxes. (The roll-off boxes will be placed so that they slope to drain to one corner of the box)
- Collect confirmation samples for the sidewall of the excavation
- Analyze confirmation samples for cadmium and lead using SW-846 method 6010B using ICP
- If confirmation sample results exceed CAOs, extend the excavation on the associated sidewall a minimum of one foot and resample sidewall for confirmation
- Collection and analysis representative excavated soil for toxicity characteristics in accordance with 40 CFR Part 261.24
- Collection, analysis and disposal of water from the roll-off boxes
- Transportation and disposal of excavated soil to an approved on-island disposal facility
- Backfill and compact 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

Prior to development of CMS, surface soil samples were collected to delineate extent of surface soil contamination shown on Figure 10-1. The initial limits of surface soil excavation completely encompasses the contamination as presented on Figure 11-1. Post-excavation confirmation sampling will be required from the side walls to verify remaining soils are below the CAOs.

The processes to be followed for implementation of the sediment excavation and disposal portion of this corrective measure include:

- 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 surface 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 and clean culverts to remove sediment
- 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 excavated sediment samples for toxicity characteristics in accordance with 40 CFR Part 261.24
- Collection, analysis and disposal of water from the roll-off boxes
- Transportation and disposal of sediment to an approved on-island disposal facility
- Line excavated area in segments C-D and E-F with geotextile and secure in place with stakes
- Backfill excavated area in segments C-D and E-F with one foot of compacted low permeability soil and grade to promote positive drainage
- Backfill ditch segments C-D and E-F clean aggregate rip rap to provide future erosion resistance and simplify backfill installation
- Revegetation of any disturbed areas
- Demobilization of all equipment, etc.
- Removal of erosion and sediment control structures

Sediment overlying impermeable barriers such as exist in Segments A-B, B-C and D-E will be removed to the barrier surface which may be more or less than one foot. Confirmation sampling will not be required for the sediment excavation since the entire width of the channels will be excavated to a depth below the zone considered biologically active (i.e., to a conservative depth of one foot below the ground surface) for the entire reach of the drainage ditch from SWMU 56 downstream to sample location 56SW/SD05. Lining the drainage ditch with geotextile, backfilling with compacted low permeability soil, and stabilizing with rip rap will remove the ecological exposure pathway to the remaining sediments and protect the drainage ditch from erosion.

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, and 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 56. 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 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 Puerto Rico Environmental Quality Board (PREQB).

- A permit for solid waste generation as well as a fugitive dust emissions air permit will be required from PREQB.

The corrective action will be conducted in accordance with Master Project Plans for Naval Station Roosevelt Roads, which includes the Project Management Plan (PMP), Data Collection Quality Assurance Plan (DCQAP), Data Management Plan (DMP), and the Health and Safety Plan (HSP) (Baker 1995 a-d, respectively).

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 56 are presented on Table 11-1.

A covenant and restriction regarding non-residential use will be developed for SWMU 56 stating that no permanent residences shall be constructed or otherwise developed on SWMU 56, and that no portion of SWMU 56 shall be used for permanent residence(s). The covenant as well as one restricting potable groundwater use will be developed and become part of the property deed for SWMU 56.

11.2 Reporting

To implement the corrective measure for SWMU 56, 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 56 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 56. 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 56. 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. The final text for the deed restriction 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. Since costs for development and implementation of the institutional control deed restriction would be minimal it was not included in Table 11-2. 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 of contaminated surface soil and sediment and off-site disposal corrective measure is $456,541.

11.4 Schedule

A schedule for implementation of this corrective measure is provided in Figure 11-3.

11.5 References

Baker. 1995a. Final Project Management Plan, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995

Baker. 1995b. Final Data Collection Quality Assurance Plan, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995

Baker. 1995c. Draft Data Management Plan, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995

Baker. 1995d. Final Health and Safety Plan Addendum, RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995

TABLES

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 56 - HANGAR 200 APRON
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	Low Level PAHs	App IX Metals (Total)	Lead and Selenium	Selenium and Vanadium	App IX Metals (Dissolved)	AVS/SEM	Total Organic Carbon	**Comment**
Surface Soil	**2008 CMS Investigation**													
	56SB01	56SB01-00	0.0 - 1.0	04/28/08	X	X		X						
	56SB02	56SB02-00	0.0 - 1.0	04/28/08	X	X		X						
	56SB03	56SB03-00	0.0 - 1.0	04/29/08	X	X		X						
		56SB03-00D	0.0 - 1.0	04/29/08	X	X		X						Duplicate
	56SB04	56SB04-00	0.0 - 1.0	04/28/08	X	X		X						
	56SB05	56SB05-00	0.0 - 1.0	04/29/08	X	X		X						
	56SB06	56SB06-00	0.0 - 1.0	04/30/08	X	X		X						
	56SB07	56SB07-00	0.0 - 1.0	05/01/08	X	X		X						
	56SB08	56SB08-00	0.0 - 1.0	05/05/08	X	X		X						
	Pre-excavation Investigation													
	56SS01	56SS01	0.0 - 1.0	09/24/08					X					
	56SS02	56SS02	0.0 - 1.0	09/24/08					X					
	56SS03	56SS03	0.0 - 1.0	09/24/08					X					
	56SS04	56SS04	0.0 - 1.0	09/24/08					X					
	56SS05	56SS05	0.0 - 1.0	09/24/08					X					
	56SS06	56SS06	0.0 - 1.0	09/24/08					X					
	56SS07	56SS07	0.0 - 1.0	09/24/08						X				
	56SS08	56SS08	0.0 - 1.0	09/24/08						X				
	56SS09	56SS09	0.0 - 1.0	09/24/08						X				
		56SS09MS/MSD	0.0 - 1.0	09/24/08						X				Matrix Spike/Matrix Spike Duplicate
	56SS10	56SS10	0.0 - 1.0	09/24/08						X				
	56SS11	56SS11	0.0 - 1.0	09/24/08						X				
		56SS11D	0.0 - 1.0	09/24/08						X				Duplicate
	56SS12	56SS12	0.0 - 1.0	09/24/08						X				
Subsurface Soil	**2008 CMS Investigation**													
	56SB01	56SB01-01	1.0-3.0	04/28/08	X	X		X						
		56SB01-04	7.0-9.0	04/28/08	X	X		X						

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 56 - HANGAR 200 APRON
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	Low Level PAHs	App IX Metals (Total)	Lead and Selenium	Selenium and Vanadium	App IX Metals (Dissolved)	AVS/SEM	Total Organic Carbon	**Comment**
Subsurface Soil (cont.)	**2008 CMS Investigation (cont.)**													
	56SB02	56SB02-02	3.0-5.0	04/28/08	X	X		X						
		56SB02-04	7.0-9.0	04/28/08	X	X		X						
	56SB03	56SB03-02	3.0-5.0	04/29/08	X	X		X						
		56SB03-04	7.0-9.0	04/29/08	X	X		X						
	56SB04	56SB04-03	5.0-7.0	04/28/08	X	X		X						
		56SB04-04	7.0-9.0	04/28/08	X	X		X						
	56SB05	56SB05-03	5.0-7.0	04/29/08	X	X		X						
		56SB05-03MS/MSD	5.0-7.0	04/29/08	X	X		X						Matrix Spike/Matrix Spike Duplicate
		56SB05-05	9.0-10.0	04/29/08	X	X		X						
	56SB06	56SB06-01	1.0-3.0	04/30/08	X	X		X						
		56SB06-01D	1.0-3.0	04/30/08	X	X		X						Duplicate
		56SB06-03	5.0-7.0	04/30/08	X	X		X						
		56SB06-03MS/MSD	9.0-11.0	04/30/08	X	X		X						Matrix Spike/Matrix Spike Duplicate
	56SB07	56SB07-02	3.0-5.0	05/01/08	X	X		X						
		56SB07-03	5.0-7.0	05/01/08	X	X		X						
	56SB08	56SB08-01	1.0-3.0	05/05/08	X	X		X						
		56SB08-02	3.0-5.0	05/05/08	X	X		X						
Sediment	**2008 CMS Investigation**													
	56SD03	56SD03	0.0-0.5	04/29/08	X	X		X					X	
	56SD04	56SD04	0.0-0.5	04/29/08	X	X		X					X	
		56SD04D	0.0-0.5	04/29/08	X	X		X						Duplicate
		56SD04MS/MSD	0.0-0.5	04/29/08	X	X		X						Matrix Spike/Matrix Spike Duplicate
	56SD05	56SD05	0.0-0.5	04/29/08	X	X		X					X	
	Pre-excavation Investigation													
	56SD12	56SD12	0.0-0.5	09/25/08				X						
	56SD13	56SD13	0.0-0.5	09/25/08				X						

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 56 - HANGAR 200 APRON
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	Low Level PAHs	App IX Metals (Total)	Lead and Selenium	Selenium and Vanadium	App IX Metals (Dissolved)	AVS/SEM	Total Organic Carbon	**Comment**
Sediment (continued)	**Pre-excavation Investigation (cont.)**													
	56SD14	56SD14	0.0-0.5	09/25/08				X						
		56SD14D	0.0-0.5	09/25/08				X						Duplicate
		56SD14MS/MSD	0.0-0.5	09/25/08				X						Matrix Spike/Matrix Spike Duplicate
	Supplemental Field Investigation													
	56SD15	56SD15	0.0-0.5	06/24/09				X				X		
	56SD16	56SD16	0.0-0.5	06/24/09				X				X		
	56SD17	56SD17	0.0-0.5	06/24/09				X				X		
	56SD18	56SD18	0.0-0.5	06/24/09				X				X		
	56SD19	56SD19	0.0-0.5	06/24/09				X				X		
	56SD20	56SD20	0.0-0.5	06/24/09				X				X		
	56SD21	56SD21	0.0-0.5	06/24/09				X				X		
	56SD22	56SD22	0.0-0.5	06/24/09				X				X		
		56SD22D	0.0-0.5	06/24/09				X						Duplicate
		56SD22MS/MSD	0.0-0.5	06/24/09				X						Matrix Spike/Matrix Spike Duplicate
Surface Water	**2008 CMS Investigation**													
	56SW01	56SW01	NA	04/29/08			X	X			X			
	56SW02	56SW02	NA	04/29/08			X	X			X			
	56SW03	56SW03	NA	04/29/08			X	X			X			
	56SW04	56SW04	NA	04/29/08			X	X			X			
		56SW04D	NA	04/29/08			X	X			X			Duplicate
	56SW05	56SW05	NA	04/29/08			X	X			X			
Groundwater	**2008 CMS Investigation**													
	56SB01	56GW01	NA	05/01/08	X	X		X			X			
	56SB02	56GW02	NA	05/01/08	X	X		X			X			
	56SB03	56GW03	NA	05/01/08	X	X		X			X			
		56GW03D	NA	05/01/08	X	X		X			X			Duplicate
		56GW03MS/MSD	NA	05/01/08	X	X		X			X			Matrix Spike/Matrix Spike Duplicate
	56SB04	56GW04	NA	05/01/08	X	X		X			X			

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 56 - HANGAR 200 APRON
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	Low Level PAHs	App IX Metals (Total)	Lead and Selenium	Selenium and Vanadium	App IX Metals (Dissolved)	AVS/SEM	Total Organic Carbon	**Comment**
Groundwater (continued)	**2008 CMS Investigation (cont.)**													
	56SB05	56GW05	NA	05/02/08	X	X		X			X			
	56SB06	56GW06	NA	05/03/08	X	X		X			X			
	56SB07	56GW07	NA	05/03/08	X	X		X			X			
	56SB08	56GW08	NA	05/07/08	X	X		X			X			

Notes:
ft bgs - feet below ground surface
NA- Not Applicable

TABLE 4-2

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

			Analysis Requested				
Media	**Sample ID**	**Sample Date**	App IX VOCs	App IX SVOCs	PCBs/Pesticides	App IX Metals	**Comment**
Trip Blanks	56TB01	04/28/08	X				
	56TB02	04/30/08	X				
	56TB03	05/01/08	X				
	56TB04	05/04/08	X				
	QATB01	05/02/08	X				
	74TB12	05/07/08	X				
Equipment Rinsates	ER01	04/28/08	X	X		X	Macro Core Liner
	ER02	04/29/08	X	X		X	Stainless Steel Spoon
	ER04	05/01/08	X	X		X	GW Sampling Tubing
	ER05	05/02/08	X	X		X	GW Sampling Tubing
	ER06	05/03/08	X			X	GW Sampling Tubing
	ER07	05/04/08	X			X	Macro Core Liner
	ER10	05/07/08	X			X	GW Sampling Tubing
	JUNE09-ER02	06/24/09	X	X	X	X	Stainless Steel Spoon
Field Blank	FB01	05/02/08	X	X		X	Lab Grade Deionized Water
	JUNE09-FB02	06/24/09				X	Lab Grade Deionized Water

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

Appendix IX - VOCs	Quantitation Limits* Water (µg/L)	Quantitation Limits* Low Soil (µg/kg)	Method Number (Description)
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)

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

Appendix IX - VOCs (Cont.)	Quantitation Limits* Water (µg/L)	Quantitation Limits* Low Soil (µg/kg)	Method Number (Description)
Toluene	1.0	5.0	8260B (5030)(low level)
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	**Quantitation Limits* Water (µg/L)**	**Quantitation Limits* Low Soil (µg/kg)**	**Method Number (Description)**
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 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

Appendix IX - SVOCs (Cont.)	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
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	0.2	6.7	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

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

Appendix IX - SVOCs (Cont.)	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
n-Nitrosodi-n-butylamine	10	330	8270C
n-Nitrosodiethylamine	10	330	8270C
n-Nitrosodimethylamine	10	330	8270C
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
Low Level PAHs	**Quantitation Limits***		**Method Number**
	Water (µg/L)	**Low Soil (µg/kg)**	
Acenaphthene	0.2	6.7	8270C
Acenaphthylene	0.2	6.7	8270C
Anthracene	0.2	6.7	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
Chrysene	0.2	6.7	8270C
Dibenzo(a,h)anthracene	0.2	6.7	8270C
Fluoranthene	0.2	6.7	8270C
Fluorene	0.2	6.7	8270C

TABLE 4-3

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

Low Level PAHs	Quantitation Limits* Water (µg/L)	Quantitation Limits* Low Soil (µg/kg)	Method Number
Indeno(1,2,3-cd)pyrene	0.2	6.7	8270C
1-Methylnaphthalene	0.2	6.7	8270C
2-Methylnaphthalene	0.2	6.7	8270C
Naphthalene	0.2	6.7	8270C
Phenanthrene	0.2	6.7	8270C
Pyrene	0.2	6.7	8270C
Appendix IX - Metals (Total and Dissolved)	**Quantitation Limits* Water (µg/L)**	**Quantitation Limits* Low Soil (mg/kg)**	**Method Number**
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)
Total Organic Carbon	**Quantitation Limits* Water (mg/L)**	**Quantitation Limits* Low Soil (mg/kg)**	**Method Number**
Total Organic Carbon	0.50	500	9060

Notes:

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

µg/L - micrograms per liter

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

TABLE 5-1

SUMMARY OF SLUG TEST RESULTS
SWMU 56 - HANGAR 200 APRON
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)
56SB01f[(1)]	4/28/2008	--	3.13	3.13
56SB02f[(1)]	4/28/2008	--	0.003	0.003
56SB03f[(1)]	4/30/2008	--	0.02	0.02
56SB06f	4/30/2008	--	2.36	--
56SB06r	4/30/2008	1.34	--	1.85
56SB07f	5/1/2008	--	6.33	--
56SB07r	5/1/2008	2.88	--	4.61
56SB08f	5/1/2008	--	0.99	--
56SB08r	5/1/2008	1.99	--	1.49
Average Hydraulic Conductivity (ft/day)				**1.85**

Notes:

[(1)] Due to slow recovery, falling head test was the only test performed.

-- Not Available

TABLE 5-2
GROUNDWATER ELEVATION SUMMARY
SWMU 56 - HANGAR 200 APRON
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 Casing (ft [1])	Depth to Groundwater on 05/07/2008 (ft [2])	Groundwater Elevation (ft [1,3])	Depth to Groundwater on 07/22/2008 (ft [2])	Groundwater Elevation (ft [1,3])
56SB01	806925.7	931927.9	16.0	115.5	6.0 to 16.0	117.87	2.55	115.32	3.10	114.77
56SB02	806894.3	931844.5	16.0	116.3	6.0 to 16.0	118.61	2.99	115.62	3.08	115.53
56SB03	806859.6	931879.1	16.0	115.4	6.0 to 16.0	117.63	3.43	114.20	3.94	113.69
56SB04	806849.2	931757.1	16.0	116.2	6.0 to 16.0	118.25	2.35	115.90	2.66	115.59
56SB05	806815.9	931810.4	16.0	117.8	6.0 to 16.0	120.11	5.44	114.67	5.77	114.34
56SB06	806628.8	931741.1	16.0	114.8	6.0 to 16.0	117.05	2.91	114.14	3.28	113.77
56SB07	806172.7	932072.7	16.0	114.0	6.0 to 16.0	116.63	6.48	110.15	6.67	109.96
56SB08	805986.3	932567.0	14.0	112.3	4.0 to 14.0	114.69	5.47	109.22	6.20	108.49

Notes:
ft = feet
bgs = below ground surface

(1) Datum: 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 - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SB01	56SB02	56SB03	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08
Sample ID	Basewide	56SB01-00	56SB02-00	56SB03-00	56SB03-00D	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00
Date	Background [(1)]	4/28/2008	4/28/2008	4/29/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008
Depth Range	(ft bgs)	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	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)										
Acetone	NE	50 J	89 J	130 J	270 J	23 J	86 U	110 J	260	280
Benzene	NE	0.76 U	0.76 U	0.68 U	0.7 U	0.79 U	0.95 J	0.8 U	0.73 U	0.99 J
Carbon disulfide	NE	0.49 U	0.49 U	0.44 U	0.45 U	0.51 U	0.51 U	0.51 U	1.9 J	0.6 U
Chloromethane	NE	0.68 U	0.69 U	1.1 J	2.2 J	0.71 U	0.71 U	0.72 U	0.65 U	0.84 U
Iodomethane	NE	1 J	0.96 UJ	2.2 J	1.8 J	1 UJ	1 U	1.7 J	2.4 J	1.2 U
Semivolatile Organic Compounds (ug/kg)										
2-Methylnaphthalene	NE	2.2 U	2.2 U	2 UJ	2.1 UJ	2.3 U	2.1 UJ	2.3 UJ	2.1 U	19
Benzo[a]anthracene	NE	2.2 U	2.2 U	3.1 UJ	9.2 J	2.3 U	2.1 UJ	2.3 UJ	2.4 J	2.9 J
Benzo[a]pyrene	NE	0.86 U	0.85 U	3.6 J	20 J	0.88 U	0.83 UJ	0.88 UJ	2.8 J	3 J
Benzo[b]fluoranthene	NE	0.99 U	0.98 U	9.2 J	44 J	1 U	0.96 UJ	1 UJ	3.1 J	8 J
Benzo[g,h,i]perylene	NE	2.2 U	2.2 U	2 UJ	17 J	2.3 U	2.1 UJ	2.3 UJ	2.1 U	3.1 J
Benzo[k]fluoranthene	NE	1.3 U	1.3 U	1.2 UJ	1.2 UJ	1.3 U	1.3 UJ	1.3 UJ	1.5 J	1.3 U
Butyl benzyl phthalate	NE	9.4 U	9.3 U	8.7 UJ	10 J	9.6 U	9 UJ	9.6 UJ	9.1 U	9.7 U
Chrysene	NE	0.8 U	0.79 U	2.9 J	36 J	0.81 U	1.4 UJ	0.81 UJ	2.2 J	3.9 J
Dibenz(a,h)anthracene	NE	0.77 U	0.76 U	0.71 UJ	2.9 J	0.79 U	0.74 UJ	0.78 UJ	0.75 U	0.79 U
Fluoranthene	NE	2.2 U	2.2 U	2.2 J	9.2 J	2.3 U	2.1 UJ	2.3 UJ	2.1 U	5 J
Indeno[1,2,3-cd]pyrene	NE	1.6 UJ	1.5 UJ	1.9 UJ	7.5 J	1.6 UJ	1.5 UJ	1.6 UJ	1.9 J	1.6 UJ
Naphthalene	NE	0.78 U	0.77 U	0.72 UJ	0.73 UJ	0.8 U	0.75 UJ	0.8 UJ	1.9 J	4.3 J
Phenanthrene	NE	2.2 UJ	2.2 UJ	2 UJ	2.3 J	2.3 UJ	2.1 UJ	2.3 UJ	3.1 U	2.5 J
Pyrene	NE	2.2 U	2.2 U	3.6 J	16 J	2.3 U	2.1 UJ	2.3 UJ	5.4 J	5.1 J

TABLE 6-1

Revised: September 29, 2011

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SB01	56SB02	56SB03	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08
Sample ID	Basewide	56SB01-00	56SB02-00	56SB03-00	56SB03-00D	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00
Date	Background [(1)]	4/28/2008	4/28/2008	4/29/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008
Depth Range	(ft bgs)	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	0.0-1.0	0.0-1.0
Metals (mg/kg)										
Antimony	2.43	2	0.14 U	0.095 UJ	0.11 UJ	0.091 U	0.11 UJ	0.13 UJ	0.16 UJ	0.11 UJ
Arsenic	2.34	2.3	2.4	2.9	2.8	0.59 J	3.4	2.2	3	1.4
Barium	231.22	39 J	16 J	130 J	130 J	15 J	120 J	20 J	190 J	71
Beryllium	0.65	0.14	0.096 J	0.27	0.28	0.053 J	0.24	0.15	0.34	0.24
Cadmium	0.65	3.3 J	0.1 J	0.16 J	0.13 J	0.038 UJ	0.18 J	0.055 J	0.16 J	0.15
Chromium	68.81	33	21	17 J	19 J	6.3	22 J	48 J	54 J	24
Cobalt	46.43	12	4.2	25 J	29 J	2.6	27 J	6.8 J	50 J	24 J
Copper	223.05	81 J	50 J	67 J	67 J	31 J	72 J	56 J	130 J	100
Lead	16.86	210	6.1	8.3 J	10 J	0.88	4.8 J	6.3 J	5.5 J	5.3
Mercury	0.10	0.015 J	0.033	0.043 J	0.046 J	0.018 J	0.041 J	0.0047 U	0.066 J	0.028
Nickel	22.97	12	4.4	8.5 J	8.9 J	1.1	13 J	7 J	14 J	8.7
Selenium	1.85	1.6	2.7	0.59 J	0.61 J	1.4	0.88 J	1.7 J	1.7 J	0.64
Silver	NE	0.24 J	0.032 J	0.069 UJ	0.042 UJ	0.019 U	0.057 UJ	0.13 UJ	0.078 UJ	0.069 U
Thallium	0.77	0.15 U	0.14 U	0.17 J	0.16 J	0.15 U	0.15 J	0.15 U	0.25 J	0.15 U
Vanadium	367.18	170 J	250 J	190 J	200 J	170 J	190 J	320 J	360 J	180
Zinc	112.16	77 J	25 J	48 J	54 J	7.5 J	49 J	23 J	62 J	58

Notes/Qualifiers:

J - Estimated value
U - Not detected above the reported method detection limit
UJ - Reported method detection limit is qualified as estimated
ft bgs - feet below ground surface
ug/kg - micrograms per kilogram
mg/kg - miligrams per kilogram
Na - Not Analyzed
NE - Not Established
NAPR - Naval Activity Puerto Rico
[(1)] NAPR basewide background airfield soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

TABLE 6-1

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SS01	56SS02	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09
Sample ID	Basewide	56SS01	56SS02	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09
Date	Background (1)	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	(ft bgs)	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	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)										
Acetone	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iodomethane	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/kg		NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 6-1

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SS01	56SS02	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09
Sample ID	Basewide	56SS01	56SS02	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09
Date	Background [1]	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	(ft bgs)	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	0.0-1.0	0.0-1.0
Metals (mg/kg)										
Antimony	2.43	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	2.34	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	231.22	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	68.81	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	46.43	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	223.05	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	16.86	83	5	8	5.9	7.2	3	NA	NA	NA
Mercury	0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	22.97	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1.85	0.51	2	2.2	3.5	0.86	1.4	0.86	0.62	2.3
Silver	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.77	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	367.18	NA	NA	NA	NA	NA	NA	160	55	430
Zinc	112.16	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes/Qualifiers:

J - Estimated value
U - Not detected above the reported method detection limit
UJ - Reported method detection limit is qualified as estimated
ft bgs - feet below ground surface
ug/kg - micrograms per kilogram
mg/kg - miligrams per kilogram
Na - Not Analyzed
NE - Not Established
NAPR - Naval Activity Puerto Rico
(1) NAPR basewide background airfield soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

TABLE 6-1

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SS10	56SS11D	56SS11	56SS12
Sample ID	Basewide	56SS10	56SS11D	56SS11	56SS12
Date	Background [1]	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	(ft bgs)	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)					
Acetone	NE	NA	NA	NA	NA
Benzene	NE	NA	NA	NA	NA
Carbon disulfide	NE	NA	NA	NA	NA
Chloromethane	NE	NA	NA	NA	NA
Iodomethane	NE	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/kg		NA	NA	NA	NA
2-Methylnaphthalene	NE	NA	NA	NA	NA
Benzo[a]anthracene	NE	NA	NA	NA	NA
Benzo[a]pyrene	NE	NA	NA	NA	NA
Benzo[b]fluoranthene	NE	NA	NA	NA	NA
Benzo[g,h,i]perylene	NE	NA	NA	NA	NA
Benzo[k]fluoranthene	NE	NA	NA	NA	NA
Butyl benzyl phthalate	NE	NA	NA	NA	NA
Chrysene	NE	NA	NA	NA	NA
Dibenz(a,h)anthracene	NE	NA	NA	NA	NA
Fluoranthene	NE	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NE	NA	NA	NA	NA
Naphthalene	NE	NA	NA	NA	NA
Phenanthrene	NE	NA	NA	NA	NA
Pyrene	NE	NA	NA	NA	NA

TABLE 6-1

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SS10	56SS11D	56SS11	56SS12
Sample ID	Basewide	56SS10	56SS11D	56SS11	56SS12
Date	Background [1]	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	(ft bgs)	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)					
Antimony	2.43	NA	NA	NA	NA
Arsenic	2.34	NA	NA	NA	NA
Barium	231.22	NA	NA	NA	NA
Beryllium	0.65	NA	NA	NA	NA
Cadmium	0.65	NA	NA	NA	NA
Chromium	68.81	NA	NA	NA	NA
Cobalt	46.43	NA	NA	NA	NA
Copper	223.05	NA	NA	NA	NA
Lead	16.86	NA	NA	NA	NA
Mercury	0.10	NA	NA	NA	NA
Nickel	22.97	NA	NA	NA	NA
Selenium	1.85	1.2	0.89	1.7	0.33 J
Silver	NE	NA	NA	NA	NA
Thallium	0.77	NA	NA	NA	NA
Vanadium	367.18	190	190 J	280 J	140
Zinc	112.16	NA	NA	NA	NA

Notes/Qualifiers:
J - Estimated value
U - Not detected above the reported method detection limit
UJ - Reported method detection limit is qualified as estimated
ft bgs - feet below ground surface
ug/kg - micrograms per kilogram
mg/kg - miligrams per kilogram
Na - Not Analyzed
NE - Not Established
NAPR - Naval Activity Puerto Rico
[1] NAPR basewide background airfield soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

SUMMARY OF DETECTED LABORATORY RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SB01	56SB01	56SB02	56SB02	56SB03	56SB03	56SB04	56SB04	56SB05
Sample ID	Basewide	56SB01-01	56SB01-04	56SB02-02	56SB02-04	56SB03-02	56SB03-04	56SB04-03	56SB04-04	56SB05-03
Date	Background [(1)]	4/28/2008	4/28/2008	4/28/2008	4/28/2008	4/29/2008	4/29/2008	4/28/2008	4/28/2008	4/29/2008
Depth Range	(ft bgs)	1.0-3.0	7.0-9.0	3.0-5.0	7.0-9.0	3.0-5.0	7.0-9.0	5.0-7.0	7.0-9.0	5.0-7.0
Volatile Organic Compounds (ug/kg)										
Acetone	NE	8.3 J	9.7 J	22 J	25 J	120 J	49 J	17 J	11 J	99 J
Carbon disulfide	NE	0.51 U	0.53 U	0.46 U	0.52 U	0.53 U	0.57 U	0.5 U	0.51 U	0.51 U
Iodomethane	NE	1 UJ	1 UJ	0.9 U	1 UJ	1 UJ	1.1 UJ	0.98 UJ	0.99 UJ	1 UJ
Semivolatile Organic Compounds (ug/kg)										
2-Methylnaphthalene	NE	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	2.2 U	2.2 U	2.2 UJ
Benzo[a]anthracene	NE	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	4 J	2.2 U	2.2 UJ
Benzo[a]pyrene	NE	0.89 U	0.9 U	0.82 U	0.86 U	0.89 UJ	0.88 UJ	4.2 J	0.85 U	0.86 UJ
Benzo[b]fluoranthene	NE	1 U	1 U	0.95 U	0.99 U	1 UJ	1 UJ	0.99 U	0.98 U	0.99 UJ
Benzo[k]fluoranthene	NE	1.3 U	1.4 U	1.2 U	1.3 U	1.3 UJ	1.3 UJ	8.6 J	1.3 U	1.3 UJ
Chrysene	NE	0.82 U	0.83 U	0.76 U	0.79 U	0.82 UJ	0.81 UJ	6.9 J	0.78 U	0.8 UJ
Di-n-butyl phthalate	NE	34 U	34 U	31 U	33 U	34 UJ	33 UJ	35 U	32 U	33 UJ
Fluoranthene	NE	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	5.7 J	2.2 U	2.2 UJ
Pyrene	NE	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	8.1 J	2.2 U	2.2 UJ
Metals (mg/kg)										
Arsenic	2.34	1.1	1.2	0.5 J	0.48 J	0.47 U	3.4	0.8	1.5	1.2
Barium	231.22	13 J	16 J	12 J	55 J	34 J	42 J	14 J	7.9 J	10 J
Beryllium	0.65	0.046 J	0.096 J	0.089 J	0.21	0.064 U	0.18	0.098 J	0.18	0.15
Cadmium	0.65	0.039 UJ	0.04 UJ	0.035 UJ	0.04 UJ	0.04 UJ	0.064 J	0.036 UJ	0.036 UJ	0.037 UJ
Chromium	68.81	15	19	3.6	4	17 J	25 J	7.2	12	56 J
Cobalt	46.43	2.3	1.6	2.7	8	0.5 J	9.9 J	5.4	12	5.6 J
Copper	223.05	45 J	55 J	94 J	130 J	18 J	85 J	42 J	84 J	59 J
Lead	16.86	1.4	3	1.3	0.54	0.39 J	4.7 J	0.8	1.5	0.76 J
Mercury	0.10	0.042	0.0054 U	0.0049 U	0.0056 J	0.0047 U	0.74 J	0.015 J	0.0048 U	0.017 J
Nickel	22.97	2.9	3.6	1.3	2.5	2.3 J	6.7 J	2.2	4.9	5.8 J
Selenium	1.85	2.9	0.64 J	0.76	0.4 J	0.59 J	2.2 J	0.57 J	1.2	0.49 J
Silver	NE	0.091 J	0.051 J	0.018 U	0.035 J	0.034 UJ	0.052 UJ	0.04 J	0.036 J	0.035 UJ
Thallium	0.77	0.15 U	0.16 U	0.13 U	0.15 U	0.15 U	0.14 U	0.14 U	0.14 U	0.14 U
Vanadium	367.18	110 J	140 J	230 J	200 J	29 J	470 J	170 J	380 J	170 J
Zinc	112.16	8.7 J	16 J	14 J	33 J	8.1 J	31 J	16 J	47 J	26 J

TABLE 6-2

SUMMARY OF DETECTED LABORATORY RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SB05	56SB06	56SB06	56SB06	56SB07	56SB07	56SB08	56SB08
Sample ID	Basewide	56SB05-05	56SB06-01	56SB06-01D	56SB06-03	56SB07-02	56SB07-03	56SB08-01	56SB08-02
Date	Background (1)	4/29/2008	4/30/2008	4/30/2008	4/30/2008	5/1/2008	5/1/2008	5/5/2008	5/5/2008
Depth Range	(ft bgs)	9.0-10.0	1.0-3.0	1.0-3.0	5.0-7.0	3.0-5.0	5.0-7.0	1.0-3.0	3.0-5.0
Volatile Organic Compounds (ug/kg)									
Acetone	NE	95 J	50 J	55 UJ	25 U	260	54 U	110	140
Carbon disulfide	NE	0.57 U	0.5 U	0.47 U	0.53 U	1.9 J	0.46 U	0.49 U	0.49 U
Iodomethane	NE	1.1 UJ	0.97 UJ	0.92 U	1 U	1.7 J	0.89 U	2.6 J	1.2 J
Semivolatile Organic Compounds (ug/kg)									
2-Methylnaphthalene	NE	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.2 U	2.1 U	6.2 J	2.3 UJ
Benzo[a]anthracene	NE	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.2 U	2.1 U	2.2 UJ	2.3 UJ
Benzo[a]pyrene	NE	0.9 UJ	0.84 UJ	0.84 UJ	0.9 UJ	1.2 J	0.83 U	0.85 UJ	0.89 UJ
Benzo[b]fluoranthene	NE	1 UJ	0.96 UJ	0.97 UJ	1 UJ	1 J	0.96 U	0.98 UJ	1 UJ
Benzo[k]fluoranthene	NE	1.4 UJ	1.3 UJ	1.3 UJ	1.4 UJ	1.3 U	1.3 U	1.3 UJ	1.3 UJ
Chrysene	NE	0.84 UJ	0.77 UJ	0.77 UJ	0.83 UJ	1.0 J	0.77 U	0.79 UJ	0.82 UJ
Di-n-butyl phthalate	NE	41 J	32 UJ	32 UJ	34 UJ	33 U	32 U	32 UJ	69 UJ
Fluoranthene	NE	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.2 U	2.1 U	2.2 UJ	2.3 UJ
Pyrene	NE	2.3 UJ	2.2 UJ	2.2 UJ	2.3 UJ	2.2 U	2.1 U	2.2 UJ	2.3 UJ
Metals (mg/kg)									
Arsenic	2.34	1.7	0.86 R	4.9 R	2.6	2.4	2.1	1.2	2.1
Barium	231.22	470 J	28 J	18 J	18 J	130 J	49 J	21	100
Beryllium	0.65	0.43	0.13	0.17	0.3	0.3	0.3	0.071 U	0.28
Cadmium	0.65	0.061 J	0.038 UJ	0.037 UJ	0.038 UJ	0.14 J	0.16 J	0.048 U	0.12 U
Chromium	68.81	120 J	19 R	90 R	70 J	60 J	67 J	13	33
Cobalt	46.43	21 J	1.1 J	2.1 J	7.3 J	34 J	29 J	4.3 J	55 J
Copper	223.05	98 J	30 J	75 J	140 J	120 J	130 J	40 J	73
Lead	16.86	0.99 J	2.4 R	19 R	11 J	8.5 J	5.8 J	1.2	7.7
Mercury	0.10	0.0051 U	0.078 J	0.025 J	0.11 J	0.13 J	0.081 J	0.056	0.11
Nickel	22.97	16 J	4.1 J	2.8 J	6.5 J	17 J	11 J	2.6	9.7
Selenium	1.85	0.62 J	2.3 J	2.3 J	1 J	1.4 J	0.85 J	0.72	2.2
Silver	NE	0.061 UJ	0.027 UJ	0.056 UJ	0.044 UJ	0.089 J	0.11 J	0.028 J	0.19 U
Thallium	0.77	0.65	0.15 U	0.14 U	0.15 U	0.19 J	0.19 J	0.15 U	0.15 U
Vanadium	367.18	220 J	83 R	940 R	410 J	290 J	360 J	120	270
Zinc	112.16	62 J	8.8 J	8.7 J	20 J	72 J	35 J	8.9	67

TABLE 6-2

SUMMARY OF DETECTED LABORATORY RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

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 method detection limit
UJ - Reported method detection 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 airfield soil screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

TABLE 6-3

SUMMARY OF DETECTED LABORATORY RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SB01	56SB02	56SB03	56SB03D	56SB04	56SB05	56SB06	56SB07	56SB08
Sample ID	Basewide	56GW01	56GW02	56GW03	56GW03D	56GW04	56GW05	56GW06	56GW07	56GW08
Date	Background [1]	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Volatile Organic Compounds (ug/L)										
Acetone	NE	5 R	5.2 J	5 UJ	5 UJ	5 UJ	7.1 J	5 U	5 U	5 U
Chloromethane	NE	0.28 R	0.28 U	1.8 J	0.28 UJ	0.28 U	0.28 UJ	0.28 U	0.28 U	0.28 U
Semivolatile Organic Compounds (ug/L)										
1,4-Dichlorobenzene	NE	0.12 U	0.16 J	0.12 UJ	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
3 & 4 Methylphenol	NE	0.15 U	0.15 U	0.15 UJ	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.63 J
Anthracene	NE	0.021 U	0.021 U	0.021 UJ	0.021 UJ	0.021 U	0.021 UJ	0.021 U	0.033 J	0.021 U
Bis(2-ethylhexyl) phthalate	NE	0.34 U	0.98	0.34 UJ	0.34 UJ	0.34 U	0.73 UJ	0.71 U	0.66 U	0.34 U
Diethyl phthalate	NE	0.18 U	0.32 J	0.18 UJ	0.18 UJ	0.18 U	0.18 UJ	0.18 U	0.18 U	0.18 U
Fluoranthene	NE	0.049 U	0.049 U	0.049 UJ	0.049 UJ	0.049 U	0.049 UJ	0.049 U	0.056 J	0.049 U
Fluorene	NE	0.018 U	0.018 U	0.018 UJ	0.018 UJ	0.018 U	0.018 UJ	0.018 U	0.055 J	0.018 U
Phenanthrene	NE	0.017 U	0.017 U	0.017 UJ	0.017 UJ	0.017 U	0.017 UJ	0.05 J	0.39	0.017 U
Total Metals (ug/L)										
Arsenic	18.89	1.8 U	1.9 U	0.5 J	0.52 J	1.7 U	0.42 J	0.31 U	0.7 U	1.2 U
Barium	686	7.1	24	21 J	21 J	23	16 J	18	100	170
Chromium	162.41	1.3 U	2.4 U	0.6 UJ	0.6 UJ	1.7 U	0.6 UJ	0.6 U	0.6 U	2.3 J
Cobalt	633.21	0.18 R	0.42 R	1.2 J	1.6 J	6.6	1.2 J	0.29 U	1.5 J	38
Copper	324	1.2 U	1.7 U	1.6 UJ	1.8 UJ	2.5 U	1.2 UJ	2.7 U	1.2 U	8.3
Nickel	95.74	0.32 U	0.88 J	0.32 UJ	0.32 UJ	0.82 J	0.35 J	0.38 J	0.32 U	3.9
Selenium	29.88	0.6 U	0.6 U	0.6 UJ	0.6 UJ	0.79 J	0.6 UJ	0.6 U	0.6 U	0.6 U
Vanadium	484.66	9.3	17	14 J	16 J	20	8.8 J	7.9	2.7 U	13
Zinc	547.53	6.5 U	6.5 U	6.5 UJ	6.5 UJ	8.7 J	6.5 UJ	6.5 U	6.5 U	18 J
Dissolved Metals (ug/L)										
Antimony	11.19	0.36 U	0.39 U	0.38 J	0.36 UJ	0.36 U	0.36 UJ	0.36 U	0.36 U	0.36 U
Arsenic	14.03	1.1 U	1.6 U	0.5 J	0.46 J	0.99 U	0.28 UJ	0.28 U	0.54 U	0.86 U
Barium	260	7.1	22	18 J	20 J	14	15 J	15	100	140
Cobalt	580.50	1.6 R	1.6 R	1.8 J	1.1 J	2.1	1.4 J	0.45 UJ	1.9 J	31
Mercury	0.157	0.08 U	0.08 U	0.08 UJ	0.08 UJ	0.098 J	0.08 UJ	0.08 U	0.08 U	0.08 U
Nickel	84.1	0.82 J	0.69 J	0.55 J	0.32 U	0.58 J	0.4 J	0.32 U	0.4 J	2.6
Selenium	23.92	0.6 U	0.6 U	0.6 UJ	0.6 UJ	0.65 J	0.7 J	0.6 U	0.6 U	0.6 U
Vanadium	20.96	8	14	12 J	14 J	9.8	5.8 J	3.6 U	2.5 U	1.7 J
Zinc	360.64	6.5 U	6.5 U	7.4 J	6.5 UJ	6.5 U	6.5 UJ	6.5 U	6.5 U	8 J

TABLE 6-3

SUMMARY OF DETECTED LABORATORY RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
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 method detection limit
UJ - Reported method detection limit is qualified as estimated
ft bgs - feet below ground surface
ug/L - micrograms per liter
NE - Not Established
NAPR - Naval Activity Puerto Rico
(1) NAPR basewide background groundwater screening value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

TABLE 6-4

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE WATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SW01	56SW02	56SW03	56SW04	56SW04D	56SW05
Sample ID	Basewide	56SW01	56SW02	56SW03	56SW04	56SW04D	56SW05
Date	Background	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008	4/29/2008
Low level PAHs (ug/L)							
Not Detected							
Total Metals (ug/L)							
Arsenic	NE	3.2	1.4 U	1.4 U	1.6 U	1.7 U	2.4 U
Barium	NE	60	15	13	35	35	86
Cadmium	NE	1.1 J	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ
Chromium	NE	6.3	1.6 U	1.5 U	1.5 U	1.4 U	1.7 U
Cobalt	NE	3.1	0.37 R	0.27 R	0.32 R	0.37 R	1.7 R
Copper	NE	13	2.3 J	3.1 J	1.2 U	1.4 J	2.4 J
Lead	NE	16	0.25 J	0.43 J	0.55 J	0.73 J	0.21 J
Nickel	NE	3.8	0.52 J	0.53 J	0.43 J	0.43 J	1.3
Selenium	NE	0.71 J	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Vanadium	NE	22	5.2	6	4.5 U	5 U	5.3
Zinc	NE	46	6.5 U	6.6 J	6.5 U	8.6 J	6.5 J
Dissolved Metals (ug/L)							
Barium	NE	33	14	12	33	33	84
Cobalt	NE	3.7	3.7 R	2.3 R	2.1 R	0.62 R	3.8 R
Copper	NE	1.5 U	2 J	2.6 J	1.2 U	1.2 U	1.9 J
Lead	NE	0.43 U	0.17 J	0.15 U	0.47 J	0.15 U	0.15 U
Nickel	NE	2.1	1	1.2	0.82 J	0.47 J	1.6
Zinc	NE	8.8 J	6.7 J	6.5 U	6.5 U	6.5 U	6.5 U

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 method detection limit
UJ - Reported method detection limit is qualified as estimated
ug/L - micrograms per liter
NE - Not Established for freshwater
NAPR - Naval Activity Puerto Rico

TABLE 6-5

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13	56SD14D	56SD14	56SD15
Sample ID	Basewide	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13	56SD14D	56SD14	56SD15
Date	Background [1]	4/29/2008	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009
Depth Range (ft. bgs)		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)										
2-Butanone (MEK)	NE	65 J	3.6 R	35 UJ	110 UJ	NA	NA	NA	NA	NA
Acetone	NE	200 J	5.9 R	250 J	1200 J	NA	NA	NA	NA	NA
Carbon disulfide	NE	0.29 UJ	19 J	15 J	800 J	NA	NA	NA	NA	NA
Iodomethane	NE	0.58 UJ	1.3 R	2.9 UJ	36 J	NA	NA	NA	NA	NA
Semivolatile Organic Compound (ug/kg)										
Benzo[a]anthracene	NE	270 J	58 J	28 J	9.8 UJ	NA	NA	NA	NA	NA
Benzo[a]pyrene	NE	300 J	85 J	39 J	3.8 UJ	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NE	1.6 UJ	3.1 UJ	77 J	4.4 UJ	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NE	150 J	46 J	31 J	9.8 UJ	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	NE	630 J	160 J	3.6 UJ	5.7 UJ	NA	NA	NA	NA	NA
Benzyl alcohol	NE	17 UJ	32 UJ	29 UJ	47 J	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NE	260 J	79 U	70 U	160 U	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NE	22 J	29 UJ	26 UJ	41 UJ	NA	NA	NA	NA	NA
Chrysene	NE	410 J	87 J	36 J	7.1 J	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NE	52 J	2.4 UJ	2.1 UJ	3.4 UJ	NA	NA	NA	NA	NA
Fluoranthene	NE	350 J	79 J	32 J	9.8 UJ	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NE	110 J	32 J	19 J	6.9 UJ	NA	NA	NA	NA	NA
Phenanthrene	NE	21 J	19 J	13 J	9.8 UJ	NA	NA	NA	NA	NA
Phenol	NE	9.9 UJ	19 UJ	19 J	28 UJ	NA	NA	NA	NA	NA
Pyrene	NE	570 J	110 J	51 J	9.8 UJ	NA	NA	NA	NA	NA
Total Metals (mg/kg)										
Antimony	8.62	0.59 UJ	1.4 UJ	1.3 UJ	0.66 UJ	0.42 UJ	0.97 UJ	0.62 UJ	0.66 UJ	0.57 UJ
Arsenic	2.83	3.9 J	4.2 J	3 J	3.8 J	2.6 J	3.2 J	3.4 J	4 J	1.5 J
Barium	208.04	54 J	78 J	70 J	160 J	78 J	110 J	43 J	51 J	93 J
Beryllium	0.36	0.21 J	0.29 J	0.24 J	0.27 J	0.26 UJ	0.25 UJ	0.28 J	0.3 J	0.45 UJ
Cadmium	0.22	2.6 J	3.9 J	3.4 J	0.54 J	0.54 J	0.72 J	0.39 J	0.23 J	0.09 UJ
Chromium	63.41	39 J	46 J	43 J	34 J	29 J	38 J	51 J	46 J	28.7 J
Cobalt	45.07	18 J	24 J	17 J	40 J	29 J	29 J	43 J	59 J	27.5 J

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13	56SD14D	56SD14	56SD15
Sample ID	Basewide	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13	56SD14D	56SD14	56SD15
Date	Background [1]	4/29/2008	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009
Total Metals (mg/kg)										
Copper	159.81	130 J	130 J	110 J	110 J	100 J	110 J	98 J	100 J	107 J
Lead	19.38	280 J	110 J	160 J	25 J	13 J	48 J	34 J	54 J	32.4 J
Mercury	0.17	0.052 J	0.11 J	0.069 J	0.069 J	0.039 UJ	0.086 J	0.063 J	0.064 J	0.092 J
Nickel	18.12	13 J	19 J	16 J	16 J	11 J	14 J	16 J	19 J	9.5 J
Selenium	3.69	1.2 J	4.2 J	2.9 J	2 J	1.3 J	1.2 J	0.88 J	0.99 J	0.92 UJ
Silver	NE	0.18 J	0.15 J	0.21 J	0.23 J	0.074 UJ	0.72 J	0.089 UJ	0.14 UJ	4.6 J
Tin	7.72	7.8 UJ	15 UJ	13 UJ	23 UJ	14 UJ	13 UJ	9.5 UJ	8.7 UJ	8.2 J
Vanadium	241.10	220 J	250 J	160 J	190 J	240 J	180 J	260 J	230 J	184 J
Zinc	148.46	89 J	140 J	130 J	110 J	86 J	100 J	120 J	110 J	93.3 J
Total Organic Carbon (mg/kg)										
Total Organic Carbon	NE	36000 J	42000 J	NA	76000 J	NA	NA	NA	NA	NA

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 method detection limit (2008 data)/ quantitation limit (2009 data)
UJ - Reported method detection limit (2008 data) or quantitation limit (2009 data) is qualified as estimated
ug/kg - micrograms per kilogram
mg/kg - miligrams per kilogram
NE - Not Established
NAPR - Naval Activity Puerto Rico
[1] NAPR basewide background freshwater drainage ditch sediment value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SD16	56SD17	56SD18	56SD19	56SD20	56SD21	56SD22	56SD22D
Sample ID	Basewide	56SD16	56SD17	56SD18	56SD19	56SD20	56SD21	56SD22	56SD22D
Date	Background [1]	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft. bgs)		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)									
2-Butanone (MEK)	NE	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NE	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	NE	NA	NA	NA	NA	NA	NA	NA	NA
Iodomethane	NE	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compound (ug/kg)									
Benzo[a]anthracene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NE	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NE	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NE	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NE	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NE	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (mg/kg)									
Antimony	8.62	0.64 UJ	0.66 UJ	0.92 J	0.29 UJ	0.81 UJ	0.72 UJ	0.74 UJ	0.86 UJ
Arsenic	2.83	0.96 J	2.2 J	3.4 J	2	1.1 UJ	1 J	10.4 J	2.4 J
Barium	208.04	67.3 J	140 J	101 J	42	109 J	105 J	571 J	197 J
Beryllium	0.36	0.5 UJ	0.5 UJ	0.56 UJ	0.4 U	0.44 UJ	0.57 UJ	1.2 UJ	0.59 UJ
Cadmium	0.22	0.1 UJ	0.1 UJ	0.13 UJ	0.04 U	0.12 UJ	0.11 UJ	0.11 UJ	0.13 UJ
Chromium	63.41	27.7 J	29.7 J	25.1 J	29.2	19.8 J	24.4 J	34.4 J	18.2 J
Cobalt	45.07	23.6 J	41.9 J	58.8 J	33	50.8 J	36.7 J	91.4 J	47.6 J

TABLE 6-5

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	NAPR	56SD16	56SD17	56SD18	56SD19	56SD20	56SD21	56SD22	56SD22D
Sample ID	Basewide	56SD16	56SD17	56SD18	56SD19	56SD20	56SD21	56SD22	56SD22D
Date	Background [(1)]	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Total Metals (mg/kg)									
Copper	159.81	100 J	96.6 J	89.3 J	77.3	75.1 J	85.7 J	92.8 J	67.6 J
Lead	19.38	39.4 J	45.7 J	23.3 J	73.1	16.7 J	19.7 J	22 J	15.1 J
Mercury	0.17	0.38 J	0.068 J	0.11 J	0.11	0.15 J	0.1 J	0.086 UJ	0.088 J
Nickel	18.12	9.6 J	11.5 J	10.5 J	11.9	8.7 J	9.9 J	19.1 J	8.7 J
Selenium	3.69	2 J	1.1 UJ	1.8 J	0.46 UJ	1.3 UJ	1.4 J	1.2 UJ	1.4 UJ
Silver	NE	0.31 J	0.12 UJ	0.16 UJ	0.05 U	0.15 UJ	0.13 UJ	0.14 UJ	0.16 UJ
Tin	7.72	7.7 J	13.6 J	10.7 J	4.6 J	14.6 J	10.1 J	16 J	14.1 J
Vanadium	241.10	172 J	189 J	201 J	167	147 J	176 J	171 J	151 J
Zinc	148.46	90.5 J	98.1 J	104 J	86	69.2 J	75.5 J	98.2 J	71.1 J
Total Organic Carbon (mg/kg)									
Total Organic Carbon	NE	NA	NA	NA	NA	NA	NA	NA	NA

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 method detection limit (2008 data)/ quantitation limit (2009 data)
UJ - Reported method detection limit (2008 data) or quantitation limit (2009 data) is qualified as estimated
ug/kg - micrograms per kilogram
mg/kg - miligrams per kilogram
NE - Not Established
NAPR - Naval Activity Puerto Rico
[(1)] NAPR basewide background freshwater drainage ditch sediment value (upper limit of the means concentration [mean plus two standard deviations]) (Baker, 2010)

Notes/Qualifie
J - Estimated
R - Result is
U - Not detec
UJ - Reported
ug/kg - micrc
mg/kg - milig
NE - Not Esta
NAPR - Nava
(1) NAPR bas
the means cc

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - FIELD QA/QC SUMMARY
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Trip Blanks					Field Blank	
Sample ID	56TB02	56TB03	56TB04	QATB01	74TB12	FB01	JUNE09-FB02
Date	4/30/2008	5/2/2008	5/4/2008	5/2/2008	5/7/2008	5/2/2008	6/24/2009
Volatile Organic Comounds (ug/L)							
Acetone	5 UJ	5 UJ	5 U	5 U	5 U	5 U	NA
2-Butanone (MEK)	0.6 U	0.6 UJ	0.6 U	0.6 U	0.6 U	0.69 J	NA
Chloromethane	0.28 U	0.38 J	0.28 U	0.28 U	0.28 U	0.28 UJ	NA
Toluene	0.31 U	0.31 UJ	0.31 U	0.31 U	0.31 U	0.31 U	NA
Semivolatile Organic Compounds (ug/L)							
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	0.16 J	NA
Acetophenone	NA	NA	NA	NA	NA	0.38 J	NA
Benzyl alcohol	NA	NA	NA	NA	NA	0.019 UJ	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	0.34 UJ	NA
Butylbenzylphthalate	NA	NA	NA	NA	NA	0.17 UJ	NA
Diethyl phthalate	NA	NA	NA	NA	NA	0.33 J	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	1.2 J	NA
Phenol	NA	NA	NA	NA	NA	0.14 UJ	NA
Pesticides (ug/L)							
Isodrin	NA	NA	NA	NA	NA	NA	NA
Metals (ug/L)							
Arsenic	NA	NA	NA	NA	NA	0.28 UJ	2.4 U
Copper	NA	NA	NA	NA	NA	2.1 J	0.88 U
Lead	NA	NA	NA	NA	NA	0.38 J	1.8 U
Tin	NA	NA	NA	NA	NA	0.9 UJ	4.8 U
Vanadium	NA	NA	NA	NA	NA	0.8 UJ	0.46 U

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 method detection limit (2008 data)/ quantitation limit (2009 data)
UJ - Reported method detection limit (2008 data) or quantitation limit (2009 data) is qualified as estimated
NA - Not Analyzed
ug/L - micrograms per liter

TABLE 6-6

SUMMARY OF DETECTED LABORATORY RESULTS - FIELD QA/QC SUMMARY
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Equipment Rinsate Blanks							
Sample ID	ER01	ER02	ER04	ER05	ER06	ER07	ER10	JUNE09-ER02
Date	4/28/2008	4/29/2008	5/1/2008	5/2/2008	5/3/2008	5/4/2008	5/7/2008	6/24/2009
Volatile Organic Comounds (ug/L)								
Acetone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.9 J
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	2.5 R
Chloromethane	0.28 U	0.28 U	0.28 U	0.28 U	0.28 UJ	0.28 UJ	0.28 U	0.5 U
Toluene	0.31 U	0.31 U	0.79 J	0.9 J	0.31 U	0.31 U	0.31 U	0.5 U
Semivolatile Organic Compounds (ug/L)								
1,4-Dichlorobenzene	0.21 J	0.17 J	0.12 UJ	0.15 UJ	NA	NA	NA	1 U
Acetophenone	0.47 J	0.42 J	0.35 J	0.35 J	NA	NA	NA	1 U
Benzyl alcohol	0.15 UJ	0.16 UJ	0.16 UJ	0.21 UJ	NA	NA	NA	4.1
Bis(2-ethylhexyl) phthalate	0.39 J	12	0.34 UJ	0.45 UJ	NA	NA	NA	1 U
Butylbenzylphthalate	0.16 UJ	0.17 UJ	0.17 UJ	0.22 UJ	NA	NA	NA	0.86 J
Diethyl phthalate	0.42 J	0.3 J	0.18 UJ	0.24 UJ	NA	NA	NA	1 U
Di-n-butyl phthalate	1.6 J	1.3 J	0.32 J	0.42 J	NA	NA	NA	2.4
Phenol	0.17 J	0.14 UJ	0.14 UJ	0.18 UJ	NA	NA	NA	1 U
Pesticides (ug/L)								
Isodrin	NA	NA	NA	NA	NA	NA	NA	0.3
Metals (ug/L)								
Arsenic	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ	0.46 J	0.33 J	0.35 J	2.4 U
Copper	2.1 J	1.9 J	1.2 UJ	1.2 UJ	3.6 J	5.2	1.9 J	0.88 U
Lead	0.48 J	0.15 UJ	0.15 UJ	0.15 UJ	0.15 U	0.15 U	0.15 U	1.8 U
Tin	1.1 J	0.9 UJ	0.9 UJ	0.9 UJ	0.9 U	0.9 U	0.9 U	4.8 U
Vanadium	0.8 UJ	0.8 UJ	0.8 UJ	0.8 UJ	1.2 J	1.1 J	0.8 U	0.46 U

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 method detection limit (2008 data)/ quantitation limit (2009 data)
UJ - Reported method detection limit (2008 data) or quantitation limit (2009 data) is qualified as estimated
NA - Not Analyzed
ug/L - micrograms per liter

TABLE 6-7

SUMMARY OF ORGANIC DETECTIONS IN SURFACE WATER - ECP PHASE II REPORT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date	PR Water Quality Standards (1) (ug/L)	**Surface Water Screening Values (1)** (ug/L)	2E-SW01 2E-SW01 05/15/04	2E-SW01 2E-SW01D 05/15/04	2E-SW02 2E-SW02 05/15/04	Number Exceeding PR Water Quality Standards	Range Exceeding PR Water Quality Standards	**Number Exceeding Surface Water Screening Values**	**Range Exceeding Surface Water Screening Values**	Location Maximum Detection
Volatile Organic Compounds (ug/L)										
Toluene	NE	37.0	1 U	1 U	1.1	NE		0/3		2E-SW02
Semivolatile Organic Compounds (ug/L)										
Dibenzo(a,h)anthracene	NE	30.0	10 U	1 J	10 U	NE		0/3		2E-SW01D
Indeno(1,2,3-cd)pyrene	NE	30.0	10 U	1 J	10 U	NE		0/3		2E-SW01D
Benzo(g,h,i)perylene	NE	30.0	10 U	1 J	10 U	NE		0/3		2E-SW01D
Total Petroleum Hydrocarbons (mg/L)										
Diesel Range Organics	NE	NE	0.1 U	0.1 U	0.088 J	NE		NE		2E-SW02
Gasoline Range Organics	NE	NE	0.05 U	0.05 U	0.011 J	NE		NE		2E-SW02

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.
ug/L - micrograms per liter.
mg/L - milligrams per liter.
NE - Not Established.
(1) Data Comparison to Screening Values are as presented in the ECP Phase II Report.

TABLE 6-8

SUMMARY OF INORGANIC DETECTIONS IN SURFACE WATER - ECP PHASE II REPORT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date	PR Water Quality Standards [1] (mg/L)	**Surface Water Screening Values [2]** (mg/L)	2E-SW01 2E-SW01 05/15/04	2E-SW01 2E-SW01D 05/15/04	2E-SW02 2E-SW02 05/15/04	Number Exceeding PR Water Quality Standards	Range Exceeding PR Water Quality Standards	**Number Exceeding Surface Water Screening Values**	**Range Exceeding Surface Water Screening Values**	Location Maximum Detection
Appendix IX (Total) Metals (mg/L)										
Barium	NE	50	0.019	0.019	0.029	NE		0/3		2E-SW02
Copper	0.0031	0.0037	0.02 U	0.02 U	**0.0038** B	1/3	0.0038B	1/3	0.0038B	2E-SW02
Vanadium	NE	0.120[1]	0.0015 B	0.0016 B	0.0008 B	NE		0/3		2E-SW01D
Zinc	NE	0.086	0.0018 B	0.0021 B	0.0061 B	NE		0/3		2E-SW02
Mercury	0.00005	0.0011	0.0002 U	0.000097 B	0.0002 U	1/3	0.000097B	0/3		2E-SW01D

Notes:

B - 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.
mg/L - milligrams per liter.
[1] - Data Comparison to Screening Values are as presented in the ECP Phase II Report.
[2] - This chemical lacks a marine/estuarine surface water screening value. The value shown is a freshwater screening value.

TABLE 6-9

SUMMARY OF ORGANIC DETECTIONS IN SEDIMENT - ECP PHASE II REPORT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Sample Date Sample Depth (ft bgs)	Marine Sediment Screening Values (1) (ug/kg)	2E-SD01 05/15/04 (1)		Number Exceeding Marine Sediment Screening Values	Range Exceeding Marine Sediment Screening Values	Location of Maximum Detection
Volatile Organic Compounds (ug/kg)						
Methylene chloride	434	8.9	J	0/1		2E-SD01
Tetrachloroethene	57.0	22		0/1		2E-SD01
Toluene	187	44		0/1		2E-SD01
Acetone	5.81	41	J	1/1	41J	2E-SD01
Semivolatile Organic Compounds (ug/kg)						
Chrysene	108	190	J	1/1	190J	2E-SD01
Fluoranthene	113	160	J	1/1	160J	2E-SD01
Pyrene	153	120	J	0/1		2E-SD01
Cresol, m & p	100	3,000		1/1	3,000	2E-SD01
Total Petroleum Hydrocarbons (mg/kg)						
Diesel Range Organics	NA	290		NA		2E-SD01

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.

(1) - This sample was composited from several locations throughout the drainage ditch. The depth of the sample was down to the concrete liner within the drainage ditch.

ft bgs - feet below ground surface.

ug/kg - micrograms per kilogram.

mg/kg - milligrams per kilogram.

(1) Data Comparison to Screening Values are as presented in the ECP Phase II Report.

TABLE 7-1
LIST OF BIRDS REPORTED FROM OR HAVING THE POTENTIAL TO OCCUR AT NAVAL ACTIVITY PUERTO RICO
SWMU 56 – HANGAR 200 APRON
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 56 – HANGAR 200 APRON
CORRECTIVE MEASURES 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
SWMU 56 - HANGAR 200 APRON
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 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.
Survival, growth, and reproduction of terrestrial reptile communities.	Are site-related chemical concentrations in surface 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.
Drainage Ditch: Survival, growth, and reproduction of aquatic invertebrate communities.	Are site-related chemical concentrations in drainage ditch surface water and sediment sufficient to adversely affect aquatic invertebrate communities?	Comparison of maximum chemical concentrations in surface water and sediment with surface water and sediment screening values.

TABLE 7-2
PRELIMINARY ASSESSMENT ENDPOINTS, RISK QUESTIONS, AND MEASUREMENT ENDPOINTS
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Assessment Endpoints	Risk Questions	Measurement Endpoints
Drainage Ditch (continued):		
Survival, growth, and reproduction of aquatic plant communities.	Are site-related chemical concentrations in drainage ditch surface water and sediment sufficient to adversely affect aquatic plant communities?	Comparison of maximum chemical concentrations in surface water and sediment with surface water and sediment screening values.
Survival, growth, and reproduction of fish communities.	Are site-related chemical concentrations in drainage ditch surface water and sediment sufficient to adversely affect fish communities?	Comparison of maximum chemical concentrations in surface water and sediment with surface water and sediment screening values.
Survival, growth, and reproduction of amphibian communities.	Are site-related chemical concentrations in drainage ditch surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to aquatic amphibians?	Comparison of maximum chemical concentrations in surface water and sediment with surface water and sediment screening values.
Survival, growth, and reproduction of terrestrial avian omnivores.	Are site-related chemical concentrations in drainage ditch sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume plants and invertebrates from the drainage ditch when sediments are exposed during dry periods?	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 sediment.

TABLE 7-3
LOG K_{ow} AND K_{oc} VALUES FOR ORGANIC CHEMICALS
SWMU 56 - HANGAR 200 APRON
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 56 - HANGAR 200 APRON
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 56 - HANGAR 200 APRON
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 56 - HANGAR 200 APRON
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 is 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.

Table References:

Syracuse Research Corporation (SRC). 1998. Experimental Octanol/Water partition Coefficient (Log P) Database. Available at http://www.syrres.com/esc/est_kowdemo.htm

United States Environmental Protection Agency (USEPA). 1996a. Superfund Chemical Data Matrix. EPA/540/R-96/028.

USEPA. 1996b. Ecotox Thresholds. Eco Update, Volume 3, Number 2. Office of Solid Waste and Emergency Response, Washington, D.C. EPA 540?F-95/038.

USEPA. 1995. Internal Report on Summary of Measured, Calculated and Recommended Log K_{ow} Values. Environmental Research Laboratory, Athens, GA. April 10, 1995.

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 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGER 200 APRON
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 56 - HANGER 200 APRON
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 56 - HANGER 200 APRON
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 56 - HANGER 200 APRON
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 56 - HANGER 200 APRON
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 56 - HANGER 200 APRON
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 56 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 56 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:

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

Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revisions. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-126/R2.

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997b. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revisions. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-85/R3

Ministry of Housing, Spatial Planning and Environment (MHSPE). 2000. Circular on Target Values and Intervention Values for Soil Remediation. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, Netherlands. February 4, 2000.

United States Environmental Protection Agency (USEPA). 2008. Ecological Soil Screening Levels for Chromium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-66.

TABLE 7-4
SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table References (continued):

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.

USEPA. 2005h. Ecological Soil Screening Levels for Vanadium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-75.

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

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 56 - HANGER 200 APRON
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	---	---

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value (1)	Reference	Comment (2)
Volatile Organics (µg/L):			
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
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
Xylenes, total	27.0 (3)(4)	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
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

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 56 - HANGER 200 APRON
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-Methylphenol	102	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Elasmopus pectinicrus* [scud]) with a safety factor of 100
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	25 [(3)(5)]	USEPA 2003	USEPA Region 5 ecological screening level (the value shown is for 4-methylphenol)
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-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-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
Diallate	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
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

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 56 - HANGER 200 APRON
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):			
Hexachlorobenzene	10.0	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	0.23	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)

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value (1)	Reference	Comment (2)
PAHs (µg/L):			
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)
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	310	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 (6)	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

TABLE 7-5
MARINE/ESTUARINE SURFACE WATER SCREENING VALUES USED FOR GROUNDWATER
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(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 56 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 o-xylene.

(5) The value shown is for 4-methylphenol.

(6) The value shown is for hexavalent chromium.

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.

Puerto Rico Environmental Quality Board (PREQB). Puerto Rico Water Quality Standards Regulation. Regulation No. 7837. March 31, 2010.

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.

USEPA. 2009. National Recommended Water Quality Criteria. Office of Water and Office of Science and Technology, Washington, D.C. http://www.epa.gov/waterscience/criteria/wqctable/.

USEPA. 2007a. ECOTOX User Guide: Ecotoxicology Database System. Version 4.0. http:/www.epa.gov/ecotox/. Accessed May 14, 2008, July 2, 2008, January 8, 2009, April 1, 2009, and August 28, 2009.

USEPA 2007b. Great Lakes Inititiative Toxicity Data Clearinghouse. http://www.epa.gov/gliclearinghouse/. Accessed January 8, 2009.

USEPA. 2004. Superfund Chemical Data Matrix. http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm .

USEPA. 2003. USEPA Region 5 Ecological Screening Levels Table. http://www.epa.gov/reg5rcra/ca/ESL.pdf.

USEPA. 2001. Region 4 Ecological Risk Assessment Bulletins - Supplement to RQGS. Waste Management Division, Atlanta, GA. http://www.epa.gov/region04/waste/ots/ecolbul.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.

TABLE 7-6
FRESHWATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment [2]
PAHs (µg/L):			
2-Methylnaphthalene	14.56	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Oncorhynchus mykiss* [rainbow trout]) with a safety factor of 100
Acenaphthene	23.0	USEPA 1996	Final Chronic Value
Acenaphthylene	6.00 [3]	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for low molecular weight PAHs)
Anthracene	0.035	USEPA 2003	USEPA Region 5 ecological screening level
Benzo(a)anthracene	0.025	USEPA 2003	USEPA Region 5 ecological screening level
Benzo(a)pyrene	0.014	USEPA 2003	USEPA Region 5 ecological screening level
Benzo(b)fluoranthene	6.00 [3]	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 [3]	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Benzo(k)fluoranthene	6.00 [3]	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Chrysene	10	USEPA 2004	Acute value (LC_{50}) with a safety factor of 100
Dibenzo(a,h)anthracene	6.00 [3]	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Fluoranthene	8.10	USEPA 1996	Final Chronic Value
Fluorene	19.0	USEPA 2003	USEPA Region 5 ecological screening level
Indeno(1,2,3-cd)pyrene	6.00 [3]	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Naphthalene	13.0	USEPA 2003	USEPA Region 5 ecological screening level
Phenanthrene	6.30	USEPA 1996	Final Chronic Value
Pyrene	0.30	USEPA 2003	USEPA Region 5 ecological screening level
Total Recoverable Metals (µg/L):			
Antimony	80.0	USEPA 2003	USEPA Region 5 total recoverable ecological screening level
Arsenic	150	USEPA 2009	Total recoverable Criteria Continuous Concentration for trivalent arsenic
Barium	220	USEPA 2003	USEPA Region 5 total recoverable ecological screening level
Beryllium	1.69 [4]	USEPA 2007b	Ohio Environmental Protection Agency Great Lakes Basin total recoverable chronic criterion (hardness dependent)
Cadmium	0.12 [4]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)
Chromium, total	33.3 [4][5]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)
Cobalt	24.0	USEPA 2003	USEPA Region 5 total recoverable ecological screening level
Copper	3.46 [4]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)
Lead	0.73 [4]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)
Mercury	0.91	USEPA 2009	Total recoverable Criteria Continuous Concentration
Nickel	19.6 [4]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)
Selenium	5.00	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters
Silver	0.51 [4]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)
Thallium	4.00	USEPA 2001	USEPA Region 4 total recoverable chronic screening value
Tin	180	USEPA 2003	USEPA Region 5 total recoverable ecological screening level
Vanadium	12.0	USEPA 2003	USEPA Region 5 total recoverable ecological screening level
Zinc	44.8 [4]	PREQB 2010	Total recoverable Puerto Rico Water Quality Standard for Class SD surface waters (hardness dependent)

Notes:

PREQB = Puerto Rico Environmental Quality Board
LOEL = Lowest Observed Effect Level
PAH = Polynuclear Aromatic Hydrocarbon
USEPA = United States Environmental Protection Agency
EC_{50} = Median Effective Concentration
µg/L = microgram per liter

TABLE 7-6
FRESHWATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(1) The values shown are freshwater screening values unless otherwise noted.

(2) The safety factors applied to acute endpoints (i.e., LC_{50} and LOEL values) are those recommended by Wentsel et al. (1996).

(3) The chemical lacks a freshwater toxicological benchmark and literature-based toxicity test data. The value shown is a marine/estuarine screening value.

(4) The screening value shown is based on a water hardness of 31.35 mg/L as $CaCO_3$.

(5) The value shown is for trivalent chromium.

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.

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.

Puerto Rico Environmental Quality Board (PREQB). Puerto Rico Water Quality Standards Regulation. Regulation No. 7837. March 31, 2010.

United States Environmental Protection Agency (USEPA). 2009. National Recommended Water Quality Criteria. Office of Water and Office of Science and Technology, Washington, D.C. http://www.epa.gov/waterscience/criteria/wqctable/

USEPA. 2007a. ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. http:/www.epa.gov/ecotox/. Assessed June 10, 2008, June 11, 2008, January 8, 2009, And August 28, 2009.

USEPA 2007b. Great Lakes Initiative Toxicity Data Clearinghouse. http://www.epa.gov/gliclearinghouse/. Accessed January 8, 2009.

USEPA. 2004. Superfund Chemical Data Matrix. http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

USEPA. 2003. USEPA Region 5 Ecological Screening Levels Table. http://www.epa.gov/reg5rcra/ca/ESL.pdf.

USEPA. 2001. Region 4 Ecological Risk Assessment Bulletins - Supplement to RQGS. Waste Management Division, Atlanta, GA. http://www.epa.gov/region04/waste/ots/ecolbul.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.

TABLE 7-7
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value (1)	Reference	Comment (2)(3)
Volatile Organics (µg/kg):			
1,1,1,2-Tetrachloroethane	2,773	USEPA 1993 and 1996	EqP-based screening value
1,1,1-Trichloroethane	750	USEPA 1993 and 1996	EqP-based screening value
1,1,2,2-Tetrachloroethane	1,933	USEPA 1993 and 1996	EqP-based screening value
1,1,2-Trichloroethane	1,865	USEPA 1993 and 1996	EqP-based screening value
1,1-Dichloroethane	97.3	USEPA 1993 and 1996	EqP-based screening value
1,1-Dichloroethene	290.6	USEPA 1993 and 1996	EqP-based screening value
1,2,3-Trichloropropane	1,607	USEPA 1993 and 1996	EqP-based screening value
1,2-Dibromo-3-chloropropane	1,438	USEPA 1993 and 1996	EqP-based screening value
1,2-Dichloroethane	913	USEPA 1993 and 1996	EqP-based screening value
1,2-Dichloropropane	1,120	USEPA 1993 and 1996	EqP-based screening value
2-Butanone (MEK)	149.4	USEPA 1993 and 1996	EqP-based screening value
2-Chloro-1,3-butadiene	NA	---	---
2-Hexanone	81.1	USEPA 1993 and 1996	EqP-based screening value
3-Chloro-1-propene	9.67	USEPA 1993 and 1996	EqP-based screening value
4-Methyl-2-pentanone (MIBK)	118.8	USEPA 1993 and 1996	EqP-based screening value
Acetone	35.57	USEPA 1993 and 1996	EqP-based screening value
Acetonitrile	200.24	USEPA 1993 and 1996	EqP-based screening value
Acrolein	0.0067	USEPA 1993 and 1996	EqP-based screening value
Acrylonitrile	4.19	USEPA 1993 and 1996	EqP-based screening value
Benzene	236.9	USEPA 1993 and 1996	EqP-based screening value
Bromoform	1,692	USEPA 1993 and 1996	EqP-based screening value
Bromomethane	8.52	USEPA 1993 and 1996	EqP-based screening value
Carbon disulfide	50.0	USEPA 1993 and 1996	EqP-based screening value
Carbon tetrachloride	4,172	USEPA 1993 and 1996	EqP-based screening value
Chlorobenzene	1,097	USEPA 1993 and 1996	EqP-based screening value
Chlorodibromomethane	1,664	USEPA 1993 and 1996	EqP-based screening value
Chloroethane	10,406	Di Toro and McGrath 2000	EqP-based toxicological threshold
Chloroform	389	USEPA 1993 and 1996	EqP-based screening value
Chloromethane	1,554	USEPA 1993 and 1996	EqP-based screening value
cis-1,3-Dichloropropene	93.1	USEPA 1993 and 1996	EqP-based screening value
Dibromomethane	252.4	USEPA 1993 and 1996	EqP-based screening value
Dichlorobromomethane	10,025	USEPA 1993 and 1996	EqP-based screening value
Dichlorodifluoromethane	1,053	USEPA 1993 and 1996	EqP-based screening value
Ethylbenzene	4.00 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Echinoderm larvae and $larval_{max}$)
Ethylene dibromide	500	USEPA 1993 and 1996	EqP-based screening value
Ethyl methacrylate	23,704	USEPA 1993 and 1996	EqP-based screening value
Iodomethane	NA	---	---
Isobutyl alcohol	787	USEPA 1993 and 1996	EqP-based screening value
Methacrylonitrile	NA	---	---

TABLE 7-7
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value (1)	Reference	Comment (2)(3)
Volatile Organics (µg/kg):			
Methylene chloride	97.0	USEPA 1993 and 1996	EqP-based screening value
Methyl methacrylate	2,292	USEPA 1993 and 1996	EqP-based screening value
Pentachloroethane	2,069	USEPA 1993 and 1996	EqP-based screening value
Propionitrile	787	USEPA 1993 and 1996	EqP-based screening value
Styrene	895	USEPA 1993 and 1996	EqP-based screening value
Tetrachloroethene	57.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (infaunal community impacts)
Toluene	3,183	USEPA 1993 and 1996	EqP-based screening value
trans-1,2-dichloroethene	3,786	USEPA 1993 and 1996	EqP-based screening value
trans-1,3-Dichloropropene	87.0	USEPA 1993 and 1996	EqP-based screening value
trans-1,4-Dichloro-2-butene	NA	---	---
Trichloroethene	781	USEPA 1993 and 1996	EqP-based screening value
Trichlorofluoromethane	2,432	USEPA 1993 and 1996	EqP-based screening value
Vinyl acetate	46.6	USEPA 1993 and 1996	EqP-based screening value
Vinyl chloride	999	USEPA 1993 and 1996	EqP-based screening value
Xylenes, total	4.00 (4)	Buchman 2008	Minimum Apparent Effects Threshold for total xylenes (bivalve)
Semi-Volatile Organics (µg/kg):			
1,2,4,5-Tetrachlorobenzene	3,934	USEPA 1993 and 1996	EqP-based screening value
1,2,4-Trichlorobenzene	4.80 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Echinoderm larvae)
1,3,5-Trinitrobenzene	41.6	USEPA 1993 and 1996	EqP-based screening value
1,1-Biphenyl	67,706	USEPA 1993 and 1996	EqP-based screening value
1,2-Dichlorobenzene	13.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Neanthes bioassay)
1,3-Dichlorobenzene	4,733	USEPA 1993 and 1996	EqP-based screening value
1,3-Dinitrobenzene	23.63	USEPA 1993 and 1996	EqP-based screening value
1,4-Dichlorobenzene	110 (4)	Buchman 2008	Minimum Apparent Effects Threshold (infaunal community impacts and Microtox bioassay)
1,4-Dioxane	430	USEPA 1993 and 1996	EqP-based screening value
1,4-Naphthoquinone	0.69	USEPA 1993 and 1996	EqP-based screening value
2,3,4,6-Tetrachlorophenol	1,024	USEPA 1993 and 1996	EqP-based screening value
2,4,5-Trichlorophenol	3.00 (4)	Buchman 2008	Minimum Apparent Effects Threshold (infaunal community impacts)
2,4,6-Trichlorophenol	6.00 (4)	Buchman 2008	Minimum Apparent Effects Threshold (infaunal community impacts)
2,2'-Oxybis(1-chloropropane)	NA	---	---
2,4-Dichlorophenol	0.2083 (4)	Buchman 2008	Minimum Apparent Effects Threshold (basis of value not specified)
2,4-Dimethylphenol	18.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Neanthes bioassay)
2,4-Dinitrophenol	7.46	USEPA 1993 and 1996	EqP-based screening value
2,4-Dinitrotoluene	149.9	USEPA 1993 and 1996	EqP-based screening value
2,6-Dichlorophenol	618	USEPA 1993 and 1996	EqP-based screening value
2,6-Dinitrotoluene	201.0	USEPA 1993 and 1996	EqP-based screening value
2-Acetylaminofluorene	841	USEPA 1993 and 1996	EqP-based screening value

TABLE 7-7
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value [1]	Reference	Comment [2][3]
Semi-Volatile Organics (µg/kg):			
2-Chloronaphthalene	2,423	USEPA 1993 and 1996	EqP-based screening value
2-Chlorophenol	0.333 [4]	Buchman 2008	Minimum Apparent Effects Threshold (basis of value not specified)
2-Methylphenol	8.00 [4]	Buchman 2008	Minimum Apparent Effects Threshold (bivalve)
2-Naphthylamine	NA	---	---
2-Nitroaniline	116.0	USEPA 1993 and 1996	EqP-based screening value
2-Nitrophenol	7,248	USEPA 1993 and 1996	EqP-based screening value
2-Picoline	3,986	USEPA 1993 and 1996	EqP-based screening value
2-Toluidine	3.73	USEPA 1993 and 1996	EqP-based screening value
3,4-Methylphenol	100 [4][5]	Buchman 2008	Minimum Apparent Effects Threshold (bivalve)
3,3'-Dichlorobenzidine	457	USEPA 1993 and 1996	EqP-based screening value
3,3'-Dimethylbenzidine	2,484	USEPA 1993 and 1996	EqP-based screening value
3-Methylcholanthrene	NA	---	---
3-Nitroaniline	7.84	USEPA 1993 and 1996	EqP-based screening value
4,6-Dinitro-2-methylphenol	100.5	USEPA 1993 and 1996	EqP-based screening value
4-Aminobiphenyl	NA	---	---
4-Bromophenyl phenyl ether	1,124	Di Toro and McGrath 2000	EqP-based toxicological threshold
4-Chloro-3-methylphenol	12.05	USEPA 1993 and 1996	EqP-based screening value
4-Chloroaniline	550	USEPA 1993 and 1996	EqP-based screening value
4-Chlorophenyl phenyl ether	1,032	Di Toro and McGrath 2000	EqP-based toxicological threshold
4-Nitroaniline	142.4	USEPA 1993 and 1996	EqP-based screening value
4-Nitrophenol	163.0	USEPA 1993 and 1996	EqP-based screening value
4-Nitroquinoline-1-oxide	NA	---	---
7,12-Dimethylbenz(a)anthracene	695,334	USEPA 1993 and 1996	EqP-based screening value
Acetophenone	2,286	USEPA 1993 and 1996	EqP-based screening value
A,A-Dimethylphenethylamine	NA	---	---
Aniline	1.36	USEPA 1993 and 1996	EqP-based screening value
Aramite, total	6,090	USEPA 1993 and 1996	EqP-based screening value
Benzyl alcohol	52.0 [4]	Buchman 2008	Minimum Apparent Effects Threshold (bivalve)
bis(2-Chloroethoxy)methane	362	USEPA 1993 and 1996	EqP-based screening value
bis(2-Chloroethyl)ether	1,326	USEPA 1993 and 1996	EqP-based screening value
bis(2-Ethylhexyl)phthalate	180	MacDonald et al. 2003	Threshold Effect Concentration
Butyl benzyl phthalate	63.0 [4]	Buchman 2008	Minimum Apparent Effects Threshold (Microtox)
Diallate	76,571	USEPA 1993 and 1996	EqP-based screening value
Dibenzofuran	110 [4]	Buchman 2008	Minimum Apparent Effects Threshold (Echinoderm larvae)
Diethyl phthalate	630	MacDonald et al. 2003	Threshold Effect Concentration
Dimethyl phthalate	6.00 [4]	Buchman 2008	Minimum Apparent Effects Threshold (bivalve)
Di-n-butyl phthalate	58.0 [4]	Buchman 2008	Minimum Apparent Effects Threshold (bivalve and larval_{max})

TABLE 7-7
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value (1)	Reference	Comment (2)(3)
Semi-Volatile Organics (µg/kg):			
Di-n-octyl phthalate	61.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (bivalve and larval$_{max}$)
Dinoseb	73.3	USEPA 1993 and 1996	EqP-based screening value
Ethyl methanesulfonate	1.61	USEPA 1993 and 1996	EqP-based screening value
Hexachlorobenzene	20.0	MacDoanld et al 2003/Persaud et al. 1993	Threshold Effect Conentration/Lowest Effect Level
Hexachlorobutadiene	55.0	MacDonald et al. 2003	Threshold Effect Concentration
Hexachlorocyclopentadiene	501	USEPA 1993 and 1996	EqP-based screening value
Hexachloroethane	73.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (bivalve and larval$_{max}$)
Hexachlorophene	8,182,484	USEPA 1993 and 1996	EqP-based screening value
Hexachloropropene	NA	---	---
Isophorone	1,554	USEPA 1993 and 1996	EqP-based screening value
Isosafrole	NA	---	---
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
N-Nitro-o-toluidine	546	USEPA 1993 and 1996	EqP-based screening value
N-Nitrosodiethylamine	82.0	USEPA 1993 and 1996	EqP-based screening value
N-Nitrosodimethylamine	0.25	USEPA 1993 and 1996	EqP-based screening value
N-Nitroso-di-n-butylamine	211	USEPA 1993 and 1996	EqP-based screening value
N-Nitroso-di-n-propylamine	21.4	USEPA 1993 and 1996	EqP-based screening value
N-Nitrosodiphenylamine	28.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (infaunal community impacts)
N-Nitrosomethylethylamine	0.69	USEPA 1993 and 1996	EqP-based screening value
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---
Nitrobenzene	21.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Neanthes bioassay)
p-Dimethylamino azobenzene	NA	---	---
Pentachlorobenzene	101.4	USEPA 1993 and 1996	EqP-based screening value
Pentachloronitrobenzene	1,311	USEPA 1993 and 1996	EqP-based screening value
Pentachlorophenol	17.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (bivalve)
Phenacetin	NA	---	---
Phenol	130 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Echinoderm larvae)
p-Phenylene diamine	3.67	USEPA 1993 and 1996	EqP-based screening value
Pronamide	772	USEPA 1993 and 1996	EqP-based screening value
Pyridine	391	USEPA 1993 and 1996	EqP-based screening value
Safrole, total	NA	---	---
PAHs (µg/kg):			
2-Methylnaphthalene	20.2	CCME 2002	Interim Sediment Quality Guideline
Acenaphthene	6.70	MacDonald et al. 2003/CCME 2002	Threshold Effect Concentration/Interim Sediment Quality Guideline
Acenaphthylene	5.90	MacDonald et al. 2003/CCME 2002	Threshold Effect Concentration/Interim Sediment Quality Guideline

TABLE 7-7
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Sediment Screening Value (1)	Reference	Comment (2)(3)
PAHs (µg/kg):			
Anthracene	57.2	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Benzo(a)anthracene	108	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Benzo(a)pyrene	150	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Benzo(b)fluoranthene	1,800 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Echinoderm larvae and infaunal commuity impacts)
Benzo(g,h,i)perylene	170	Persaud et al. 1993	Lowest Effect Level
Benzo(k)fluoranthene	240	Persaud et al. 1993	Lowest Effect Level
Chrysene	166	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Dibenzo(a,h)anthracene	33.0	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Fluoranthene	423	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Fluorene	77.4	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Indeno(1,2,3-cd)pyrene	200	Persaud et al. 1993	Lowest Effect Level
Naphthalene	176	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Phenanthrene	204	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
Pyrene	195	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration
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 (4)	Buchman 2008	Minimum Apparent Effects Threshold for tributyl tin (Neanthes bioassay)
Vanadium	57.0 (4)	Buchman 2008	Minimum Apparent Effects Threshold (Neanthes bioassay)
Zinc	121	MacDonald et al. 2000	Consensus-based Threshold Effect Concentration

Notes:

NA = Not Available
EqP = Equilibrium partitioning
PAH = Polynuclear Aromatic Hydrocarbon
USEPA = United States Environmental Protection Agency
CCME = Canadian Council of Ministers of the Environment
BTAG = Biological Technical Assistance Group
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram

TABLE 7-7
FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(1) The values shown are literature-based freshwater screening values/toxicological benchmarks 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 0.036 was used (minimum f_{oc} for SWMU 56 sediment).

(3) EqP-based sediment screening values from Di Toro and McGrath (2000) are based on an f_{oc} of 0.036 (minimum f_{oc} for SWMU 56 sediment).

(4) The chemical lacks a literature-based freshwater bulk sediment screening value/toxicological benchmark. The value shown is a literature-based marine/estuarine bulk sediment screening value/toxicological benchmark.

(5) The value shown is for 4-methylphenol.

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.

Canadian Council of Ministers of the Environment (CCME). 2002. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Updated 2002. In: Canadian Environmental Qlulaity Guidelines, 1999, CCME, Winnapeg. http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=124.

Di Toro, D.M. and J.A. McGrath. 2000. Technical Basis for Narcotic Chemicals and Polycyclic Aromatic Hydrocarbon Criteria. II. Mixtures and Sediments. Environ. Toxicol. Chem. 19:1971-1982.

Lemley, A.D. 2002. Selenium Assessment in Aquatic Ecosystems. U.S. Forest Service, Blacksburg, VA.

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.

Persaud, D.R., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment (OMOE).

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 7-8
TOXICITY REFERENCE VALUES FOR BIRDS
SWMU 56 - HANGAR 200 APRON
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	17.0	7.59	3.39 [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	---	---

TABLE 7-8
TOXICITY REFERENCE VALUES FOR BIRDS
SWMU 56 - HANGAR 200 APRON
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:											
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]	---
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	---

TABLE 7-8
TOXICITY REFERENCE VALUES FOR BIRDS
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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, 1997).

(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.

Table References:

Coulston, F. and A.C. Kolbye, Jr. (eds.) 1994. Interpretive Review of the Potential Adverse Effects of Chlorinated Organic Chemicals on Human Health and the Environment. Regul. Toxicol. Pharmacol. 20:S1-S1056.

Hill, E.F. and M.B. Camardese. 1986. Lethal Dietary Toxicities of Environmental Contaminants and Pesticides to Coturnix. U.S. Fish and Wildlife Services Technical Report 2.

Opresko, D.M., B.E. Sample, and G.W. Suter II. 1993. Toxicological Benchmarks for Wildlife. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-86

Rigdon, R.H. and J.Neal. 1963. Fluorescence of Chickens and Eggs Following the Feeding of Benzopyrene Crystals. Texas Reports on Biology and Medicine. 21(4):558-566.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory, Health Sciences Research Division, Oak Ridge, TN. ES/ER/TM-86/R3.

United States Environmental Protection Agency (USEPA). 2008. Ecological Soil Screening Levels for Chromium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-66.

USEPA. 2007a. Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons (PAHs). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-78.

USEPA. 2007b. ECOTOX User Guide: Ecotoxicology Database System. Version 4.0. http:/www.epa.gov/ecotox/. Accessed June 6, 2010.

UAEPA. 2007c. Ecological Soil Screening Levels for Pentachlorophenol (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-58.

Table References (continued):

USEPA. 2007d. Ecological Soil Screening Levels for Copper (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-77.

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.

USEPA. 2007f. Ecological Soil Screening Levels for Selenium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-72.

USEPA. 2007g. 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 9285.7-61

USEPA. 2005a. Ecological Soil Screening Levels for Arsenic (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-62.

USEPA. 2005b. Ecological Soil Screening Levels for Cadmium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-65.

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

USEPA. 2005d. Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

USEPA. 2005e. Ecological Soil Screening Levels for Vanadium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-75.

USEPA. 2004. Ecotoxicity Database. http://www.epa.gov/pesticides/science/models_db.htm.

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

USEPA. 1997a. Mercury Study Report to Congress. Volume VI: An Ecological Assessment for Anthropogenic Mercury Emissions in the United States. EPA-452/R-97-008.

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.

TABLE 7-9
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	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)

TABLE 7-9
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	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	In(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	In(C_p) = 0.5944[In(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	In(C_p) = 0.5944[In(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	In(C_p) = -0.8556[ln(C_s)] - 5.562	USEPA 2007	Uptake equation (3)	2.089	USEPA 2007	Modeled BAF (10)

TABLE 7-9
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	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**
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	$\text{In}(C_p) = 0.564[\ln[C_s]) - 1.992$	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	$\text{In}(C_p) = 0.7345[\ln[C_s]) - 0.5361$	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	$\text{In}(C_p) = 0.544[\ln[C_s]) - 0.996$	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.

TABLE 7-9
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(2) Maximum BAF value listed in Appendix F, Table F-1 of USEPA (2007).

(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 soilds [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:

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.

Baes III, C.F., R.D. Scharp, A.L. Sjoreen, and R.W. Shor. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture ORNL 5786. Oak Ridge National Laboratory, Oak Ridge, TN.

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. 1999. Literature-Derived Bioaccumulation Models for Earthworms: Development and Validation. Environ. Toxicol. Chem. 18:2110-2120.

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.

TABLE 7-9
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table References (continued):

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 Derivatior of Wildlife Eco-SSLs. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-55.

USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

TABLE 7-10
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil-Small Mammal BAF (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)
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)

TABLE 7-10
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Soil-Small Mammal BAF (dry weight)		
Chemical	**BAF Value/Uptake Equation**	**Source Document**	**Description**
Semi-Volatile Organics:			
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)
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

TABLE 7-10
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Soil-Small Mammal BAF (dry weight)		
Chemical	**BAF Value/Uptake Equation**	**Source Document**	**Description**
PAHs:			
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	$\ln(C_m) = 0.4865[\ln(C_s)] - 0.4306$	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)
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)

TABLE 7-10
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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).

(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.

United States Environmental Protection Agency (USEPA). 2007. Attachemnt 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.

TABLE 7-11
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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	0.056 [(1)]	Dunning 2008	0.01503	Allometric equation from Nagy (2001) for insectivorous birds[(5)]: $[0.540((BW*1000)^{0.705})]/1000$	0.01361	Allometric equation from Calder and Braun (1983) for all birds[(5)]: $0.059(BW)^{0.67}$	1.00
Mourning dove	Terrestrial	0.115 [(2)]	Dunning 2008	0.01723	Allometric equation from Nagy (2001) for all birds[(5)]: $[0.638((BW*1000)^{0.685})]/1000$	0.01449	Allometric equation from Calder and Braun (1983) for all birds[(5)]: $0.059(BW)^{0.67}$	1.00
Red-tailed hawk	Terrestrial	0.923 [(3)]	Dunning 2008	0.09679	Allometric equation from Nagy (2001) for carnivorous birds[(5)]: $[0.849((BW*1000)^{0.663})]/1000$	0.06910	Allometric equation from Calder and Braun (1983) for all birds[(5)]: $0.059(BW)^{0.67}$	1.00
Mammals:								
Norway rat (prey item for red-tailed hawk)	Terrestrial	0.200 [(4)]	Jackson 1992	0.04075	Allometric equation from Nagy (2001) for rodents[(6)]: $[0.332((BW*1000)^{0.774})]/1000$	0.05305	Allometric equation from Calder and Braun (1983) for all mammals[(6)]: $0.099(BW)^{0.90}$	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 7-11
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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 within the range of reported values (sex and location not specified).

(5) 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).

(6) Food ingestion rate 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.

Dunning, J.B., Jr. (ed.). 2008. CRC Handbook of Avian Body Masses, Second Edition. CRC Press, Boca Raton, FL.

Jackson, W.B. 1992. Norway Rat and Allies. Chapter 54 *In* Chapman, J.A. and G.A. Feldhamer (eds.), Wild Mammals of North America: Biology, Management, and Economics. The John Hopkins University Press, Baltimore, MD. pp. 1077-1088.

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 7-12
DIETARY COMPOSITION FOR UPPER TROPHIC LEVEL RECEPTORS: SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Receptor	Dietary Composition (percent)				Soil Ingestion (percent)	
	Terrestrial Plants	**Soil Invertebrates**	**Small Mammals**	**Reference**	**Value**	**Reference**
Birds:						
American robin	0	89.5	0	Assumed [(1)]	10.5 [(2)]	Sample and Suter II 1994
Mourning dove	95.0	0	0	Tomlinson et al. 1994	5.0	Assumed
Red-tailed hawk	0	0	100	USEPA 1993; Sample and Suter II 1994	0	Sample and Suter II 1994
Mammals:						
Norway rat (prey item for red-tailed hawk)	0	98.0	0	Assumed [(1)]	2.0	Assumed

Notes:

USEPA = United States Environmental Protection Agency

[(1)] For the screening level risk calculation, an exclusive diet of terrestrial invertebrates (i.e., earthworms) was assumed.

[(2)] 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.

Table References:

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.

TABLE 7-13
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
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 Value (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Volatile Organics (µg/kg)										
1,1,1,2-Tetrachloroethane	0/8	ND	0.56U - 0.75U	0.317	0.75	100	CCME 2007	<0.01	No	HQ < 1.0
1,1,1-Trichloroethane	0/8	ND	0.51U - 0.68U	0.287	0.68	100	CCME 2007	<0.01	No	HQ < 1.0
1,1,2,2-Tetrachloroethane	0/8	ND	1.2U - 1.7U	0.694	1.7	100	CCME 2007	0.02	No	HQ < 1.0
1,1,2-Trichloroethane	0/8	ND	1U - 1.4U	0.594	1.4	100	CCME 2007	0.01	No	HQ < 1.0
1,1-Dichloroethane	0/8	ND	0.44U - 0.59U	0.247	0.59	100	CCME 2007	<0.01	No	HQ < 1.0
1,1-Dichloroethene	0/8	ND	0.48U - 0.64U	0.268	0.64	100	CCME 2007	<0.01	No	HQ < 1.0
1,2,3-Trichloropropane	0/8	ND	1.2U - 1.7U	0.694	1.7	NE	---	NA	Yes	No SSV
1,2-Dibromo-3-Chloropropane	0/8	ND	2.5U - 3.3U	1.388	3.3	NE	---	NA	Yes	No SSV
1,2-Dichloroethane	0/8	ND	0.88U - 1.2U	0.495	1.2	402	MHSPE 2000	<0.01	No	HQ < 1.0
1,2-Dichloropropane	0/8	ND	0.97U - 1.3U	0.548	1.3	700,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2-Butanone (MEK)	0/8	ND	2.6U - 24U	5.356	24	NE	---	NA	Yes	No SSV
2-Chloro-1,3-butadiene	0/8	ND	0.5U - 0.67UJ	0.281	0.67	NE	---	NA	Yes	No SSV
2-Hexanone	0/8	ND	1.9U - 2.5U	1.038	2.5	NE	---	NA	Yes	No SSV
3-Chloro-1-propene	0/7	ND	1.3UJ - 1.8U	0.743	1.8	NE	---	NA	Yes	No SSV
4-Methyl-2-pentanone (MIBK)	0/8	ND	2.6U - 3.4U	1.438	3.4	NE	---	NA	Yes	No SSV
Acetone	7/8	23J - 280	86U - 86U	140.625	280	NE	---	NA	Yes	No SSV
Acetonitrile	0/7	ND	40U - 45U	21.571	45	NE	---	NA	Yes	No SSV
Acrylonitrile	0/8	ND	20U - 27U	11.313	27	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Benzene	2/8	0.95J - 0.99J	0.7U - 0.8U	0.526	0.99	101	MHSPE 2000	<0.01	No	HQ < 1.0
Bromoform	0/8	ND	0.97U - 1.3U	0.548	1.3	NE	---	NA	Yes	No SSV
Bromomethane	0/8	ND	1.4U - 1.9U	0.788	1.9	NE	---	NA	Yes	No SSV
Carbon disulfide	1/8	1.9J - 1.9J	0.45U - 0.6U	0.460	1.9	NE	---	NA	Yes	No SSV
Carbon tetrachloride	0/8	ND	0.88U - 1.2U	0.495	1.2	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorobenzene	0/8	ND	0.64U - 0.86U	0.361	0.86	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorodibromomethane	0/8	ND	0.44U - 0.59U	0.247	0.59	NE	---	NA	Yes	No SSV
Chloroethane	0/8	ND	1.1U - 1.4U	0.600	1.4	NE	---	NA	Yes	No SSV
Chloroform	0/8	ND	0.44U - 0.59U	0.247	0.59	1,002	MHSPE 2000	<0.01	No	HQ < 1.0
Chloromethane	1/8	2.2J - 2.2J	0.65U - 0.84U	0.588	2.2	NE	---	NA	Yes	No SSV
cis-1,3-Dichloropropene	0/8	ND	0.77U - 1U	0.429	1	100	CCME 2007	0.01	No	HQ < 1.0
Dibromomethane	0/8	ND	1.1U - 1.4U	0.600	1.4	NE	---	NA	Yes	No SSV
Dichlorobromomethane	0/8	ND	0.44U - 0.59U	0.247	0.59	NE	---	NA	Yes	No SSV
Dichlorodifluoromethane	0/8	ND	0.78U - 1U	0.438	1	NE	---	NA	Yes	No SSV
Ethyl methacrylate	0/8	ND	1.9U - 2.6U	1.081	2.6	NE	---	NA	Yes	No SSV
Ethylbenzene	0/8	ND	0.66U - 0.88U	0.371	0.88	5,003	MHSPE 2000	<0.01	No	HQ < 1.0
Ethylene Dibromide	0/8	ND	1.3U - 1.8U	0.738	1.8	300	CCME 2007	<0.01	No	HQ < 1.0
Iodomethane	4/8	1J - 2.4J	0.96UJ - 1.2U	1.173	2.4	NE	---	NA	Yes	No SSV
Isobutyl alcohol	0/3	ND	66U - 69U	33.667	69	NE	---	NA	Yes	No SSV
Methacrylonitrile	0/8	ND	21UJ - 28UJ	11.813	28	NE	---	NA	Yes	No SSV
Methyl methacrylate	0/8	ND	3.3UJ - 4.4U	1.838	4.4	NE	---	NA	Yes	No SSV
Methylene Chloride	0/8	ND	0.88U - 1.2U	0.495	1.2	1,040	MHSPE 2000	<0.01	No	HQ < 1.0
Pentachloroethane	0/8	ND	1.9UJ - 2.6UJ	1.081	2.6	NE	---	NA	Yes	No SSV
Propionitrile	0/8	ND	19U - 25U	10.375	25	NE	---	NA	Yes	No SSV
Styrene	0/8	ND	0.58U - 0.78U	0.327	0.78	10,030	MHSPE 2000	<0.01	No	HQ < 1.0
Tetrachloroethene	0/8	ND	0.64U - 0.86U	0.361	0.86	400	MHSPE 2000	<0.01	No	HQ < 1.0
Toluene	0/8	ND	0.7U - 0.93U	0.391	0.93	13,001	MHSPE 2000	<0.01	No	HQ < 1.0
trans-1,2-Dichloroethene	0/8	ND	0.85U - 1.1U	0.477	1.1	100	CCME 2007	0.01	No	HQ < 1.0

TABLE 7-13
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
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 Value (SSV)	Reference (2)	Max. HQ (3)	Ecological COPC?	Comments
Volatile Organics (µg/kg)										
trans-1,3-Dichloropropene	0/8	ND	0.77U - 1U	0.429	1	100	CCME 2007	0.01	No	HQ < 1.0
trans-1,4-Dichloro-2-butene	0/8	ND	2.7UJ - 3.7U	1.531	3.7	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Trichloroethene	0/8	ND	0.88U - 1.2U	0.495	1.2	6010	MHSPE 2000	<0.01	No	HQ < 1.0
Trichlorofluoromethane	0/8	ND	1.3U - 1.8U	0.738	1.8	NE	---	NA	Yes	No SSV
Vinyl acetate	0/8	ND	1.3U - 1.8U	0.738	1.8	NE	---	NA	Yes	No SSV
Vinyl chloride	0/8	ND	0.51U - 0.68U	0.287	0.68	11.0	MHSPE 2000	0.06	No	HQ < 1.0
Xylenes, Total	0/8	ND	2U - 2.7U	1.131	2.7	2,510	MHSPE 2000	<0.01	No	HQ < 1.0
Semi-Volatile Organics (µg/kg)										
1,1'-Biphenyl	0/8	ND	8.9UJ - 9.9U	4.769	9.9	NE	---	NA	Yes	No SSV
1,2,4,5-Tetrachlorobenzene	0/8	ND	7.6UJ - 8.5U	4.069	8.5	50	CCME 2007	0.17	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/8	ND	8.9UJ - 9.9U	4.769	9.9	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,2-Dichlorobenzene	0/8	ND	8.5UJ - 9.4U	4.513	9.4	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3,5-Trinitrobenzene	0/8	ND	21U - 23U	11.000	23	40,000	---	<0.01	No	HQ < 1.0
1,3-Dichlorobenzene	0/8	ND	7.3UJ - 8.1U	3.875	8.1	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/8	ND	4.7UJ - 5.2U	2.513	5.2	40,000	---	<0.01	No	HQ < 1.0
1,4-Dichlorobenzene	0/8	ND	7.5UJ - 8.3U	4.000	8.3	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,4-Dioxane	0/8	ND	9.7UJ - 11U	5.169	11	NE	---	NA	Yes	No SSV
1,4-Naphthoquinone	0/8	ND	4.7UJ - 5.2U	2.513	5.2	NE	---	NA	Yes	No SSV
2,2'-oxybis(1-chloropropane)	0/8	ND	7.6UJ - 8.5U	4.069	8.5	NE	---	NA	Yes	No SSV
2,3,4,6-Tetrachlorophenol	0/8	ND	5.1UJ - 5.6U	2.713	5.6	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2,4,5-Trichlorophenol	0/8	ND	8.2UJ - 9.1U	4.388	9.1	4,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4,6-Trichlorophenol	0/8	ND	9.5UJ - 11U	5.088	11	10,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2,4-Dichlorophenol	0/8	ND	9.8UJ - 11U	5.238	11	1,001	MHSPE 2000	0.01	No	HQ < 1.0
2,4-Dimethylphenol	0/8	ND	21U - 23U	11.000	23	100	CCME 2007	0.23	No	HQ < 1.0
2,4-Dinitrophenol	0/8	ND	100U - 110U	53.125	110	20,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4-Dinitrotoluene	0/8	ND	7.1UJ - 7.9U	3.806	7.9	NE	---	NA	Yes	No SSV
2,6-Dichlorophenol	0/8	ND	7.7UJ - 8.6U	4.119	8.6	1001	MHSPE 2000	<0.01	No	HQ < 1.0
2,6-Dinitrotoluene	0/8	ND	7.5UJ - 8.3U	4.000	8.3	NE	---	NA	Yes	No SSV
2-Acetylaminofluorene	0/8	ND	6.2UJ - 6.8U	3.288	6.8	NE	---	NA	Yes	No SSV
2-Chloronaphthalene	0/8	ND	7.5UJ - 8.3U	4.000	8.3	NE	---	NA	Yes	No SSV
2-Chlorophenol	0/8	ND	8UJ - 8.9U	4.263	8.9	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2-Methylphenol	0/8	ND	9.8UJ - 11U	5.238	11	100	CCME 2007	0.11	No	HQ < 1.0
2-Naphthylamine	0/8	ND	24UJ - 27U	12.938	27	NE	---	NA	Yes	No SSV
2-Nitroaniline	0/8	ND	7.9UJ - 8.7U	4.200	8.7	NE	---	NA	Yes	No SSV
2-Nitrophenol	0/8	ND	8.8UJ - 9.8U	4.706	9.8	7,000	---	<0.01	No	HQ < 1.0
2-Picoline	0/8	ND	15U - 16U	7.750	16	NE	---	NA	Yes	No SSV
2-Toluidine	0/8	ND	11UJ - 12U	5.938	12	NE	---	NA	Yes	No SSV
3 & 4 Methylphenol	0/8	ND	8.8UJ - 9.8U	4.706	9.8	100	CCME 2007	0.10	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/8	ND	11UJ - 12UJ	5.938	12	NE	---	NA	Yes	No SSV
3,3'-Dimethylbenzidine	0/8	ND	220UJ - 240UJ	116.250	240	NE	---	NA	Yes	No SSV
3-Methylcholanthrene	0/8	ND	7.4UJ - 8.2U	3.944	8.2	NE	---	NA	Yes	No SSV
3-Nitroaniline	0/8	ND	5.4UJ - 6U	2.906	6	NE	---	NA	Yes	No SSV
4,6-Dinitro-2-methylphenol	0/8	ND	7UJ - 7.8UJ	3.744	7.8	NE	---	NA	Yes	No SSV
4-Aminobiphenyl	0/8	ND	16U - 17U	8.313	17	NE	---	NA	Yes	No SSV
4-Bromophenyl phenyl ether	0/8	ND	8.6UJ - 9.5U	4.581	9.5	NE	---	NA	Yes	No SSV
4-Chloro-3-methylphenol	0/8	ND	9.1UJ - 10U	4.844	10	NE	---	NA	Yes	No SSV

TABLE 7-13
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Soil Screening Value (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]					
Semi-Volatile Organics (µg/kg)										
4-Chloroaniline	0/8	ND	7.3UJ - 8.1U	3.875	8.1	NE	---	NA	Yes	No SSV
4-Chlorophenyl phenyl ether	0/8	ND	7.5UJ - 8.3U	4.000	8.3	NE	---	NA	Yes	No SSV
4-Nitroaniline	0/8	ND	9.3UJ - 10UJ	4.913	10	NE	---	NA	Yes	No SSV
4-Nitrophenol	0/8	ND	40UJ - 44U	21.250	44	7,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
7,12-Dimethylbenz(a)anthracene	0/8	ND	11UJ - 12U	5.938	12	NE	---	NA	Yes	No SSV
Acetophenone	0/8	ND	10UJ - 12U	5.500	12	NE	---	NA	Yes	No SSV
alpha,alpha-Dimethyl phenethylamine	0/8	ND	71UJ - 79U	38.063	79	NE	---	NA	Yes	No SSV
Aniline	0/8	ND	7.6UJ - 8.5U	4.069	8.5	NE	---	NA	Yes	No SSV
Aramite, Total	0/8	ND	13UJ - 15U	7.125	15	NE	---	NA	Yes	No SSV
Benzyl alcohol	0/8	ND	9.7UJ - 11U	5.169	11	NE	---	NA	Yes	No SSV
Bis(2-chloroethoxy)methane	0/8	ND	8.2UJ - 9.1U	4.388	9.1	NE	---	NA	Yes	No SSV
Bis(2-chloroethyl)ether	0/8	ND	6.9UJ - 7.6U	3.675	7.6	NE	---	NA	Yes	No SSV
Bis(2-ethylhexyl) phthalate	0/8	ND	7.9UJ - 80UJ	14.738	80	6,010	MHSPE 2000	0.01	No	HQ < 1.0
Butyl benzyl phthalate	1/8	10J - 10J	9UJ - 9.7U	5.356	10	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Diallate	0/8	ND	12U - 13U	6.250	13	NE	---	NA	Yes	No SSV
Dibenzofuran	0/8	ND	5.1UJ - 5.6U	2.713	5.6	NE	---	NA	Yes	No SSV
Diethyl phthalate	0/8	ND	13UJ - 15U	7.125	15	100,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Dimethyl phthalate	0/8	ND	7.7UJ - 8.6U	4.119	8.6	200,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Di-n-butyl phthalate	0/8	ND	30UJ - 97U	20.188	97	200,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Di-n-octyl phthalate	0/8	ND	4UJ - 4.4U	2.125	4.4	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Dinoseb	0/8	ND	21U - 23UJ	11.000	23	NE	---	NA	Yes	No SSV
Ethyl methanesulfonate	0/8	ND	13UJ - 15U	7.125	15	NE	---	NA	Yes	No SSV
Hexachlorobenzene	0/8	ND	8.2UJ - 9.1U	4.388	9.1	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Hexachlorobutadiene	0/8	ND	11UJ - 12U	5.875	12	NE	---	NA	Yes	No SSV
Hexachlorocyclopentadiene	0/8	ND	17UJ - 19U	9.125	19	10,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Hexachloroethane	0/8	ND	8.9UJ - 9.9U	4.769	9.9	NE	---	NA	Yes	No SSV
Hexachlorophene	0/2	ND	1000UJ - 1000UJ	500.000	1,000	NE	---	NA	Yes	No SSV
Hexachloropropene	0/8	ND	8.7UJ - 9.7U	4.650	9.7	NE	---	NA	Yes	No SSV
Isophorone	0/8	ND	7.5UJ - 8.3U	4.000	8.3	NE	---	NA	Yes	No SSV
Isosafrole	0/8	ND	8.6UJ - 9.5U	4.581	9.5	NE	---	NA	Yes	No SSV
Methapyrilene	0/8	ND	11UJ - 12U	5.938	12	NE	---	NA	Yes	No SSV
Methyl methanesulfonate	0/8	ND	11UJ - 12U	5.938	12	NE	---	NA	Yes	No SSV
Nitrobenzene	0/8	ND	8.3UJ - 9.3U	4.456	9.3	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitro-o-toluidine	0/8	ND	7.3UJ - 8.1U	3.875	8.1	NE	---	NA	Yes	No SSV
N-Nitrosodiethylamine	0/8	ND	15U - 16U	7.750	16	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodimethylamine	0/8	ND	12U - 13U	6.313	13	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-butylamine	0/8	ND	11UJ - 12U	5.875	12	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/8	ND	7.9UJ - 8.7U	4.200	8.7	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodiphenylamine	0/8	ND	8.6UJ - 9.5U	4.581	9.5	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitrosomethylethylamine	0/8	ND	6.9UJ - 7.6U	3.675	7.6	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosomorpholine	0/8	ND	8UJ - 8.9U	4.263	8.9	NE	---	NA	Yes	No SSV
N-Nitrosopiperidine	0/8	ND	10UJ - 11U	5.438	11	NE	---	NA	Yes	No SSV
N-Nitrosopyrrolidine	0/8	ND	11U - 12U	5.750	12	NE	---	NA	Yes	No SSV
p-Dimethylamino azobenzene	0/8	ND	8.6UJ - 9.5U	4.581	9.5	NE	---	NA	Yes	No SSV
Pentachlorobenzene	0/8	ND	7.5UJ - 8.3U	4.000	8.3	1,150	USEPA 1999	<0.01	No	HQ < 1.0
Pentachloronitrobenzene	0/8	ND	7.1UJ - 7.9U	3.806	7.9	NE	---	NA	Yes	No SSV

TABLE 7-13
FREQUENCY AND RANGE OF SURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range: 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 Value (SSV)	Reference [2]	Max. HQ [3]	Ecological COPC?	Comments
Semi-Volatile Organics (µg/kg)										
Pentachlorophenol	0/8	ND	10U - 11U	5.313	11	5,000	USEPA 2007a	<0.01	No	HQ < 1.0
Phenacetin	0/8	ND	5.7UJ - 6.3U	3.031	6.3	NE	---	NA	Yes	
Phenol	0/8	ND	5.8UJ - 6.4U	3.100	6.4	30,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
p-Phenylene diamine	0/8	ND	190UJ - 210U	102.500	210	NE	---	NA	Yes	No SSV
Pronamide	0/8	ND	11U - 12U	5.813	12	NE	---	NA	Yes	No SSV
Pyridine	0/8	ND	13UJ - 15U	7.125	15	NE	---	NA	Yes	No SSV
Safrole, Total	0/8	ND	10U - 11U	5.313	11	NE	---	NA	Yes	No SSV
PAHs (µg/kg)										
Low Molecular Weight PAHs [4]	NA	41.96	NA	NA	41.96	29,000	USEPA 2007b	<0.01	No	HQ < 1.0
High Molecular Weight PAHs [5]	NA	154.1	NA	NA	154.10	18,000	USEPA 2007b	<0.01	No	HQ < 1.0
Metals (mg/kg)										
Antimony	1/8	2 - 2	0.091U - 0.16UJ	0.303	2	78	USEPA 2005a	0.03	No	HQ < 1.0
Arsenic	8/8	0.59J - 3.4	ND	2.274	3.4	18	USEPA 2005b	0.19	No	HQ < 1.0
Barium	8/8	15J - 190J	ND	75.125	190	330	USEPA 2005c	0.58	No	HQ < 1.0
Beryllium	8/8	0.053J - 0.34	ND	0.192	0.34	40	USEPA 2005d	<0.01	No	HQ < 1.0
Cadmium	7/8	0.055J - 3.3J	0.038UJ - 0.038UJ	0.516	3.3	32	USEPA 2005e	0.10	No	HQ < 1.0
Chromium	8/8	6.3 - 54J	ND	28.413	54	57	USEPA 2008	0.95	No	HQ < 1.0
Cobalt	8/8	2.6 - 50J	ND	19.450	50	13	USEPA 2005f	3.85	Yes	HQ > 1.0
Copper	8/8	31J - 130J	ND	73.375	130	70	USEPA 2007c	1.86	Yes	HQ > 1.0
Lead	14/14	0.88 - 210	ND	25.784	210	120	USEPA 2005g	1.75	Yes	HQ > 1.0
Mercury	7/8	0.015J - 0.066J	0.0047U - 0.0047U	0.031	0.066	0.1	Efroymson et al. 1997a	0.66	No	HQ < 1.0
Nickel	8/8	1.1 - 14J	ND	8.638	14	38	USEPA 2007d	0.37	No	HQ < 1.0
Selenium	20/20	0.33J - 3.5	ND	1.436	3.5	0.52	USEPA 2007e	6.73	Yes	HQ > 1.0
Silver	2/8	0.032J - 0.24J	0.019U - 0.13UJ	0.060	0.24	560	USEPA 2006	<0.01	No	HQ < 1.0
Thallium	3/8	0.15J - 0.25J	0.14U - 0.15U	0.118	0.25	1	Efroymson et al. 1997b	0.25	No	HQ < 1.0
Tin	0/8	ND	4.6U - 5U	2.388	5	50	Efroymson et al. 1997b	0.10	No	HQ < 1.0
Vanadium	14/14	55 - 430	ND	221.071	430	20	USEPA 2005h	21.50	Yes	HQ > 1.0
Zinc	8/8	7.5J - 77J	ND	44.438	77	120	USEPA 2007f	0.64	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
PAH = Polynuclear Aromatic Hydrocarbon
COPC = Chemical of Potential Concern
SSV = Soil Screening Value
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
HQ = Hazard Quotient
U = Not Detected
UJ = Not Detected (estimated value)
J = Detected (estimated value)
NA = Not Available
NE = Not Established
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 rmethod 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 56 subsurface soil were 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene. The concentration value used in the Step 2 risk calculation was calculated by summing maximum detected concentrations in SWMU 56 subsurface soil for each chemical. Maximum method detection limits were used for non-detected PAHs.

(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 56 subsurface 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. The concentration value used in the Step 2 risk calculation was calculated by summing maximum detected concentrations in SWMU 56 subsurface soil for each chemical. Maximum method detection limits were used for non-detected PAHs.

TABLE 7-14
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Soil Screening Value (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]					
Volatile Organics (µg/kg)										
1,1,1,2-Tetrachloroethane	0/3	ND	0.62U - 0.64U	0.313	0.64	100	CCME 2007	<0.01	No	HQ < 1.0
1,1,1-Trichloroethane	0/3	ND	0.56U - 0.58U	0.285	0.58	100	CCME 2007	<0.01	No	HQ < 1.0
1,1,2,2-Tetrachloroethane	0/3	ND	1.3U - 1.4U	0.683	1.4	100	CCME 2007	0.01	No	HQ < 1.0
1,1,2-Trichloroethane	0/3	ND	1.2U - 1.2U	0.600	1.2	100	CCME 2007	0.01	No	HQ < 1.0
1,1-Dichloroethane	0/3	ND	0.48U - 0.5U	0.245	0.5	100	CCME 2007	<0.01	No	HQ < 1.0
1,1-Dichloroethene	0/3	ND	0.52U - 0.54U	0.265	0.54	100	CCME 2007	<0.01	No	HQ < 1.0
1,2,3-Trichloropropane	0/3	ND	1.3U - 1.4U	0.683	1.4	NE	---	NA	Yes	No SSV
1,2-Dibromo-3-Chloropropane	0/3	ND	2.7U - 2.8U	1.367	2.8	NE	---	NA	Yes	No SSV
1,2-Dichloroethane	0/3	ND	0.96U - 1U	0.488	1	402	MHSPE 2000	<0.01	No	HQ < 1.0
1,2-Dichloropropane	0/3	ND	1.1U - 1.1U	0.550	1.1	700,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2-Butanone (MEK)	0/3	ND	2.6U - 3.9U	1.533	3.9	NE	---	NA	Yes	No SSV
2-Chloro-1,3-butadiene	0/3	ND	0.55U - 0.57U	0.280	0.57	NE	---	NA	Yes	No SSV
2-Hexanone	0/3	ND	2U - 2.1U	1.017	2.1	NE	---	NA	Yes	No SSV
3-Chloro-1-propene	0/3	ND	1.4U - 1.5UJ	0.733	1.5	NE	---	NA	Yes	No SSV
4-Methyl-2-pentanone (MIBK)	0/3	ND	2.8U - 2.9U	1.417	2.9	NE	---	NA	Yes	No SSV
Acetone	3/3	8.3J - 110	NA	56.100	110	NE	---	NA	Yes	No SSV
Acetonitrile	0/2	ND	44U - 45U	22.250	45	NE	---	NA	Yes	No SSV
Acrolein	0/1	ND	18U - 18U	9.000	18	NE	---	NA	Yes	No SSV
Acrylonitrile	0/3	ND	22U - 23U	11.167	23	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Benzene	0/3	ND	0.76U - 0.79U	0.387	0.79	101	MHSPE 2000	<0.01	No	HQ < 1.0
Bromoform	0/3	ND	1.1U - 1.1U	0.550	1.1	NE	---	NA	Yes	No SSV
Bromomethane	0/3	ND	1.5U - 1.6U	0.783	1.6	NE	---	NA	Yes	No SSV
Carbon disulfide	0/3	ND	0.49U - 0.51U	0.250	0.51	NE	---	NA	Yes	No SSV
Carbon tetrachloride	0/3	ND	0.96U - 1U	0.488	1	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorobenzene	0/3	ND	0.7U - 0.73U	0.357	0.73	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Chlorodibromomethane	0/3	ND	0.48U - 0.5U	0.245	0.5	NE	---	NA	Yes	No SSV
Chloroethane	0/3	ND	1.2U - 1.2U	0.600	1.2	NE	---	NA	Yes	No SSV
Chloroform	0/3	ND	0.48U - 0.5U	0.245	0.5	1002	MHSPE 2000	<0.01	No	HQ < 1.0
Chloromethane	0/3	ND	0.68U - 0.71U	0.347	0.71	NE	---	NA	Yes	No SSV
cis-1,3-Dichloropropene	0/3	ND	0.84U - 0.87U	0.427	0.87	100	CCME 2007	<0.01	No	HQ < 1.0
Dibromomethane	0/3	ND	1.2U - 1.2U	0.600	1.2	NE	---	NA	Yes	No SSV
Dichlorobromomethane	0/3	ND	0.48U - 0.5U	0.245	0.5	NE	---	NA	Yes	No SSV
Dichlorodifluoromethane	0/3	ND	0.86U - 0.89U	0.437	0.89	NE	---	NA	Yes	No SSV
Ethyl methacrylate	0/3	ND	2.1U - 2.2U	1.067	2.2	NE	---	NA	Yes	No SSV
Ethylbenzene	0/3	ND	0.72U - 0.75U	0.367	0.75	5,003	MHSPE 2000	<0.01	No	HQ < 1.0
Ethylene Dibromide	0/3	ND	1.4U - 1.5U	0.733	1.5	300	CCME 2007	<0.01	No	HQ < 1.0
Iodomethane	1/3	2.6J - 2.6J	0.97UJ - 1UJ	1.195	2.6	NE	---	NA	Yes	No SSV
Isobutyl alcohol	0/1	ND	69U - 69U	34.500	69	NE	---	NA	Yes	No SSV
Methacrylonitrile	0/3	ND	23UJ - 24U	11.667	24	NE	---	NA	Yes	No SSV
Methyl methacrylate	0/3	ND	3.6U - 3.7U	1.817	3.7	NE	---	NA	Yes	No SSV
Methylene Chloride	0/3	ND	0.96U - 1U	0.488	1	1,040	MHSPE 2000	<0.01	No	HQ < 1.0
Pentachloroethane	0/3	ND	2.1UJ - 2.2U	1.067	2.2	NE	---	NA	Yes	No SSV
Propionitrile	0/3	ND	20U - 21U	10.167	21	NE	---	NA	Yes	No SSV
Styrene	0/3	ND	0.63U - 0.66U	0.322	0.66	10,030	MHSPE 2000	<0.01	No	HQ < 1.0
Tetrachloroethene	0/3	ND	0.7U - 0.73U	0.357	0.73	400	MHSPE 2000	<0.01	No	HQ < 1.0
Toluene	0/3	ND	0.76U - 0.79U	0.387	0.79	13,001	MHSPE 2000	<0.01	No	HQ < 1.0
trans-1,2-Dichloroethene	0/3	ND	0.93U - 0.97U	0.475	0.97	100	CCME 2007	<0.01	No	HQ < 1.0

TABLE 7-14
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
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 Value (SSV)	Reference (2)	Max. HQ (3)	Ecological COPC?	Comments
Volatile Organics (µg/kg)										
trans-1,3-Dichloropropene	0/3	ND	0.84U - 0.87U	0.427	0.87	100	CCME 2007	<0.01	No	HQ < 1.0
trans-1,4-Dichloro-2-butene	0/3	ND	3U - 3.1U	1.517	3.1	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Trichloroethene	0/3	ND	0.96U - 1U	0.488	1	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Trichlorofluoromethane	0/3	ND	1.4U - 1.5U	0.733	1.5	NE	---	NA	Yes	No SSV
Vinyl acetate	0/3	ND	1.4U - 1.5U	0.733	1.5	NE	---	NA	Yes	No SSV
Vinyl chloride	0/3	ND	0.56U - 0.58U	0.285	0.58	11.0	MHSPE 2000	0.05	No	HQ < 1.0
Xylenes, Total	0/3	ND	2.2U - 2.3U	1.117	2.3	2,510	MHSPE 2000	<0.01	No	HQ < 1.0
Semi-Volatile Organics (µg/kg)										
1,1'-Biphenyl	0/3	ND	9.4UJ - 9.9U	4.817	9.9	NE	---	NA	Yes	No SSV
1,2,4,5-Tetrachlorobenzene	0/3	ND	8UJ - 8.5U	4.100	8.5	50	CCME 2007	0.17	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/3	ND	9.4UJ - 9.9U	4.817	9.9	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,2-Dichlorobenzene	0/3	ND	8.9UJ - 9.4U	4.550	9.4	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3,5-Trinitrobenzene	0/3	ND	22UJ - 23U	11.167	23	40,000	---	<0.01	No	HQ < 1.0
1,3-Dichlorobenzene	0/3	ND	7.6UJ - 8.1U	3.917	8.1	3,003	MHSPE 2000	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/3	ND	5UJ - 5.2U	2.550	5.2	40,000	---	<0.01	No	HQ < 1.0
1,4-Dichlorobenzene	0/3	ND	7.9UJ - 8.3U	4.033	8.3	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
1,4-Dioxane	0/3	ND	10UJ - 11U	5.167	11	NE	---	NA	Yes	No SSV
1,4-Naphthoquinone	0/3	ND	5UJ - 5.2U	2.533	5.2	NE	---	NA	Yes	No SSV
2,2'-oxybis(1-chloropropane)	0/3	ND	8UJ - 8.5U	4.133	8.5	NE	---	NA	Yes	No SSV
2,3,4,6-Tetrachlorophenol	0/3	ND	5.3UJ - 5.6U	2.717	5.6	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2,4,5-Trichlorophenol	0/3	ND	8.6UJ - 9.1U	4.417	9.1	4,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4,6-Trichlorophenol	0/3	ND	10UJ - 11U	5.167	11	10,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
2,4-Dichlorophenol	0/3	ND	10UJ - 11U	5.167	11	1,001	MHSPE 2000	0.01	No	HQ < 1.0
2,4-Dimethylphenol	0/3	ND	22UJ - 23U	11.167	23	100	CCME 2007	0.23	No	HQ < 1.0
2,4-Dinitrophenol	0/3	ND	110UJ - 110UJ	55.000	110	20,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
2,4-Dinitrotoluene	0/3	ND	7.5UJ - 7.9UJ	3.833	7.9	NE	---	NA	Yes	No SSV
2,6-Dichlorophenol	0/3	ND	8.1UJ - 8.6U	4.167	8.6	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2,6-Dinitrotoluene	0/3	ND	7.9UJ - 8.3U	4.033	8.3	NE	---	NA	Yes	No SSV
2-Acetylaminofluorene	0/3	ND	6.5UJ - 6.8U	3.317	6.8	NE	---	NA	Yes	No SSV
2-Chloronaphthalene	0/3	ND	7.9UJ - 8.3U	4.033	8.3	NE	---	NA	Yes	No SSV
2-Chlorophenol	0/3	ND	8.4UJ - 8.9U	4.300	8.9	1,001	MHSPE 2000	<0.01	No	HQ < 1.0
2-Methylphenol	0/3	ND	10UJ - 11U	5.167	11	100	CCME 2007	0.11	No	HQ < 1.0
2-Naphthylamine	0/3	ND	25UJ - 27U	13.000	27	NE	---	NA	Yes	No SSV
2-Nitroaniline	0/3	ND	8.3UJ - 8.7U	4.233	8.7	NE	---	NA	Yes	No SSV
2-Nitrophenol	0/3	ND	9.3UJ - 9.8U	4.750	9.8	7,000	---	<0.01	No	HQ < 1.0
2-Picoline	0/3	ND	15UJ - 16UJ	7.833	16	NE	---	NA	Yes	No SSV
2-Toluidine	0/3	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
3 & 4 Methylphenol	0/3	ND	9.3UJ - 9.8U	4.750	9.8	100	CCME 2007	0.10	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/3	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
3,3'-Dimethylbenzidine	0/3	ND	230UJ - 240U	116.667	240	NE	---	NA	Yes	No SSV
3-Methylcholanthrene	0/3	ND	7.7UJ - 8.2U	3.967	8.2	NE	---	NA	Yes	No SSV
3-Nitroaniline	0/3	ND	5.7UJ - 6U	2.917	6	NE	---	NA	Yes	No SSV
4,6-Dinitro-2-methylphenol	0/3	ND	7.4UJ - 7.8UJ	3.783	7.8	NE	---	NA	Yes	No SSV
4-Aminobiphenyl	0/3	ND	17UJ - 17UJ	8.500	17	NE	---	NA	Yes	No SSV
4-Bromophenyl phenyl ether	0/3	ND	9UJ - 9.5U	4.617	9.5	NE	---	NA	Yes	No SSV
4-Chloro-3-methylphenol	0/3	ND	9.5UJ - 10U	4.867	10	NE	---	NA	Yes	No SSV
4-Chloroaniline	0/3	ND	7.6UJ - 8.1U	3.917	8.1	NE	---	NA	Yes	No SSV

TABLE 7-14
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Soil Screening Value (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)					
Semi-Volatile Organics (µg/kg)										
4-Chlorophenyl phenyl ether	0/3	ND	7.9UJ - 8.3U	4.033	8.3	NE	---	NA	Yes	No SSV
4-Nitroaniline	0/3	ND	9.8UJ - 10UJ	4.950	10	NE	---	NA	Yes	No SSV
4-Nitrophenol	0/3	ND	42UJ - 44UJ	21.500	44	7,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
7,12-Dimethylbenz(a)anthracene	0/3	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
Acetophenone	0/3	ND	11UJ - 12U	5.667	12	NE	---	NA	Yes	No SSV
alpha,alpha-Dimethyl phenethylamine	0/3	ND	75UJ - 79U	38.333	79	NE	---	NA	Yes	No SSV
Aniline	0/3	ND	8UJ - 8.5U	4.100	8.5	NE	---	NA	Yes	No SSV
Aramite, Total	0/3	ND	14UJ - 15U	7.167	15	NE	---	NA	Yes	No SSV
Benzyl alcohol	0/3	ND	10UJ - 11U	5.167	11	NE	---	NA	Yes	No SSV
Bis(2-chloroethoxy)methane	0/3	ND	8.6UJ - 9.1U	4.417	9.1	NE	---	NA	Yes	No SSV
Bis(2-chloroethyl)ether	0/3	ND	7.2UJ - 7.7U	3.717	7.7	NE	---	NA	Yes	No SSV
Bis(2-ethylhexyl) phthalate	0/3	ND	8.5UJ - 16UJ	5.517	16	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Butyl benzyl phthalate	0/3	ND	9.1UJ - 9.7U	4.717	9.7	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Diallate	0/3	ND	12UJ - 13U	6.167	13	NE	---	NA	Yes	No SSV
Dibenzofuran	0/3	ND	5.3UJ - 5.6U	2.717	5.6	NE	---	NA	Yes	No SSV
Diethyl phthalate	0/3	ND	14UJ - 15U	7.167	15	100,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Dimethyl phthalate	0/3	ND	8.1UJ - 8.6U	4.183	8.6	200,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Di-n-butyl phthalate	0/3	ND	32UJ - 34U	16.333	34	200,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Di-n-octyl phthalate	0/3	ND	4.2UJ - 4.4U	2.150	4.4	6,010	MHSPE 2000	<0.01	No	HQ < 1.0
Dinoseb	0/3	ND	22UJ - 23U	11.167	23	NE	---	NA	Yes	No SSV
Ethyl methanesulfonate	0/3	ND	14UJ - 15U	7.167	15	NE	---	NA	Yes	No SSV
Hexachlorobenzene	0/3	ND	8.6UJ - 9.1U	4.417	9.1	1,000,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
Hexachlorobutadiene	0/3	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
Hexachlorocyclopentadiene	0/3	ND	18UJ - 19U	9.167	19	10,000	Efroymson et al. 1997b	<0.01	No	HQ < 1.0
Hexachloroethane	0/3	ND	9.4UJ - 9.9U	4.817	9.9	NE	---	NA	Yes	No SSV
Hexachloropropene	0/3	ND	9.1UJ - 9.7UJ	4.683	9.7	NE	---	NA	Yes	No SSV
Isophorone	0/3	ND	7.9UJ - 8.3U	4.033	8.3	NE	---	NA	Yes	No SSV
Isosafrole	0/3	ND	9UJ - 9.5U	4.617	9.5	NE	---	NA	Yes	No SSV
Methapyrilene	0/3	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
Methyl methanesulfonate	0/3	ND	12UJ - 12UJ	6.000	12	NE	---	NA	Yes	No SSV
Nitrobenzene	0/3	ND	8.8UJ - 9.3U	4.533	9.3	40,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitro-o-toluidine	0/3	ND	7.6UJ - 8.9UJ	4.100	8.9	NE	---	NA	Yes	No SSV
N-Nitrosodiethylamine	0/3	ND	15UJ - 16UJ	7.833	16	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodimethylamine	0/3	ND	12UJ - 13UJ	6.333	13	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-butylamine	0/3	ND	12UJ - 12UJ	6.000	12	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/3	ND	8.3UJ - 8.7U	4.233	8.7	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosodiphenylamine	0/3	ND	9UJ - 9.5U	4.617	9.5	20,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0
N-Nitrosomethylethylamine	0/3	ND	7.2UJ - 7.7U	3.717	7.7	20,000	---	<0.01	No	HQ < 1.0
N-Nitrosomorpholine	0/3	ND	8.4UJ - 8.9UJ	4.300	8.9	NE	---	NA	Yes	No SSV
N-Nitrosopiperidine	0/3	ND	11UJ - 11UJ	5.500	11	NE	---	NA	Yes	No SSV
N-Nitrosopyrrolidine	0/3	ND	11UJ - 12UJ	5.833	12	NE	---	NA	Yes	No SSV
p-Dimethylamino azobenzene	0/3	ND	9UJ - 9.5U	4.633	9.5	NE	---	NA	Yes	No SSV
Pentachlorobenzene	0/3	ND	7.9UJ - 8.3U	4.033	8.3	1,150	USEPA 1999	<0.01	No	HQ < 1.0
Pentachloronitrobenzene	0/3	ND	7.5UJ - 7.9U	3.833	7.9	NE	---	NA	Yes	No SSV
Pentachlorophenol	0/3	ND	11UJ - 11UJ	5.500	11	5,000	USEPA 2007a	<0.01	No	HQ < 1.0
Phenacetin	0/3	ND	6UJ - 6.3U	3.067	6.3	NE	---	NA	Yes	No SSV
Phenol	0/3	ND	6.1UJ - 6.4U	3.117	6.4	30,000	Efroymson et al. 1997a	<0.01	No	HQ < 1.0

TABLE 7-14
FREQUENCY AND RANGE OF SUBSURFACE SOIL DATA (MAXIMUM CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Soil Screening Value (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)					
Semi-Volatile Organics (µg/kg)										
p-Phenylene diamine	0/3	ND	200UJ - 210UJ	103.333	210	NE	---	NA	Yes	No SSV
Pronamide	0/3	ND	11UJ - 12UJ	5.833	12	NE	---	NA	Yes	No SSV
Pyridine	0/3	ND	14UJ - 15U	7.167	15	NE	---	NA	Yes	No SSV
Safrole, Total	0/3	ND	11UJ - 11UJ	5.500	11	NE	---	NA	Yes	No SSV
PAHs (µg/kg)										
Low Molecular Weight PAHs (3)	NA	17.98	NA	NA	17.98	29,000	USEPA 2007b	<0.01	No	HQ < 1.0
High Molecular Weight PAHs (4)	NA	13.30	NA	NA	13.30	18,000	USEPA 2007b	<0.01	No	HQ < 1.0
Metals (mg/kg)										
Antimony	0/3	ND	0.092UJ - 0.33UJ	0.086	0.33	78	USEPA 2005a	<0.01	No	HQ < 1.0
Arsenic	2/2	1.1 - 1.2	NA	1.150	1.2	18	USEPA 2005b	0.07	No	HQ < 1.0
Barium	3/3	13J - 28J	NA	20.667	28	330	USEPA 2005c	0.08	No	HQ < 1.0
Beryllium	2/3	0.046J - 0.17	0.071U - 0.071U	0.084	0.17	40	USEPA 2005d	<0.01	No	HQ < 1.0
Cadmium	0/3	ND	0.038UJ - 0.048U	0.021	0.048	32	USEPA 2005e	<0.01	No	HQ < 1.0
Chromium	2/2	13 - 15	NA	14.000	15	57	USEPA 2008	0.26	No	HQ < 1.0
Cobalt	3/3	2.1J - 4.3J	NA	2.900	4.3	13	USEPA 2005f	0.33	No	HQ < 1.0
Copper	3/3	40J - 75J	NA	53.333	75	70	USEPA 2007c	1.07	Yes	HQ > 1.0
Lead	2/2	1.2 - 1.4	NA	1.300	1.4	120	USEPA 2005g	0.01	No	HQ < 1.0
Mercury	3/3	0.042 - 0.078J	NA	0.059	0.078	0.1	Efroymson et al. 1997a	0.78	No	HQ < 1.0
Nickel	3/3	2.6 - 4.1J	NA	3.200	4.1	38	USEPA 2007d	0.11	No	HQ < 1.0
Selenium	3/3	0.72 - 2.9	NA	1.973	2.9	0.52	USEPA 2007e	5.58	Yes	HA > 1.0
Silver	2/3	0.028J - 0.091J	0.056UJ - 0.056UJ	0.049	0.091	560	USEPA 2006	<0.01	No	HQ < 1.0
Thallium	0/3	ND	0.15U - 0.15U	0.075	0.15	1	Efroymson et al. 1997b	0.15	No	HQ < 1.0
Tin	0/3	ND	4.9U - 5U	2.467	5	50	Efroymson et al. 1997b	0.10	No	HQ < 1.0
Vanadium	2/2	110J - 120	NA	115.000	120	20	USEPA 2005h	6.00	Yes	HQ > 1.0
Zinc	3/3	8.7J - 8.9	NA	8.800	8.9	120	USEPA 2007f	0.07	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
PAH = Polynuclear Aromatic Hydrocarbon

COPC = Chemical of Potential Concern
SSV = Soil Screening Value
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram

HQ = Hazard Quotient
U = Not Detected
UJ = Not Detected (estimated value)
J = Detected (estimated value)

NA = Not Available
NE = Not Established
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 rmethod 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 56 subsurface soil were 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene. The concentration value used in the Step 2 risk calculation was calculated by summing maximum detected concentrations in SWMU 56 subsurface soil for each chemical. Maximum method detection limits were used for non-detected PAHs.

(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 56 subsurface 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. The concentration value used in the Step 2 risk calculation was calculated by summing maximum detected concentrations in SWMU 56 subsurface soil for each chemical. Maximum method detection limits were used for non-detected PAHs.

TABLE 7-15
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Water Screening Value (SWSV)	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)]					
Volatile Organics (µg/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	NA	---	NE	Yes	No SWSV
2-Hexanone	0/7	ND	0.68U - 0.68U	0.340	0.68	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	2/7	5.2J - 7.1J	5U - 5U	3.543	7.1	1,000	USEPA 2007a	<0.01	No	HQ < 1.0
Acetonitrile	0/7	ND	15U - 15U	7.500	15	12,000	USEPA 2003	<0.01	No	HQ < 1.0
Acrolein	0/4	ND	18UJ - 18UJ	9.000	18	0.55	USEPA 2001	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	NA	---	NE	Yes	No SWSV
Chloroform	0/7	ND	0.29U - 0.29U	0.145	0.29	815	USEPA 2001	<0.01	No	HQ < 1.0
Chloromethane	1/7	1.8J - 1.8J	0.28U - 0.28U	0.377	1.8	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	0.3U - 0.3U	0.150	0.3	340	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	NA	---	NE	Yes	No SWSV
Isobutyl alcohol	0/3	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	NA	---	NE	Yes	No SWSV
Methyl methacrylate	0/7	ND	0.38U - 0.38U	0.190	0.38	2,800	USEPA 2003	<0.01	No	HQ < 1.0
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

TABLE 7-15
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
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]					
Volatile Organics (µg/L)										
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
trans-1,4-Dichloro-2-butene	0/7	ND	0.83U - 0.83U	0.415	0.83	NA	---	NE	Yes	No SWSV
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
Semi-Volatile Organics (µg/L)										
1,1'-Biphenyl	0/8	ND	0.17U - 0.17U	0.085	0.17	230	USEPA 2007a	<0.01	No	HQ < 1.0
1,2,4,5-Tetrachlorobenzene	0/8	ND	0.23U - 0.23U	0.115	0.23	10.0	USEPA 2007a	0.02	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/8	ND	0.13U - 0.13U	0.065	0.13	4.50	USEPA 2001	0.03	No	HQ < 1.0
1,2-Dichlorobenzene	0/8	ND	0.13U - 0.13U	0.065	0.13	19.7	USEPA 2001	<0.01	No	HQ < 1.0
1,3,5-Trinitrobenzene	0/8	ND	0.2U - 0.2U	0.100	0.2	80.0	USEPA 2007a	<0.01	No	HQ < 1.0
1,3-Dichlorobenzene	0/8	ND	0.12U - 0.12U	0.060	0.12	28.5	USEPA 2001	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/8	ND	0.22U - 0.22U	0.110	0.22	22.0	USEPA 2003	0.01	No	HQ < 1.0
1,4-Dichlorobenzene	1/8	0.16J - 0.16J	0.12U - 0.12U	0.073	0.16	19.9	USEPA 2001	<0.01	No	HQ < 1.0
1,4-Dioxane	0/8	ND	0.49U - 0.49U	0.245	0.49	67,000	USEPA 2007a	<0.01	No	HQ < 1.0
1,4-Naphthoquinone	0/8	ND	0.16U - 0.16U	0.080	0.16	NA	---	NE	Yes	No SWSV
2,2'-oxybis(1-chloropropane)	0/8	ND	0.097U - 0.097U	0.049	0.097	NA	---	NE	Yes	No SWSV
2,3,4,6-Tetrachlorophenol	0/8	ND	0.29U - 0.29U	0.145	0.29	8.80	Buchman 2008	0.03	No	HQ < 1.0
2,4,5-Trichlorophenol	0/8	ND	0.16U - 0.16U	0.080	0.16	11.0	Buchman 2008	0.01	No	HQ < 1.0
2,4,6-Trichlorophenol	0/8	ND	0.16U - 0.16U	0.080	0.16	12.1	USEPA 2007a	0.01	No	HQ < 1.0
2,4-Dichlorophenol	0/8	ND	0.15U - 0.15U	0.075	0.15	1.67	USEPA 2007a	0.09	No	HQ < 1.0
2,4-Dimethylphenol	0/8	ND	0.4U - 0.4U	0.200	0.4	131	USEPA 2007a	<0.01	No	HQ < 1.0
2,4-Dinitrophenol	0/8	ND	2.4U - 2.4U	1.200	2.4	48.5	USEPA 2001	0.05	No	HQ < 1.0
2,4-Dinitrotoluene	0/8	ND	0.17U - 0.17U	0.085	0.17	44.0	USEPA 2003	<0.01	No	HQ < 1.0
2,6-Dichlorophenol	0/8	ND	0.21U - 0.21U	0.105	0.21	54.0	USEPA 2007a	<0.01	No	HQ < 1.0
2,6-Dinitrotoluene	0/8	ND	0.15U - 0.15U	0.075	0.15	81.0	USEPA 2003	<0.01	No	HQ < 1.0
2-Acetylaminofluorene	0/8	ND	0.19U - 0.19U	0.095	0.19	20.0	USEPA 2007a	<0.01	No	HQ < 1.0
2-Chloronaphthalene	0/8	ND	0.12U - 0.12U	0.060	0.12	0.15	Buchman 2008	0.80	No	HQ < 1.0
2-Chlorophenol	0/8	ND	0.15U - 0.15U	0.075	0.15	53.0	USEPA 2007a	<0.01	No	HQ < 1.0
2-Methylnaphthalene	0/8	ND	0.022U - 0.022U	0.011	0.022	6.00	USEPA 2007a	<0.01	No	HQ < 1.0
2-Methylphenol	0/8	ND	0.15U - 0.15U	0.075	0.15	102	USEPA 2007a	<0.01	No	HQ < 1.0
2-Naphthylamine	0/8	ND	1.1U - 1.1U	0.550	1.1	NA	---	NE	Yes	No SWSV
2-Nitroaniline	0/8	ND	0.14U - 0.14U	0.070	0.14	48.9	USEPA 2007a	<0.01	No	HQ < 1.0
2-Nitrophenol	0/8	ND	0.17U - 0.17U	0.085	0.17	10,000	USEPA 2007a	<0.01	No	HQ < 1.0
2-Picoline	0/8	ND	0.57U - 0.57U	0.285	0.57	8,979	USEPA 2007a	<0.01	No	HQ < 1.0
2-Toluidine	0/8	ND	0.32U - 0.32U	0.160	0.32	5.20	USEPA 2007a	0.06	No	HQ < 1.0
3 & 4 Methylphenol	1/8	0.63J - 0.63J	0.15U - 0.15U	0.144	0.63	25.0	USEPA 2003	0.03	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/8	ND	3.7UJ - 3.7UJ	1.850	3.7	4.50	USEPA 2003	0.82	No	HQ < 1.0
3,3'-Dimethylbenzidine	0/8	ND	3.7UJ - 3.7UJ	1.850	3.7	160	USEPA 2007a	0.02	No	HQ < 1.0
3-Methylcholanthrene	0/8	ND	0.2U - 0.2U	0.100	0.2	NA	---	NE	Yes	No SWSV
3-Nitroaniline	0/8	ND	0.28UJ - 0.28UJ	0.140	0.28	9.80	USEPA 2007a	0.03	No	HQ < 1.0
4,6-Dinitro-2-methylphenol	0/8	ND	0.49U - 0.49U	0.245	0.49	23.0	USEPA 2003	0.02	No	HQ < 1.0
4-Aminobiphenyl	0/8	ND	0.68U - 0.68U	0.340	0.68	NA	---	NE	Yes	No SWSV
4-Bromophenyl phenyl ether	0/8	ND	0.16U - 0.16U	0.080	0.16	1.50	USEPA 2003	0.11	No	HQ < 1.0
4-Chloro-3-methylphenol	0/8	ND	0.16U - 0.16U	0.080	0.16	0.30	USEPA 2003	0.53	No	HQ < 1.0

TABLE 7-15
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range: 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
Semi-Volatile Organics (µg/L)										
4-Chloroaniline	0/8	ND	0.4U - 0.4U	0.200	0.4	10.0	USEPA 2007a	0.04	No	HQ < 1.0
4-Chlorophenyl phenyl ether	0/8	ND	0.15U - 0.15U	0.075	0.15	7.30	USEPA 2007a	0.02	No	HQ < 1.0
4-Nitroaniline	0/8	ND	0.26UJ - 0.26UJ	0.130	0.26	170	USEPA 2007a	<0.01	No	HQ < 1.0
4-Nitrophenol	0/8	ND	0.18U - 0.18U	0.090	0.18	71.7	USEPA 2001	<0.01	No	HQ < 1.0
7,12-Dimethylbenz(a)anthracene	0/8	ND	0.2U - 0.2U	0.100	0.2	6.00	Buchman 2008	0.03	No	HQ < 1.0
Acenaphthene	0/8	ND	0.019U - 0.019U	0.010	0.019	9.70	USEPA 2001	<0.01	No	HQ < 1.0
Acenaphthylene	0/8	ND	0.049U - 0.049U	0.025	0.049	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Acetophenone	0/8	ND	0.19U - 0.19U	0.095	0.19	1,550	USEPA 2007a	<0.01	No	HQ < 1.0
alpha,alpha-Dimethyl phenethylamine	0/8	ND	1.3U - 1.3U	0.650	1.3	NA	---	NE	Yes	No SWSV
Aniline	0/8	ND	0.4U - 0.4U	0.200	0.4	294	USEPA 2007a	<0.01	No	HQ < 1.0
Anthracene	1/8	0.033J - 0.033J	0.021U - 0.021U	0.013	0.033	5.35	USEPA 2007a	<0.01	No	HQ < 1.0
Aramite, Total	0/8	ND	0.49U - 0.49U	0.245	0.49	3.09	USEPA 2003	0.16	No	HQ < 1.0
Benzo(a)anthracene	0/8	ND	0.025U - 0.025U	0.013	0.025	0.025	USEPA 2003	1.00	No	HQ = 1.0
Benzo(a)pyrene	0/8	ND	0.024U - 0.024U	0.012	0.024	10.0	USEPA 2004	<0.01	No	HQ < 1.0
Benzo(b)fluoranthene	0/8	ND	0.036U - 0.036U	0.018	0.036	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzo(g,h,i)perylene	0/8	ND	0.023UJ - 0.023UJ	0.012	0.023	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzo(k)fluoranthene	0/8	ND	0.019U - 0.019U	0.010	0.019	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzyl alcohol	0/8	ND	0.16U - 0.16U	0.080	0.16	150	USEPA 2007a	<0.01	No	HQ < 1.0
Bis(2-chloroethoxy)methane	0/8	ND	0.15U - 0.15U	0.075	0.15	1,840	USEPA 2007a	<0.01	No	HQ < 1.0
Bis(2-chloroethyl)ether	0/8	ND	0.14U - 0.14U	0.070	0.14	2,380	USEPA 2001	<0.01	No	HQ < 1.0
Bis(2-ethylhexyl) phthalate	1/8	0.98 - 0.98	0.34U - 0.73UJ	0.339	0.98	360	Buchman 2008	<0.01	No	HQ < 1.0
Butyl benzyl phthalate	0/8	ND	0.17U - 0.17U	0.085	0.17	29.4	USEPA 2001	<0.01	No	HQ < 1.0
Chrysene	0/8	ND	0.027U - 0.027U	0.014	0.027	10	USEPA 2004	<0.01	No	HQ < 1.0
Diallate	0/8	ND	0.19U - 0.19U	0.095	0.19	82.0	USEPA 2007a	<0.01	No	HQ < 1.0
Dibenz(a,h)anthracene	0/8	ND	0.023U - 0.023U	0.012	0.023	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Dibenzofuran	0/8	ND	0.097U - 0.097U	0.049	0.097	33.3	USEPA 2007a	<0.01	No	HQ < 1.0
Diethyl phthalate	1/8	0.32J - 0.32J	0.18U - 0.18U	0.119	0.32	75.9	USEPA 2001	<0.01	No	HQ < 1.0
Dimethyl phthalate	0/8	ND	0.17U - 0.17U	0.085	0.17	580	USEPA 2001	<0.01	No	HQ < 1.0
Di-n-butyl phthalate	0/8	ND	0.11U - 0.3U	0.089	0.3	3.40	USEPA 2001	0.09	No	HQ < 1.0
Di-n-octyl phthalate	0/8	ND	0.097U - 0.097U	0.049	0.097	1,150	USEPA 2007a	<0.01	No	HQ < 1.0
Dinoseb	0/8	ND	0.49U - 0.49U	0.245	0.49	1.70	USEPA 2007a	0.29	No	HQ < 1.0
Ethyl methanesulfonate	0/8	ND	0.23U - 0.23U	0.115	0.23	40.0	USEPA 2007a	<0.01	No	HQ < 1.0
Fluoranthene	1/8	0.056J - 0.056J	0.049U - 0.049U	0.028	0.056	11.0	USEPA 1996	<0.01	No	HQ < 1.0
Fluorene	1/8	0.055J - 0.055J	0.018U - 0.018U	0.015	0.055	10.0	USEPA 2007a	<0.01	No	HQ < 1.0
Hexachlorobenzene	0/8	ND	0.16U - 0.16U	0.080	0.16	10.0	USEPA 2007a	0.02	No	HQ < 1.0
Hexachlorobutadiene	0/8	ND	0.13U - 0.13U	0.065	0.13	0.32	USEPA 2001	0.41	No	HQ < 1.0
Hexachlorocyclopentadiene	0/8	ND	0.49U - 0.49U	0.245	0.49	0.07	USEPA 2001	7.00	Yes	HQ > 1.0
Hexachloroethane	0/8	ND	0.15U - 0.15U	0.075	0.15	9.40	USEPA 2001	0.02	No	HQ < 1.0
Hexachloropropene	0/8	ND	0.12U - 0.12U	0.060	0.12	NA	---	NE	Yes	No SWSV
Indeno(1,2,3-cd)pyrene	0/8	ND	0.022U - 0.022U	0.011	0.022	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Isophorone	0/8	ND	0.15U - 0.15U	0.075	0.15	129	USEPA 2001	<0.01	No	HQ < 1.0
Isosafrole	0/8	ND	0.3U - 0.3U	0.150	0.3	NA	---	NE	Yes	No SWSV
Methapyrilene	0/8	ND	0.26U - 0.26U	0.130	0.26	NA	---	NE	Yes	No SWSV
Methyl methanesulfonate	0/8	ND	0.46U - 0.46U	0.230	0.46	NA	---	NE	Yes	No SWSV
Naphthalene	0/8	ND	0.049U - 0.049U	0.025	0.049	23.5	USEPA 2001	<0.01	No	HQ < 1.0
Nitrobenzene	0/8	ND	0.14U - 0.14U	0.070	0.14	66.8	USEPA 2001	<0.01	No	HQ < 1.0
N-Nitro-o-toluidine	0/8	ND	0.24U - 0.24U	0.120	0.24	220	USEPA 2007a	<0.01	No	HQ < 1.0

TABLE 7-15
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range: 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
Semi-Volatile Organics (µg/L)										
N-Nitrosodiethylamine	0/8	ND	0.32U - 0.32U	0.160	0.32	768	USEPA 2003	<0.01	No	HQ < 1.0
N-Nitrosodimethylamine	0/8	ND	0.19U - 0.19U	0.095	0.19	25.0	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-butylamine	0/8	ND	0.18U - 0.18U	0.090	0.18	25.0	---	<0.01	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/8	ND	0.13U - 0.13U	0.065	0.13	25.0	---	<0.01	No	HQ < 1.0
N-Nitrosodiphenylamine	0/8	ND	0.17U - 0.17U	0.085	0.17	25.0	USEPA 2007b	<0.01	No	HQ < 1.0
N-Nitrosomethylethylamine	0/8	ND	0.28U - 0.28U	0.140	0.28	25.0	---	0.01	No	HQ < 1.0
N-Nitrosomorpholine	0/8	ND	0.19U - 0.19U	0.095	0.19	NA	---	NE	Yes	No SWSV
N-Nitrosopiperidine	0/8	ND	0.22U - 0.22U	0.110	0.22	NA	---	NE	Yes	No SWSV
N-Nitrosopyrrolidine	0/8	ND	0.25U - 0.25U	0.125	0.25	NA	---	NE	Yes	No SWSV
p-Dimethylamino azobenzene	0/8	ND	0.6U - 0.6U	0.300	0.6	NA	---	NE	Yes	No SWSV
Pentachlorobenzene	0/8	ND	0.27U - 0.27U	0.135	0.27	129	USEPA 2001	<0.01	No	HQ < 1.0
Pentachloronitrobenzene	0/8	ND	0.3U - 0.3U	0.150	0.3	0.23	USEPA 2007a	1.30	Yes	HQ > 1.0
Pentachlorophenol	0/8	ND	0.18U - 0.18U	0.090	0.18	7.90	PREQB 2010	0.02	No	HQ < 1.0
Phenacetin	0/8	ND	0.2U - 0.2U	0.100	0.2	NA	---	NE	Yes	No SWSV
Phenanthrene	2/8	0.05J - 0.39	0.017U - 0.017U	0.061	0.39	8.30	USEPA 1996	0.05	No	HQ < 1.0
Phenol	0/8	ND	0.14U - 0.14U	0.070	0.14	58.0	USEPA 2001	<0.01	No	HQ < 1.0
p-Phenylene diamine	0/8	ND	2.4U - 2.4U	1.200	2.4	200	USEPA 2007a	0.01	No	HQ < 1.0
Pronamide	0/8	ND	0.25U - 0.25U	0.125	0.25	35.0	USEPA 2007a	<0.01	No	HQ < 1.0
Pyrene	0/8	ND	0.026U - 0.026U	0.013	0.026	0.248	USEPA 2007a	0.10	No	HQ < 1.0
Pyridine	0/8	ND	0.22U - 0.22U	0.110	0.22	500	USEPA 2007a	<0.01	No	HQ < 1.0
Safrole, Total	0/8	ND	0.23U - 0.23U	0.115	0.23	NA	---	NE	Yes	No SWSV
Total Recoverable Metals (µg/L)										
Antimony	0/8	ND	0.36U - 0.36U	0.180	0.36	500	Buchman 2008	<0.01	No	HQ < 1.0
Arsenic	2/8	0.42J - 0.52J	0.31U - 1.9U	0.593	0.52	36.0	PREQB 2010	0.01	No	HQ < 1.0
Barium	8/8	7.1 - 170	NA	47.388	170	16,667	USEPA 2007a	0.01	No	HQ < 1.0
Beryllium	0/8	ND	0.065U - 0.065U	0.033	0.065	310	USEPA 2007a	<0.01	No	HQ < 1.0
Cadmium	0/8	ND	0.12U - 0.12U	0.060	0.12	8.85	PREQB 2010	0.01	No	HQ < 1.0
Chromium	1/8	2.3J - 2.3J	0.6U - 2.4U	0.775	2.3	50.4	PREQB 2010	0.05	No	HQ < 1.0
Cobalt	5/6	1.2 - 38	0.29U - 0.29U	8.174	38	45.0	USEPA 2007a	0.84	No	HQ < 1.0
Copper	1/8	8.3 - 8.3	1.2U - 2.7U	1.806	8.3	3.73	PREQB 2010	2.23	Yes	HQ > 1.0
Lead	0/8	ND	0.15U - 0.3U	0.086	0.3	8.52	PREQB 2010	0.04	No	HQ < 1.0
Mercury	0/8	ND	0.08U - 0.08U	0.040	0.08	1.11	USEPA 2009	0.07	No	HQ < 1.0
Nickel	5/8	0.35J - 3.9	0.32U - 0.32U	0.851	3.9	8.28	PREQB 2010	0.47	No	HQ < 1.0
Selenium	1/8	0.79J - 0.79J	0.6U - 0.6U	0.361	0.79	71.1	PREQB 2010	0.01	No	HQ < 1.0
Silver	0/8	ND	0.09U - 0.09U	0.045	0.09	2.24	PREQB 2010	0.04	No	HQ < 1.0
Thallium	0/8	ND	0.55U - 0.55U	0.275	0.55	21.3	USEPA 2001	0.03	No	HQ < 1.0
Tin	0/8	ND	0.9U - 3.4U	0.700	3.4	180	USEPA 2003	0.02	No	HQ < 1.0
Vanadium	7/8	7.9 - 20	2.7U - 2.7U	11.669	20	12.0	USEPA 2003	1.67	Yes	HQ >1.0
Zinc	2/8	8.7J - 18J	6.5U - 6.5U	5.775	18	85.6	PREQB 2010	0.21	No	HQ < 1.0

Notes:

COPC = Chemical of Potential Concern
USEPA = United States Environmental Protection Agency
SWSV = Surface Water Screening Value
µg/L - microgram per liter
HQ = Hazard Quotient
J = Detected (estimated value)
U = Not Detected
UJ = Not Detected (estimated value)
ND = Not Detected
NA = Not Applicable
NE = Not Established

TABLE 7-15
FREQUENCY AND RANGE OF GROUNDWATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO MARINE/ESTUARINE SURFACE WATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(2) See Table 7-6 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 7-16
FREQUENCY AND RANGE OF DRAINAGE DITCH SURFACE WATER DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Surface Water Screening Value (SWSV)	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)]					
PAHs (µg/L)										
2-Methylnaphthalene	0/5	ND	0.022UJ - 0.022UJ	0.011	0.022	14.56	USEPA 2007a	<0.01	No	HQ < 1.0
Acenaphthene	0/5	ND	0.019UJ - 0.019UJ	0.010	0.019	23.0	USEPA 1996	<0.01	No	HQ < 1.0
Acenaphthylene	0/5	ND	0.047UJ - 0.049UJ	0.024	0.049	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Anthracene	0/5	ND	0.021UJ - 0.021UJ	0.011	0.021	0.035	USEPA 2003	0.60	No	HQ < 1.0
Benzo(a)anthracene	0/5	ND	0.025UJ - 0.025UJ	0.013	0.025	0.025	USEPA 2003	1.00	No	HQ = 1.0
Benzo(a)pyrene	0/5	ND	0.024UJ - 0.024UJ	0.012	0.024	0.014	USEPA 2003	1.71	Yes	HQ > 1.0
Benzo(b)fluoranthene	0/5	ND	0.035UJ - 0.036UJ	0.018	0.036	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzo(g,h,i)perylene	0/5	ND	0.023UJ - 0.023UJ	0.012	0.023	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Benzo(k)fluoranthene	0/5	ND	0.019UJ - 0.019UJ	0.010	0.019	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Chrysene	0/5	ND	0.026UJ - 0.027UJ	0.013	0.027	10.0	USEPA 2004	<0.01	No	HQ < 1.0
Dibenz(a,h)anthracene	0/5	ND	0.023UJ - 0.023UJ	0.012	0.023	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Fluoranthene	0/5	ND	0.047UJ - 0.049UJ	0.024	0.049	8.10	USEPA 1996	<0.01	No	HQ < 1.0
Fluorene	0/5	ND	0.018UJ - 0.018UJ	0.009	0.018	19.00	USEPA 2003	<0.01	No	HQ < 1.0
Indeno(1,2,3-cd)pyrene	0/5	ND	0.022UJ - 0.022UJ	0.011	0.022	6.00	Buchman 2008	<0.01	No	HQ < 1.0
Naphthalene	0/5	ND	0.047UJ - 0.049UJ	0.024	0.049	13.0	USEPA 2003	<0.01	No	HQ < 1.0
Phenanthrene	0/5	ND	0.017UJ - 0.017UJ	0.009	0.017	6.30	USEPA 1996	<0.01	No	HQ < 1.0
Pyrene	0/5	ND	0.025UJ - 0.026UJ	0.013	0.026	0.30	USEPA 2003	0.09	No	HQ < 1.0
Total Recoverable Metals (µg/L)										
Antimony	0/5	ND	0.36U - 0.36U	0.180	0.36	80.0	USEPA 2003	<0.01	No	HQ < 1.0
Arsenic	1/5	3.2 - 3.2	1.4U - 2.4U	1.330	3.2	150	PREQB 2010	0.02	No	HQ < 1.0
Barium	5/5	13 - 86	NA	41.800	86	220	USEPA 2003	0.39	No	HQ < 1.0
Beryllium	0/5	ND	0.065U - 0.065U	0.033	0.065	1.83	USEPA 2007b	0.04	No	HQ < 1.0
Cadmium	1/5	1.1J - 1.1J	0.12UJ - 0.12UJ	0.268	1.1	0.12	PREQB 2010	9.27	Yes	HQ > 1.0
Chromium	1/5	6.3 - 6.3	1.5U - 1.7U	1.890	6.3	34.6	PREQB 2010	0.18	No	HQ < 1.0
Cobalt	1/1	3.1 - 3.1	NA	3.100	3.1	24.0	USEPA 2003	0.13	No	HQ < 1.0
Copper	5/5	1.4J - 13	NA	4.440	13	3.60	PREQB 2010	3.61	Yes	HQ > 1.0
Lead	5/5	0.21J - 16	NA	3.524	16	0.77	PREQB 2010	20.74	Yes	HQ > 1.0
Mercury	0/5	ND	0.08UJ - 0.08UJ	0.040	0.08	0.91	USEPA 2009	0.09	No	HQ < 1.0
Nickel	5/5	0.43J - 3.8	NA	1.316	3.8	20.3	PREQB 2010	0.19	No	HQ < 1.0
Selenium	1/5	0.71J - 0.71J	0.6U - 0.6U	0.382	0.71	5.00	PREQB 2010	0.14	No	HQ < 1.0
Silver	0/5	ND	0.09UJ - 0.09UJ	0.045	0.09	0.56	PREQB 2010	0.16	No	HQ < 1.0
Thallium	0/5	ND	0.55U - 0.55U	0.275	0.55	4.00	USEPA 2001	0.14	No	HQ < 1.0
Tin	0/5	ND	0.9U - 0.9U	0.450	0.9	180	USEPA 2003	<0.01	No	HQ < 1.0
Vanadium	4/5	5.2 - 22	5U - 5U	8.200	22	12.0	USEPA 2003	1.83	Yes	HQ > 1.0
Zinc	4/5	6.5J - 46	6.5U - 6.5U	14.190	46	46.7	PREQB 2010	0.99	No	HQ < 1.0

Notes:

USEPA = United States Environmental Protection Agency
COPC = Contaminant of Potential Concern
SWSV = Surface Water Screening Value
PREQB = Puerto Rico Environmental Quality Board

PAH = Polynuclear Aromatic Hydrocarbon
HQ = Hazard Quotient
NA = Not Applicable
ND = Not Detected

µg/L = microgram per liter
J = Estimated value
U = Not detected
UJ = Not detected, estimated value

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(2) See Table 7-7 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 7-17
FREQUENCY AND RANGE OF DRAINAGE DITCH SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Sediemnt Screening Value (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]					
Volatile Organics (µg/kg)										
1,1,1,2-Tetrachloroethane	0/3	ND	0.37UJ - 1.8UJ	0.650	1.8	2,773	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,1,1-Trichloroethane	0/3	ND	0.33UJ - 1.7UJ	0.590	1.7	750	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,1,2,2-Tetrachloroethane	0/3	ND	0.81UJ - 4UJ	1.420	4	1,933	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,1,2-Trichloroethane	0/3	ND	0.69UJ - 3.4UJ	1.200	3.4	1,865	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,1-Dichloroethane	0/3	ND	0.29UJ - 1.4UJ	0.500	1.4	97.3	USEPA 1993 and 1996	0.01	No	HQ < 1.0
1,1-Dichloroethene	0/3	ND	0.31UJ - 1.6UJ	0.550	1.6	291	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,2,3-Trichloropropane	0/3	ND	0.81UJ - 4UJ	1.420	4	1,607	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,2-Dibromo-3-Chloropropane	0/3	ND	1.6UJ - 8UJ	2.820	8	1,438	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,2-Dichloroethane	0/3	ND	0.58UJ - 2.9UJ	1.010	2.9	913	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,2-Dichloropropane	0/3	ND	0.63UJ - 3.2UJ	1.120	3.2	1,120	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
2-Butanone (MEK)	1/3	65J - 65J	35UJ - 110UJ	45.830	65	149	USEPA 1993 and 1996	0.44	No	HQ < 1.0
2-Chloro-1,3-butadiene	0/3	ND	0.33UJ - 1.6UJ	0.570	1.6	NE	---	NA	Yes	No SDSV
2-Hexanone	0/3	ND	1.2UJ - 6UJ	2.120	6	81.1	USEPA 1993 and 1996	0.07	No	HQ < 1.0
3-Chloro-1-propene	0/3	ND	0.86UJ - 4.3UJ	1.510	4.3	9.67	USEPA 1993 and 1996	0.44	No	HQ < 1.0
4-Methyl-2-pentanone (MIBK)	0/3	ND	1.7UJ - 8.3UJ	2.930	8.3	119	USEPA 1993 and 1996	0.07	No	HQ < 1.0
Acetone	3/3	200J - 1200J	NA	550.000	1200	35.6	USEPA 1993 and 1996	33.73	Yes	HQ > 1.0
Acetonitrile	0/3	ND	26UJ - 130UJ	46.000	130	200	USEPA 1993 and 1996	0.65	No	HQ < 1.0
Acrylonitrile	0/3	ND	13UJ - 66UJ	23.170	66	4.2	USEPA 1993 and 1996	15.76	Yes	HQ > 1.0
Benzene	0/3	ND	0.46UJ - 2.3UJ	0.810	2.3	237	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Bromoform	0/3	ND	0.63UJ - 3.2UJ	1.120	3.2	1,692	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Bromomethane	0/3	ND	0.92UJ - 4.6UJ	1.620	4.6	8.52	USEPA 1993 and 1996	0.54	No	HQ < 1.0
Carbon disulfide	2/3	19J - 800J	0.29UJ - 0.29UJ	273.050	800	50.0	USEPA 1993 and 1996	16.01	Yes	HQ > 1.0
Carbon tetrachloride	0/3	ND	0.58UJ - 2.9UJ	1.010	2.9	4,172	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Chlorobenzene	0/3	ND	0.42UJ - 2.1UJ	0.740	2.1	1,097	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Chlorodibromomethane	0/3	ND	0.29UJ - 1.4UJ	0.500	1.4	1,664	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Chloroethane	0/3	ND	0.69UJ - 3.4UJ	1.200	3.4	10,406	Di Toro and McGrath 2000	<0.01	No	HQ < 1.0
Chloroform	0/3	ND	0.29UJ - 1.4UJ	0.500	1.4	389	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Chloromethane	0/3	ND	0.41UJ - 2UJ	0.720	2	1,554	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
cis-1,3-Dichloropropene	0/3	ND	0.5UJ - 2.5UJ	0.880	2.5	93.1	USEPA 1993 and 1996	0.03	No	HQ < 1.0
Dibromomethane	0/3	ND	0.69UJ - 3.4UJ	1.200	3.4	252	USEPA 1993 and 1996	0.01	No	HQ < 1.0
Dichlorobromomethane	0/3	ND	0.29UJ - 1.4UJ	0.500	1.4	1,664	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Dichlorodifluoromethane	0/3	ND	0.51UJ - 2.6UJ	0.900	2.6	1,053	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Ethyl methacrylate	0/3	ND	1.3UJ - 6.3UJ	2.230	6.3	23,704	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Ethylbenzene	0/3	ND	0.43UJ - 2.2UJ	0.770	2.2	4.0	Buchman 2008	0.55	No	HQ < 1.0
Ethylene Dibromide	0/3	ND	0.86UJ - 4.3UJ	1.510	4.3	500	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Iodomethane	1/3	36J - 36J	0.58UJ - 2.9UJ	12.580	36	NE	---	NA	Yes	No SDSV
Isobutyl alcohol	0/3	ND	40UJ - 200UJ	70.000	200	787	USEPA 1993 and 1996	0.25	No	HQ < 1.0
Methacrylonitrile	0/3	ND	14UJ - 69UJ	24.330	69	NE	---	NA	Yes	No SDSV
Methyl methacrylate	0/3	ND	2.1UJ - 11UJ	3.800	11	2,292	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Methylene Chloride	0/3	ND	0.58UJ - 2.9UJ	1.010	2.9	97.0	USEPA 1993 and 1996	0.03	No	HQ < 1.0
Pentachloroethane	0/3	ND	1.3UJ - 6.3UJ	2.230	6.3	2069	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Propionitrile	0/3	ND	12UJ - 60UJ	21.170	60	787	USEPA 1993 and 1996	0.08	No	HQ < 1.0
Styrene	0/3	ND	0.38UJ - 1.9UJ	0.660	1.9	895	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Tetrachloroethene	0/3	ND	0.42UJ - 2.1UJ	0.740	2.1	57.0	Buchman 2008	0.04	No	HQ < 1.0
Toluene	0/3	ND	0.46UJ - 2.3UJ	0.810	2.3	3,183	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
trans-1,2-Dichloroethene	0/3	ND	0.56UJ - 2.8UJ	0.980	2.8	3,786	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
trans-1,3-Dichloropropene	0/3	ND	0.5UJ - 2.5UJ	0.880	2.5	87.0	USEPA 1993 and 1996	0.03	No	HQ < 1.0

TABLE 7-17
FREQUENCY AND RANGE OF DRAINAGE DITCH SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
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)	Sediemnt Screening Value (SDSV)	Reference (2)	Max. HQ (3)	Ecological COPC?	Comments
Volatile Organics (µg/kg)										
trans-1,4-Dichloro-2-butene	0/3	ND	1.8UJ - 8.9UJ	3.130	8.9	NE	---	NA	Yes	No SDSV
Trichloroethene	0/3	ND	0.58UJ - 2.9UJ	1.010	2.9	781	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Trichlorofluoromethane	0/3	ND	0.86UJ - 4.3UJ	1.510	4.3	2,432	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Vinyl acetate	0/3	ND	0.86UJ - 4.3UJ	1.510	4.3	46.6	USEPA 1993 and 1996	0.09	No	HQ < 1.0
Vinyl chloride	0/3	ND	0.33UJ - 1.7UJ	0.590	1.7	999	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Xylenes, Total	0/3	ND	1.3UJ - 6.6UJ	2.320	6.6	4.0	Buchman 2008	1.65	Yes	HQ > 1.0
Semi-Volatile Organics (µg/kg)										
1,1'-Biphenyl	0/3	ND	15UJ - 43UJ	14.670	43	67,706	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,2,4,5-Tetrachlorobenzene	0/3	ND	13UJ - 36UJ	12.330	36	3,934	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,2,4-Trichlorobenzene	0/3	ND	15UJ - 43UJ	14.670	43	4.8	Buchman 2008	8.96	Yes	HQ > 1.0
1,2-Dichlorobenzene	0/3	ND	14UJ - 40UJ	13.670	40	13.0	Buchman 2008	3.08	Yes	HQ > 1.0
1,3,5-Trinitrobenzene	0/3	ND	35UJ - 98UJ	33.500	98	41.6	USEPA 1993 and 1996	2.35	Yes	HQ > 1.0
1,3-Dichlorobenzene	0/3	ND	12UJ - 34UJ	11.670	34	4,733	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
1,3-Dinitrobenzene	0/3	ND	8.1UJ - 22UJ	7.680	22	23.6	USEPA 1993 and 1996	0.93	No	HQ < 1.0
1,4-Dichlorobenzene	0/3	ND	13UJ - 36UJ	12.330	36	110	Buchman 2008	0.33	No	HQ < 1.0
1,4-Dioxane	0/3	ND	17UJ - 46UJ	15.830	46	430	USEPA 1993 and 1996	0.11	No	HQ < 1.0
1,4-Naphthoquinone	0/3	ND	8.1UJ - 22UJ	7.680	22	0.69	USEPA 1993 and 1996	31.83	Yes	HQ > 1.0
2,2'-oxybis[1-chloropropane]	0/3	ND	13UJ - 36UJ	12.330	36	NE	---	NA	Yes	No SDSV
2,3,4,6-Tetrachlorophenol	0/3	ND	8.7UJ - 24UJ	8.280	24	1,024	USEPA 1993 and 1996	0.02	No	HQ < 1.0
2,4,5-Trichlorophenol	0/3	ND	14UJ - 39UJ	13.330	39	3.0	Buchman 2008	13.00	Yes	HQ > 1.0
2,4,6-Trichlorophenol	0/3	ND	16UJ - 45UJ	15.500	45	6.0	Buchman 2008	7.50	Yes	HQ > 1.0
2,4-Dichlorophenol	0/3	ND	17UJ - 47UJ	16.170	47	0.2	Buchman 2008	225.64	Yes	HQ > 1.0
2,4-Dimethylphenol	0/3	ND	35UJ - 98UJ	33.500	98	18.0	Buchman 2008	5.44	Yes	HQ > 1.0
2,4-Dinitrophenol	0/3	ND	170UJ - 480UJ	163.330	480	7.5	USEPA 1993 and 1996	64.36	Yes	HQ > 1.0
2,4-Dinitrotoluene	0/3	ND	12UJ - 34UJ	11.670	34	150	USEPA 1993 and 1996	0.23	No	HQ < 1.0
2,6-Dichlorophenol	0/3	ND	13UJ - 37UJ	12.670	37	618	USEPA 1993 and 1996	0.06	No	HQ < 1.0
2,6-Dinitrotoluene	0/3	ND	13UJ - 36UJ	12.330	36	201	USEPA 1993 and 1996	0.18	No	HQ < 1.0
2-Acetylaminofluorene	0/3	ND	11UJ - 29UJ	10.000	29	841	USEPA 1993 and 1996	0.03	No	HQ < 1.0
2-Chloronaphthalene	0/3	ND	13UJ - 36UJ	12.330	36	2,423	USEPA 1993 and 1996	0.01	No	HQ < 1.0
2-Chlorophenol	0/3	ND	14UJ - 38UJ	13.170	38	0.3	Buchman 2008	114.11	Yes	HQ > 1.0
2-Methylnaphthalene	0/3	ND	3.5UJ - 9.8UJ	3.350	9.8	20.2	CCME 2002	0.49	No	HQ < 1.0
2-Methylphenol	0/3	ND	17UJ - 47UJ	16.170	47	8.0	Buchman 2008	5.88	Yes	HQ > 1.0
2-Naphthylamine	0/3	ND	41UJ - 110UJ	38.500	110	NE	---	NA	Yes	No SDSV
2-Nitroaniline	0/3	ND	13UJ - 37UJ	12.670	37	116	USEPA 1993 and 1996	0.32	No	HQ < 1.0
2-Nitrophenol	0/3	ND	15UJ - 42UJ	14.330	42	7,248	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
2-Picoline	0/3	ND	25UJ - 69UJ	23.670	69	3,986	USEPA 1993 and 1996	0.02	No	HQ < 1.0
2-Toluidine	0/3	ND	19UJ - 53UJ	18.170	53	3.73	USEPA 1993 and 1996	14.23	Yes	HQ > 1.0
3 & 4 Methylphenol	0/3	ND	15UJ - 42UJ	14.330	42	100	Buchman 2008	0.42	No	HQ < 1.0
3,3'-Dichlorobenzidine	0/3	ND	19UJ - 53UJ	18.170	53	457	USEPA 1993 and 1996	0.12	No	HQ < 1.0
3,3'-Dimethylbenzidine	0/3	ND	370UJ - 1000UJ	348.330	1000	2484	USEPA 1993 and 1996	0.40	No	HQ < 1.0
3-Methylcholanthrene	0/3	ND	13UJ - 35UJ	12.170	35	NE	---	NA	Yes	No SDSV
3-Nitroaniline	0/3	ND	9.3UJ - 26UJ	8.880	26	7.84	USEPA 1993 and 1996	3.31	Yes	HQ > 1.0
4,6-Dinitro-2-methylphenol	0/3	ND	12UJ - 33UJ	11.330	33	101	USEPA 1993 and 1996	0.33	No	HQ < 1.0
4-Aminobiphenyl	0/3	ND	27UJ - 75UJ	25.670	75	NE	---	NA	Yes	No SDSV
4-Bromophenyl phenyl ether	0/3	ND	15UJ - 41UJ	14.170	41	1,124	Di Toro and McGrath 2000	0.04	No	HQ < 1.0
4-Chloro-3-methylphenol	0/3	ND	16UJ - 43UJ	14.830	43	12.1	USEPA 1993 and 1996	3.57	Yes	HQ > 1.0
4-Chloroaniline	0/3	ND	12UJ - 34UJ	11.670	34	550	USEPA 1993 and 1996	0.06	No	HQ < 1.0

TABLE 7-17
FREQUENCY AND RANGE OF DRAINAGE DITCH SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range					Sediemnt Screening Value (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]					
Semi-Volatile Organics (µg/kg)										
4-Chlorophenyl phenyl ether	0/3	ND	13UJ - 36UJ	12.330	36	1,032	Di Toro and McGrath 2000	0.03	No	HQ < 1.0
4-Nitroaniline	0/3	ND	16UJ - 44UJ	15.170	44	142	USEPA 1993 and 1996	0.31	No	HQ < 1.0
4-Nitrophenol	0/3	ND	68UJ - 190UJ	64.670	190	163	USEPA 1993 and 1996	1.17	Yes	HQ > 1.0
4-Nitroquinoline-1-oxide	0/1	ND	63UJ - 63UJ	31.500	63	NE	---	NA	Yes	No SDSV
7,12-Dimethylbenz(a)anthracene	0/3	ND	19UJ - 53UJ	18.170	53	695,334	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Acenaphthene	0/3	ND	1.2UJ - 3.3UJ	1.130	3.3	6.7	MacDonald et al. 2003/CCME 2002	0.49	No	HQ < 1.0
Acenaphthylene	0/3	ND	3.5UJ - 9.8UJ	3.350	9.8	5.9	MacDonald et al. 2003/CCME 2002	1.66	Yes	HQ > 1.0
Acetophenone	0/3	ND	18UJ - 49UJ	17.000	49	2,286	USEPA 1993 and 1996	0.02	No	HQ < 1.0
alpha,alpha-Dimethyl phenethylamine	0/3	ND	120UJ - 340UJ	116.670	340	NE	---	NA	Yes	No SDSV
Aniline	0/3	ND	13UJ - 36UJ	12.330	36	1.4	USEPA 1993 and 1996	26.52	Yes	HQ > 1.0
Anthracene	0/3	ND	3.5UJ - 9.8UJ	3.350	9.8	57.2	MacDonald et al. 2000	0.17	No	HQ < 1.0
Aramite, Total	0/3	ND	23UJ - 63UJ	21.670	63	6,090	USEPA 1993 and 1996	0.01	No	HQ < 1.0
Benzo[a]anthracene	2/3	58J - 270J	9.8UJ - 9.8UJ	110.970	270	108	MacDonald et al. 2000	2.50	Yes	HQ > 1.0
Benzo[a]pyrene	2/3	85J - 300J	3.8UJ - 3.8UJ	128.970	300	150	MacDonald et al. 2000	2.00	Yes	HQ > 1.0
Benzo[b]fluoranthene	1/3	77J - 77J	1.6UJ - 4.4UJ	26.670	77	1,800	Buchman 2008	0.04	No	HQ < 1.0
Benzo[g,h,i]perylene	2/3	46J - 150J	9.8UJ - 9.8UJ	66.970	150	170	Persaud et al. 1993	0.88	No	HQ < 1.0
Benzo[k]fluoranthene	2/3	160J - 630J	5.7UJ - 5.7UJ	264.280	630	240	Persaud et al. 1993	2.63	Yes	HQ > 1.0
Benzyl alcohol	1/3	47J - 47J	17UJ - 32UJ	23.830	47	52.0	Buchman 2008	0.90	No	HQ < 1.0
Bis(2-chloroethoxy)methane	0/3	ND	14UJ - 39UJ	13.330	39	362	USEPA 1993 and 1996	0.11	No	HQ < 1.0
Bis(2-chloroethyl)ether	0/3	ND	12UJ - 33UJ	11.330	33	1,326	USEPA 1993 and 1996	0.02	No	HQ < 1.0
Bis(2-ethylhexyl) phthalate	1/3	260J - 260J	79U - 160U	126.500	260	180	MacDonald et al. 2003	1.44	Yes	HQ > 1.0
Butyl benzyl phthalate	1/3	22J - 22J	29UJ - 41UJ	19.000	22	63.0	Buchman 2008	0.35	No	HQ < 1.0
Chrysene	3/3	7.1J - 410J	NA	168.030	410	166.0	MacDonald et al. 2000	2.47	Yes	HQ > 1.0
Diallate	0/3	ND	20UJ - 55UJ	19.000	55	76,571	USEPA 1993 and 1996	<0.01	No	HQ < 1.0
Dibenz(a,h)anthracene	1/3	52J - 52J	2.4UJ - 3.4UJ	18.300	52	33.0	MacDonald et al. 2000	1.58	Yes	HQ > 1.0
Dibenzofuran	0/3	ND	8.7UJ - 24UJ	8.280	24	110	Buchman 2008	0.22	No	HQ < 1.0
Diethyl phthalate	0/3	ND	23UJ - 63UJ	21.670	63	630	MacDonald et al. 2003	0.10	No	HQ < 1.0
Dimethyl phthalate	0/3	ND	13UJ - 37UJ	12.670	37	6.00	Buchman 2008	6.17	Yes	HQ > 1.0
Di-n-butyl phthalate	0/3	ND	52UJ - 610UJ	127.000	610	58.0	Buchman 2008	10.52	Yes	HQ > 1.0
Di-n-octyl phthalate	0/3	ND	6.8UJ - 19UJ	6.470	19	61.0	Buchman 2008	0.31	No	HQ < 1.0
Dinoseb	0/3	ND	35UJ - 98UJ	33.500	98	73.3	USEPA 1993 and 1996	1.34	Yes	HQ > 1.0
Ethyl methanesulfonate	0/3	ND	23UJ - 63UJ	21.670	63	1.61	USEPA 1993 and 1996	39.04	Yes	HQ > 1.0
Fluoranthene	2/3	79J - 350J	9.8UJ - 9.8UJ	144.630	350	423	MacDonald et al. 2000	0.83	No	HQ < 1.0
Fluorene	0/3	ND	1.6UJ - 4.4UJ	1.520	4.4	77.4	MacDonald et al. 2000	0.06	No	HQ < 1.0
Hexachlorobenzene	0/3	ND	14UJ - 39UJ	13.330	39	20.0	MacDoanld et al 2003/Persaud et al. 1993	1.95	Yes	HQ > 1.0
Hexachlorobutadiene	0/3	ND	19UJ - 52UJ	18.000	52	55.0	MacDonald et al. 2003	0.95	No	HQ < 1.0
Hexachlorocyclopentadiene	0/3	ND	29UJ - 80UJ	27.500	80	501	USEPA 1993 and 1996	0.16	No	HQ < 1.0
Hexachloroethane	0/3	ND	15UJ - 43UJ	14.670	43	73.0	Buchman 2008	0.59	No	HQ < 1.0
Hexachloropropene	0/3	ND	15UJ - 41UJ	14.170	41	NE	---	NA	Yes	HQ > 1.0
Indeno[1,2,3-cd]pyrene	2/3	32J - 110J	6.9UJ - 6.9UJ	48.480	110	200	Persaud et al. 1993	0.55	No	HQ < 1.0
Isophorone	0/3	ND	13UJ - 36UJ	12.330	36	1,554	USEPA 1993 and 1996	0.02	No	HQ < 1.0
Isosafrole	0/3	ND	15UJ - 41UJ	14.170	41	NE	---	NA	Yes	No SDSV
Methapyrilene	0/3	ND	19UJ - 53UJ	18.170	53	NE	---	NA	Yes	No SDSV
Methyl methanesulfonate	0/3	ND	19UJ - 53UJ	18.170	53	NE	---	NA	Yes	No SDSV
Naphthalene	0/3	ND	1.2UJ - 3.4UJ	1.170	3.4	176	MacDonald et al. 2000	0.02	No	HQ < 1.0
Nitrobenzene	0/3	ND	14UJ - 40UJ	13.670	40	21.0	Buchman 2008	1.90	Yes	HQ > 1.0
N-Nitro-o-toluidine	0/3	ND	12UJ - 34UJ	11.670	34	546	USEPA 1993 and 1996	0.06	No	HQ < 1.0

TABLE 7-17
FREQUENCY AND RANGE OF DRAINAGE DITCH SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Analyte	Contaminant Frequency/Range									
	Frequency of Detection	Range of Positive Detections	Range of Non- Detects	Arithmetic Mean (Half Non-Detects)	Value used in Step 2 Screen (1)	Sediemnt Screening Value (SDSV)	Reference (2)	Max. HQ (3)	Ecological COPC?	Comments
Semi-Volatile Organics (µg/kg)										
N-Nitrosodiethylamine	0/3	ND	25UJ - 69UJ	23.670	69	82.0	USEPA 1993 and 1996	0.84	No	HQ < 1.0
N-Nitrosodimethylamine	0/3	ND	20UJ - 56UJ	19.170	56	0.25	USEPA 1993 and 1996	225.93	Yes	HQ > 1.0
N-Nitrosodi-n-butylamine	0/3	ND	19UJ - 52UJ	18.000	52	211	USEPA 1993 and 1996	0.25	No	HQ < 1.0
N-Nitrosodi-n-propylamine	0/3	ND	13UJ - 37UJ	12.670	37	21.4	USEPA 1993 and 1996	1.73	Yes	HQ > 1.0
N-Nitrosodiphenylamine	0/3	ND	15UJ - 41UJ	14.170	41	28.0	Buchman 2008	1.46	Yes	HQ > 1.0
N-Nitrosomethylethylamine	0/3	ND	12UJ - 33UJ	11.330	33	0.69	USEPA 1993 and 1996	48.08	Yes	HQ > 1.0
N-Nitrosomorpholine	0/3	ND	14UJ - 38UJ	13.170	38	NE	---	NA	Yes	No SDSV
N-Nitrosopiperidine	0/3	ND	18UJ - 49UJ	16.830	49	NE	---	NA	Yes	No SDSV
N-Nitrosopyrrolidine	0/3	ND	18UJ - 51UJ	17.500	51	NE	---	NA	Yes	No SDSV
p-Dimethylamino azobenzene	0/3	ND	15UJ - 41UJ	14.170	41	NE	---	NA	Yes	No SDSV
Pentachlorobenzene	0/3	ND	13UJ - 36UJ	12.330	36	101	USEPA 1993 and 1996	0.36	No	HQ < 1.0
Pentachloronitrobenzene	0/3	ND	12UJ - 34UJ	11.670	34	1,311	USEPA 1993 and 1996	0.03	No	HQ < 1.0
Pentachlorophenol	0/3	ND	17UJ - 48UJ	16.330	48	17.0	Buchman 2008	2.82	Yes	HQ > 1.0
Phenacetin	0/3	ND	9.7UJ - 27UJ	9.280	27	NE	---	NA	Yes	No SDSV
Phenanthrene	2/3	19J - 21J	9.8UJ - 9.8UJ	14.970	21	204	MacDonald et al. 2000	0.10	No	HQ < 1.0
Phenol	0/3	ND	9.9UJ - 28UJ	9.480	28	130	Buchman 2008	0.22	No	HQ < 1.0
p-Phenylene diamine	0/3	ND	330UJ - 920UJ	315.000	920	3.7	USEPA 1993 and 1996	250.54	Yes	HQ > 1.0
Pronamide	0/3	ND	19UJ - 52UJ	17.830	52	772	USEPA 1993 and 1996	0.07	No	HQ < 1.0
Pyrene	2/3	110J - 570J	9.8UJ - 9.8UJ	228.300	570	195	MacDonald et al. 2000	2.92	Yes	HQ > 1.0
Pyridine	0/3	ND	23UJ - 63UJ	21.670	63	391	USEPA 1993 and 1996	0.16	No	HQ < 1.0
Safrole, Total	0/3	ND	17UJ - 48UJ	16.330	48	NE	---	NA	Yes	No SDSV
Total Metals (mg/kg)										
Antimony	1/14	0.92J - 0.92J	0.29UJ - 1.4UJ	0.400	0.92	2.0	Long and Morgan 1991	0.46	No	HQ < 1.0
Arsenic	13/14	0.96J - 10.4J	1.1UJ - 1.1UJ	3.120	10.4	9.8	MacDonald et al. 2000	1.06	Yes	HQ > 1.0
Barium	14/14	42 - 571J	NA	125.660	571	20.0	MacDonald et al. 2003	28.55	Yes	HQ > 1.0
Beryllium	4/14	0.21J - 0.3J	0.25UJ - 1.2UJ	0.260	0.3	NE	---	NA	Yes	No SDSV
Cadmium	6/14	0.39J - 3.9J	0.04U - 0.13UJ	0.650	3.9	1.0	MacDonald et al. 2000	3.94	Yes	HQ > 1.0
Chromium	14/14	19.8J - 51J	NA	32.570	51	43.4	MacDonald et al. 2000	1.18	Yes	HQ > 1.0
Cobalt	14/14	18J - 91.4J	NA	40.190	91.4	50.0	MacDonald et al. 2003	1.83	Yes	HQ > 1.0
Copper	14/14	75.1J - 130J	NA	100.270	130	31.6	MacDonald et al. 2000	4.11	Yes	HQ > 1.0
Lead	14/14	13J - 280J	NA	60.880	280	35.8	MacDonald et al. 2000	7.82	Yes	HQ > 1.0
Mercury	13/14	0.052J - 0.38J	0.039UJ - 0.039UJ	0.110	0.38	0.18	MacDonald et al. 2000	2.11	Yes	HQ > 1.0
Nickel	14/14	8.7J - 19.1J	NA	13.050	19.1	22.7	MacDonald et al. 2000	0.84	No	HQ < 1.0
Selenium	9/14	0.99J - 4.2J	0.46UJ - 1.4UJ	1.330	4.2	2.0	Lemley 2002 (as cited in USEPA 2007)	2.10	Yes	HQ > 1.0
Silver	6/14	0.18J - 4.6J	0.05U - 0.16UJ	0.480	4.6	1.0	MacDonald et al. 2003	4.60	Yes	HQ > 1.0
Thallium	0/14	ND	0.23UJ - 1.8UJ	0.490	1.8	NE	---	NA	Yes	No SDSV
Tin	8/14	4.6J - 16J	7.8UJ - 23UJ	9.050	16	3.4	Buchman 2008	4.71	Yes	HQ > 1.0
Vanadium	14/14	147J - 260J	NA	196.210	260	57.0	Buchman 2008	4.56	Yes	HQ > 1.0
Zinc	14/14	69.2J - 140J	NA	97.130	140	121.0	MacDonald et al. 2000	1.16	Yes	HQ > 1.0

Notes:

COPC = Chemical of Potential Concern
SDSV = Sediment Screening Value
USEPA = United States Environmental Protection Agency

µg/kg - microgram per kilogram
mg/kg = milligram per kilogram
HQ = Hazard Quotient

ND = Not Detected
NA = Not Applicable
NE = Not Established

CCME = Canadian Council of Ministers of the Environment
UJ = Not Detected (estimated value)
J = Detected (estimated value)

TABLE 7-17
FREQUENCY AND RANGE OF DRAINAGE DITCH SEDIMENT DATA (MAXIMUM CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(1) Maximum detected concentration (or maximum method detection limit for non-detected chemicals).

(2) See Table 7-7 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 7-18
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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
Volatile Organic:									
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	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
Semi-Volatile Organics:									
1,1-Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	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
1,3-Dichlorobenzene	<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
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromopheny phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	<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
bis(2-Ethylhexyl)phthalate	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 7-18
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN
SURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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
Semi-Volatile Organics:									
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	0.21	0.04	0.09	0.05	0.01	0.02	0.04	<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
Dinoseb	0.05	0.01	0.02	0.02	<0.01	0.01	0.01	<0.01	<0.01
Hexachlorobenzene	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
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	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
PAHs:									
2-Methylnaphthalene	<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
Acenaphthylene	<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
Benzo(a)anthracene	<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
Benzo(b)fluoranthene	<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
Benzo(k)fluoranthene	<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
Dibenz(a,h)anthracene	<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
Fluorene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

TABLE 7-18
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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
PAHs:									
Indeno(1,2,3-cd)pyrene	<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
Phenanthrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	<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
Arsenic	0.10	0.05	0.07	0.03	0.01	0.02	<0.01	<0.01	<0.01
Barium	0.61	0.30	0.43	0.65	0.32	0.46	<0.01	<0.01	<0.01
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	3.56	0.82	1.71	0.13	0.03	0.06	0.08	0.02	0.04
Chromium, total	16.00	2.73	6.61	0.39	0.07	0.16	0.17	0.03	0.07
Cobalt	0.64	0.27	0.42	0.07	0.03	0.05	0.03	0.01	0.02
Copper	2.05	0.69	1.19	0.71	0.24	0.41	0.40	0.13	0.23
Lead	4.88	2.44	3.45	1.43	0.72	1.01	0.74	0.37	0.52
Mercury	12.66	4.22	7.31	0.48	0.16	0.28	0.05	0.02	0.03
Nickel	2.43	0.88	1.46	0.03	0.01	0.02	0.04	0.02	0.03
Selenium	2.27	1.13	1.60	1.08	0.54	0.77	0.38	0.19	0.27
Silver	0.44	0.04	0.14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium	0.19	0.04	0.09	<0.01	<0.01	<0.01	0.05	<0.01	0.02
Tin	0.20	0.08	0.13	<0.01	<0.01	<0.01	0.05	0.02	0.03
Vanadium	61.68	30.84	43.62	11.10	5.55	7.85	2.35	1.18	1.66
Zinc	1.33	0.51	0.82	0.12	0.05	0.07	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 7-19
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SUBSURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION
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
Volatile Organic:									
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	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
Semi-Volatile Organics:									
1,1-Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	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
1,3-Dichlorobenzene	<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
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromopheny phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	<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
bis(2-Ethylhexyl)phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 7-19
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SUBSURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	American robin			Mourning dove			Red-tailed hawk		
Chemical	**NOAEL**	**LOAEL**	**MATC**	**NOAEL**	**LOAEL**	**MATC**	**NOAEL**	**LOAEL**	**MATC**
Semi-Volatile Organics:									
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	0.07	0.01	0.03	0.02	<0.01	<0.01	0.01	<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
Dinoseb	0.05	0.01	0.02	0.02	<0.01	0.01	0.01	<0.01	<0.01
Hexachlorobenzene	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
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	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
PAHs:									
2-Methylnaphthalene	<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
Acenaphthylene	<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
Benzo(a)anthracene	<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
Benzo(b)fluoranthene	<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
Benzo(k)fluoranthene	<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
Dibenz(a,h)anthracene	<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
Fluorene	<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
Naphthalene	<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

TABLE 7-19
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SUBSURFACE SOIL: STEP 2 SCREENING LEVEL RISK CALCULATION
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
PAHs:									
Pyrene	<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
Arsenic	0.04	0.02	0.03	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.09	0.05	0.06	0.10	0.05	0.07	<0.01	<0.01	<0.01
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.12	0.03	0.06	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Chromium, total	4.44	0.76	1.84	0.11	0.02	0.05	0.07	0.01	0.03
Cobalt	0.06	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	1.51	0.51	0.88	0.51	0.17	0.30	0.37	0.12	0.22
Lead	0.05	0.02	0.03	0.04	0.02	0.03	0.08	0.04	0.06
Mercury	14.96	4.99	8.64	0.53	0.18	0.30	0.06	0.02	0.03
Nickel	0.71	0.26	0.43	0.01	<0.01	<0.01	0.02	<0.01	0.01
Selenium	1.96	0.98	1.39	0.88	0.44	0.62	0.36	0.18	0.25
Silver	0.17	0.02	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium	0.12	0.02	0.05	<0.01	<0.01	<0.01	0.03	<0.01	0.01
Tin	0.20	0.08	0.13	<0.01	<0.01	<0.01	0.05	0.02	0.03
Vanadium	17.21	8.60	12.17	3.10	1.55	2.19	0.66	0.33	0.47
Zinc	0.64	0.25	0.40	0.04	0.01	0.02	0.16	0.06	0.10

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 7-20
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN DRAINAGE DITCH SEDIMENT: STEP 2 SCREENING LEVEL RISK CALCULATION
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin		
	NOAEL	LOAEL	MATC
Volatile Organic:			
Pentachloroethane	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA
Carbon tetrachloride	NA	NA	NA
Chlorobenzene	NA	NA	NA
Chloroform	NA	NA	NA
Ethylbenzene	NA	NA	NA
Styrene	NA	NA	NA
Toluene	NA	NA	NA
Trichloroethene	NA	NA	NA
Xylenes, total	<0.01	<0.01	<0.01
Semi-Volatile Organics:			
1'1-Biphenyl	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA
1,2-Dichlorobenzene	<0.01	<0.01	<0.01
1,3-Dichlorobenzene	<0.01	<0.01	<0.01
1,4-Dichlorobenzene	<0.01	<0.01	<0.01
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-Bromopheny phenyl ether	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	<0.01	<0.01	<0.01
Aramite, total	NA	NA	NA
bis(2-Ethylhexyl)phthalate	0.06	0.01	0.03
Butyl benzyl phthalate	NA	NA	NA
Diallate	NA	NA	NA

TABLE 7-20
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN DRAINAGE DITCH SEDIMENT: STEP 2 SCREENING LEVEL RISK CALCULATION
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin		
	NOAEL	**LOAEL**	**MATC**
Semi-Volatile Organics:			
Dibenzofuran	NA	NA	NA
Diethyl phthalate	NA	NA	NA
Di-n-butyl phthalate	1.32	0.26	0.59
Di-n-octyl phthalate	<0.01	<0.01	<0.01
Dinoseb	0.22	0.04	0.10
Hexachlorobenzene	0.12	0.02	0.05
Hexachlorobutadiene	<0.01	<0.01	<0.01
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	<0.01	<0.01	<0.01
Pentachlorophenol	0.15	0.02	0.05
Pronamide	NA	NA	NA
PAHs:			
2-Methylnaphthalene	<0.01	<0.01	<0.01
Acenaphthene	<0.01	<0.01	<0.01
Acenaphthylene	<0.01	<0.01	<0.01
Anthracene	<0.01	<0.01	<0.01
Benzo(a)anthracene	<0.01	<0.01	<0.01
Benzo(a)pyrene	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	<0.01	<0.01	<0.01
Chrysene	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	<0.01	<0.01	<0.01
Fluoranthene	<0.01	<0.01	<0.01
Fluorene	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	<0.01	<0.01	<0.01

TABLE 7-20
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN DRAINAGE DITCH SEDIMENT: STEP 2 SCREENING LEVEL RISK CALCULATION
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin		
	NOAEL	LOALE	MATC
PAHs:			
Naphthalene	<0.01	<0.01	<0.01
Phenanthrene	<0.01	<0.01	<0.01
Pyrene	<0.01	<0.01	<0.01
Metals:			
Antimony	<0.01	<0.01	<0.01
Arsenic	0.27	0.13	0.19
Barium	1.83	0.91	1.29
Beryllium	NA	NA	NA
Cadmium	4.07	0.94	1.96
Chromium, total	15.11	2.58	6.24
Cobalt	1.18	0.49	0.76
Copper	2.05	0.69	1.19
Lead	6.42	3.21	4.54
Mercury	72.86	24.29	42.07
Nickel	3.32	1.20	1.99
Selenium	2.61	1.31	1.85
Silver	8.46	0.85	2.67
Thallium	1.38	0.28	0.62
Tin	0.63	0.25	0.40
Vanadium	37.30	18.65	26.38
Zinc	1.63	0.63	1.01

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
PAH = Polynuclear Aromatic Hydrocarbon
NA = Toxicity reference value not available (hazard quotient value could not be calculated)

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Volatile Organics:								
1,1,1,2-Tetrachloroethane				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
1,1,1-Trichloroethane				NE (9)		NE (11)	NE (11)	NE (11)
1,1,2,2-Tetrachloroethane				NE (9)		NE (11)	NE (11)	NE (11)
1,1,2-Trichloroethane				NE (9)		NE (11)	NE (11)	NE (11)
1,1-Dichloroethane				NE (9)		NE (11)	NE (11)	NE (11)
1,1-Dichloroethene				NE (9)		NE (11)	NE (11)	NE (11)
1,2,3-Trichloropropane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
1,2-Dibromo-3-Chloropropane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
1,2-Dichloroethane				NE (9)		NE (11)	NE (11)	NE (11)
1,2-Dichloropropane				NE (9)		NE (11)	NE (11)	NE (11)
2-Butanone (MEK)	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
2-Chloro-1,3-butadiene	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
2-Hexanone	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
3-Chloro-1-propene	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
4-Methyl-2-pentanone (MIBK)	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Acetone	No SSV (2)	No SSV (2)		NE (9)	HQ = 33.73 (5)	NE (11)	NE (11)	NE (11)
Acetonitrile	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Acrolein	NE (3)	No SSV (1)	HQ = 32.73 (6)	NE (9)	NE (3)	NE (11)	NE (11)	NE (11)
Acrylonitrile				NE (9)	HQ = 15.76 (6)	NE (11)	NE (11)	NE (11)
Benzene				NE (9)		NE (11)	NE (11)	NE (11)
Bromoform	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Bromomethane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Carbon disulfide	No SSV (2)	No SSV (1)		NE (9)	HQ = 16.01 (5)	NE (11)	NE (11)	NE (11)
Carbon tetrachloride				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Chlorobenzene				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Chlorodibromomethane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Volatile Organics:								
Chloroethane	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)		NE (11)	NE (11)	NE (11)
Chloroform				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Chloromethane	No SSV (2)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
cis-1,3-Dichloropropene				NE (9)		NE (11)	NE (11)	NE (11)
Dibromomethane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Dichlorobromomethane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Dichlorodifluoromethane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Ethyl methacrylate	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Ethylbenzene				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Ethylene dibromide				NE (9)		NE (11)	NE (11)	NE (11)
Iodomethane	No SSV (2)	No SSV (2)	No SWSV (1)	NE (9)	No SDSV (2)	NE (11)	NE (11)	NE (11)
Isobutyl alcohol	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Methacrylonitrile	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
Methyl methacrylate	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Methylene chloride				NE (9)		NE (11)	NE (11)	NE (11)
Pentachloroethane	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Propionitrile	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Styrene				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Tetrachloroethene				NE (9)		NE (11)	NE (11)	NE (11)
Toluene				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
trans-1,2-Dichloroethene				NE (9)		NE (11)	NE (11)	NE (11)
trans-1,3-Dichloropropene				NE (9)		NE (11)	NE (11)	NE (11)
trans-1,4-Dichloro-2-butene			No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
Trichloroethene				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Trichlorofluoromethane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Vinyl acetate	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)

Revised: September 29, 2011

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Volatile Organics:								
Vinyl chloride				NE (9)		NE (11)	NE (11)	NE (11)
Xylenes, total				NE (9)	HQ = 1.65 (6)			
Semi-Volatile Organics:								
1,1'-Biphenyl	No SSV (1)	No SSV (1)		NE (8)		No TRV (10)	No TRV (10)	No TRV (10)
1,2,4,5-Tetrachlorobenzene				NE (8)		No TRV (10)	No TRV (10)	No TRV (10)
1,2,4-Trichlorobenzene				NE (8)	HQ = 8.96 (6)	No TRV (10)	No TRV (10)	No TRV (10)
1,2-Dichlorobenzene				NE (8)	HQ = 3.08 (6)			
1,3,5-Trinitrobenzene				NE (9)	HQ = 2.35 (6)	NE (11)	NE (11)	NE (11)
1,3-Dichlorobenzene				NE (9)				
1,3-Dinitrobenzene				NE (9)		NE (11)	NE (11)	NE (11)
1,4-Dichlorobenzene				NE (9)				
1,4-Dioxane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
1,4-Naphthoquinone	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	HQ = 31.83 (6)	NE (11)	NE (11)	NE (11)
2,2'-oxybis(1-chloropropane)	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
2,3,4,6-Tetrachlorophenol				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
2,4,5-Trichlorophenol				NE (9)	HQ = 13.00 (6)	No TRV (10)	No TRV (10)	No TRV (10)
2,4,6-Trichlorophenol				NE (9)	HQ = 7.50 (6)	No TRV (10)	No TRV (10)	No TRV (10)
2,4-Dichlorophenol				NE (9)	HQ = 225.64 (6)	No TRV (10)	No TRV (10)	No TRV (10)
2,4-Dimethylphenol				NE (9)	HQ = 5.44 (6)	NE (11)	NE (11)	NE (11)
2,4-Dinitrophenol				NE (9)	HQ = 64.36 (6)	NE (11)	NE (11)	NE (11)
2,4-Dinitrotoluene	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
2,6-Dichlorophenol				NE (9)		NE (11)	NE (11)	NE (11)
2,6-Dinitrotoluene	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
2-Acetylaminofluorene	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
2-Chloronaphthalene	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
2-Chlorophenol				NE (9)	HQ = 114.11 (6)	NE (11)	NE (11)	NE (11)

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Semi-Volatile Organics:								
2-Methylphenol				NE (9)	HQ = 5.88 (6)	NE (11)	NE (11)	NE (11)
2-Naphthylamine	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
2-Nitroaniline	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
2-Nitrophenol				NE (9)		NE (11)	NE (11)	NE (11)
2-Picoline	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
2-Toluidine	No SSV (1)	No SSV (1)		NE (9)	HQ = 14.23 (6)	NE (11)	NE (11)	NE (11)
3,4-Methylphenol				NE (9)		NE (11)	NE (11)	NE (11)
3,3'-Dichlorobenzidine	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
3,3'-Dimethylbenzidine	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
3-Methylcholanthrene	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	No TRV (10)	No TRV (10)	No TRV (10)
3-Nitroaniline	No SSV (1)	No SSV (1)		NE (9)	HQ = 3.31 (6)	NE (11)	NE (11)	NE (11)
4,6-Dinitro-2-methylphenol	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
4-Aminobiphenyl	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
4-Bromophenyl phenyl ether	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
4-Chloro-3-methylphenol	No SSV (1)	No SSV (1)		NE (9)	HQ = 3.57 (6)	No TRV (10)	No TRV (10)	No TRV (10)
4-Chloroaniline	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
4-Chlorophenyl phenyl ether	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
4-Nitroaniline	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
4-Nitrophenol				NE (9)	HQ = 1.17 (6)	NE (11)	NE (11)	NE (11)
4-Nitroquinoline-1-oxide	NE (3)	NE (3)	NE (3)	NE (9)	No SDSV (1)	NE (3)	NE (3)	NE (11)
7,12-Dimethylbenz(a)anthracene	No SSV (1)	No SSV (1)		NE (9)				
Acetophenone	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
A,A-Dimethyl phenethylamine	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
Aniline	No SSV (1)	No SSV (1)		NE (9)	HQ = 26.52 (6)	NE (11)	NE (11)	NE (11)
Aramite, total	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Benzyl alcohol	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Semi-Volatile Organics:								
Bis(2-chloroethoxy)methane	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Bis(2-chloroethyl)ether	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Bis(2-ethylhexyl) phthalate				NE (9)	HQ = 1.44 (5)			
Butyl benzyl phthalate				NE (9)		No TRV (12)	No TRV (10)	No TRV (12)
Diallate	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Dibenzofuran	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Diethyl phthalate				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Dimethyl phthalate				NE (9)	HQ = 6.17 (6)	NE (11)	NE (11)	NE (11)
Di-n-butyl phthalate				NE (9)	HQ = 10.52 (6)			HQ = 1.32 (14)
Di-n-octyl phthalate				NE (9)				
Dinoseb	No SSV (1)	No SSV (1)		NE (9)	HQ = 1.34 (6)			
Ethyl methanesulfonate	No SSV (1)	No SSV (1)		NE (9)	HQ = 39.04 (6)	NE (11)	NE (11)	NE (11)
Hexachlorobenzene				NE (9)				
Hexachlorobutadiene	No SSV (1)	No SSV (1)		NE (9)				
Hexachlorocyclopentadiene			HQ = 7.00 (6)	NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Hexachloroethane	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Hexachlorophene	No SSV (1)	NE (3)	NE (3)	NE (9)	NE (3)	No TRV (10)	NE (3)	No TRV (10)
Hexachloropropene	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	No TRV (10)	No TRV (10)	No TRV (10)
Isophorone	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Isosafrole	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	No TRV (10)	No TRV (10)	No TRV (10)
Methapyrilene	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
Methyl methanesulfonate	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
Nitrobenzene				NE (9)	HQ = 1.90 (6)	NE (11)	NE (11)	NE (11)
N-Nitro-o-toluidine	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
N-Nitrosodiethylamine				NE (9)		NE (11)	NE (11)	NE (11)
N-Nitrosodimethylamine				NE (8)	HQ = 225.93 (6)	NE (11)	NE (11)	NE (11)

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Semi-Volatile Organics:								
N-Nitrosodi-n-butylamine				NE (9)		NE (11)	NE (11)	NE (11)
N-Nitrosodi-n-propylamine				NE (9)	HQ = 1.73 (6)	NE (11)	NE (11)	NE (11)
N-Nitrosodiphenylamine				NE (9)	HQ = 1.46 (6)	No TRV (10)	No TRV (10)	No TRV (10)
N-Nitrosomethylethylamine				NE (9)	HQ = 48.08 (6)	NE (11)	NE (11)	NE (11)
N-Nitrosomorpholine	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
N-Nitrosopiperidine	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
N-Nitrosopyrrolidine	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
p-Dimethylamino azobenzene	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	No TRV (10)	No TRV (10)	No TRV (10)
Pentachlorobenzene				NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Pentachloronitrobenzene	No SSV (1)	No SSV (1)	HQ = 1.30 (6)	NE (9)				
Pentachlorophenol				NE (9)	No SDSV (1)			
Phenacetin	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
Phenol				NE (9)		NE (11)	NE (11)	NE (11)
p-Phenylene diamine	No SSV (1)	No SSV (1)		NE (9)	HQ = 250.54 (6)	NE (11)	NE (11)	NE (11)
Pronamide	No SSV (1)	No SSV (1)		NE (9)		No TRV (10)	No TRV (10)	No TRV (10)
Pyridine	No SSV (1)	No SSV (1)		NE (9)		NE (11)	NE (11)	NE (11)
Safrole, total	No SSV (1)	No SSV (1)	No SWSV (1)	NE (9)	No SDSV (1)	NE (11)	NE (11)	NE (11)
PAHs:								
2-Methylnaphthalene	NE (4)	NE (4)						
Acenaphthene	NE (4)	NE (4)						
Acenaphthylene	NE (4)	NE (4)			HQ = 1.66 (6)			
Anthracene	NE (4)	NE (4)						
Benzo(a)anthracene	NE (4)	NE (4)			HQ = 2.50 (5)			
Benzo(a)pyrene	NE (4)	NE (4)		HQ = 1.71 (6)	HQ = 2.00 (5)			
Benzo(b)fluoranthene	NE (4)	NE (4)						
Benzo(g,h,i)perylene	NE (4)	NE (4)						

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
PAHs:								
Benzo(k)fluoranthene	NE (4)	NE (4)			HQ = 2.63 (5)			
Chrysene	NE (4)	NE (4)			HQ = 2.47 (5)			
Dibenz(a,h)anthracene	NE (4)	NE (4)			HQ = 1.58 (5)			
Fluoranthene	NE (4)	NE (4)						
Fluorene	NE (4)	NE (4)						
Indeno(1,2,3-cd)pyrene	NE (4)	NE (4)						
Naphthalene	NE (4)	NE (4)						
Phenanthrene	NE (4)	NE (4)						
Pyrene	NE (4)	NE (4)			HQ = 2.92 (5)			
Low Molecular Weight PAHs			NE (7)	NE (7)	NE (7)	NE (7)	NE (7)	NE (7)
High Molecular Weight PAHs			NE (7)	NE (7)	NE (7)	NE (7)	NE (7)	NE (7)
Metals:								
Antimony								
Arsenic					HQ = 1.06 (5)			
Barium					HQ = 28.55 (5)			HQ = 1.83 (15)
Beryllium					No SDSV (2)	No TRV (12)	No TRV (12)	No TRV (12)
Cadmium				HQ = 9.60 (5)(8)	HQ = 3.94 (5)	HQ = 3.56 (13)		HQ = 4.07 (15)
Chromium					HQ = 1.18 (5)	HQ = 16.00 (13)	HQ = 4.44 (13)	HQ = 15.11 (15)
Cobalt	HQ = 3.85 (5)				HQ = 1.83 (5)			HQ = 1.18 (15)
Copper	HQ = 1.86 (5)	HQ = 1.07 (5)	HQ = 2.23 (5)(8)	HQ = 3.75 (5)(8)	HQ = 4.11 (5)	HQ = 2.05 (13)		HQ = 2.05 (15)
Lead	HQ = 1.75 (5)			HQ = 22.02 (5)(8)	HQ = 7.82 (5)	HQ = 4.88 (13)	HQ = 1.51 (13)	HQ = 6.42 (15)
Mercury					HQ = 2.11 (5)	HQ = 12.65 (13)	HQ = 14.96 (13)	HQ = 72.86 (15)
Nickel						HQ = 2.43 (13)		HQ = 3.32 (15)
Selenium	HQ = 6.73 (5)	HQ = 5.58 (5)			HQ = 2.10 (5)	HQ = 2.27 (13)	HQ = 1.96 (13)	HQ = 2.61 (15)
Silver					HQ = 4.60 (5)			HQ = 8.46 (15)
Thallium					No SDSV (1)			HQ = 1.38 (14)

TABLE 7-21
SUMMARY OF THE SCREENING LEVEL RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
	Surface Soil	Subsurface Soil	Groundwater	Drainage Ditch Surface Water	Drainage Ditch Sediment	Surface Soil	Subsurface Soil	Drainage Ditch Sediment
Metals:								
Tin					HQ =4.71 (5)			
Vanadium	HQ = 21.50 (5)	HQ = 12.00 (5)	HQ = 1.67 (5)(8)	HQ = 1.83 (5)(8)	HQ = 4.56 (5)	HQ = 61.67 (13)	HQ = 17.21 (13)	HQ = 37.30 (15)
Zinc				HQ = 1.03 (5)(8)	HQ = 1.16 (5)	HQ = 1.33 (13)		HQ = 1.63 (15)

Notes:

Shaded cells indicates that the chemical was detected and identified as an ecological chemical of potential concern (COPC); Blank cells indicate acceptable risk (i.e., maximum HQ $\leq$ 1.0).

NE = Not Evaluated
HQ = Hazard Quotient
SSV = Soil Screening Value
SWSV = Surface Water Screenng Value
SDSV = Sediment Screening Value
GWSV = Groundwater Screening Value
TRV = Toxicity Reference Value
PAH = Polynuclear Aromatic Hydrocarbon

(1) Although not detected, the chemical was identified as an ecological COPC based on the lack of a media-specific screening value.

(2) The chemical was detected and identified as a ecological chemical of potential concern based on the lack of a media-specific screening value.

(3) All analytical data were rejected during data validation activities.

(4) Low and high molecular weight ecological soil screening values were used to evaluate subgroups of PAHs due to the lack of ecological soil screening values or other screening values for individual PAHs.

(5) The chemical was detected and identified as an ecological chemical of potential concern because the maximum detected concentration exceeds the media-specific screening value.

(6) Although not detected, the chemical was identified as an ecological chemical of potential concern because the maximum non-detected result exceeds the media-specific screening value.

(7) Subgroups of PAHs were not evaluated (PAHs were evaluated on an individual basis).

(8) The hazard quotient value shown is based on total recoverable concentrations.

(9) Drainage ditch surface water was not analyzed for this chemical.

(10) Although not detected, the chemical was identified as an ecological chemical of potential concern based on the lack of a toxicity reference value.

(11) The chemical was not evaluated because it is not considered a bioaccumulative chemical (i.e., the Log K_{ow} is less than 3.0).

(12) The chemical was detected and identified as an ecological chemical of potential concern based on the lack of a toxicity reference value.

(13) The chemical was detected and identified as an ecological chemical of potential concern because estimated dietary doses for one or more of the avian receptors (calculated using the maximum detected concentration) exceed the NOAEL-based toxicity reference value. The HQ value shown is for the most sensitive receptor (i.e., American robin).

(14) Although not detected, the chemical was identified as an ecological chemical of potential concern because the estimated dietary dose for the American robin (calculated using the maximum non-detected result) exceeds the NOAEL-based toxicity reference value.

(15) The chemical was detected and identified as an ecological chemical of potential concern because the estimated dietary dose for the American robin (calculated using the maximum detected concentration) exceeds the NOAEL-based toxicity reference value.

TABLE 7-22
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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(5): $[0.67((BW*1000)^{0.627})]/1000$	0.01073	Allometric equation from Calder and Braun (1983) for all birds(5): $0.059(BW)^{0.67}$	1.00
Mourning dove	Terrestrial	0.115 (2)	Dunning 2008	0.01646	Allometric equation from Nagy (2001) for all birds(5): $[0.638((BW*1000)^{0.685})]/1000$	0.01385	Allometric equation from Calder and Braun (1983) for all birds(5): $0.059(BW)^{0.67}$	1.00
Red-tailed hawk	Terrestrial	1.0945 (3)	Dunning 2008	0.08788	Allometric equation from Nagy (2001) for carnivorous birds(5): $[0.849((BW*1000)^{0.663})]/1000$	0.06268	Allometric equation from Calder and Braun (1983) for all birds(5): $0.059(BW)^{0.67}$	1.00
Mammals:								
Norway rat (prey item for red-tailed hawk)	Terrestrial	0.350 (4)	Jackson 1992	0.03092	Allometric equation from Nagy (2001) for rodents(6): $[0.332((BW*1000)^{0.774})]/1000$	0.03849	Allometric equation from Calder and Braun (1983) for all mammals(6): $0.099(BW)^{0.90}$	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 7-22
EXPOSURE PARAMETERS FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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) The body weight shown represents the midpoint within the range of reported values (sex and location not specified).

(5) 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).

(6) Food ingestion rate 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.

Jackson, W.B. 1992. Norway Rat and Allies. Chapter 54 *In* Chapman, J.A. and G.A. Feldhamer (eds.), Wild Mammals of North America: Biology, Management, and Economics. The John Hopkins University Press, Baltimore MD. pp. 1077-1088.

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 7-23
DIETARY COMPOSITION FOR UPPER TROPHIC LEVEL RECEPTORS: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Receptor	Dietary Composition (percent)				Soil Ingestion (percent)	
	Terrestrial Plants	Soil Invertebrates	Small Mammals	Reference	Value	Reference
Birds:						
American robin	7.3	83.0	0	Wheelwright 1986	8.7 [1]	Sample and Suter II 1994
Mourning dove	95.0	0	0	Tomlinson et al. 1994	5.0	Assumed
Red-tailed hawk	0	0	100	USEPA 1993; Sample and Suter II 1994	0	Sample and Suter II 1994
Mammals:						
Norway rat (prey item for red-tailed hawk)	49.0	49.0	0	Assumed	2.0	Assumed

Notes:

USEPA = United States Environmental Protection Agency

[1] The percentage of soil in the diet of the American robin was estimated using the relationship presented in Sample and Sutter II (1994). An diet of 83 percent earthworms extrapolates to a soil contribution of 8.7 percent to the total diet.

Table References:

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 7-24
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical [1]	Soil-Plant BAF (dry weight)			Soil-Invertebrate BAF (dry weight)		
	BAF Value/Uptake Equation	Source Document	Description	BAF Value/Uptake Equation	Source Document	Description
Semi-Volatile Organics:						
Butyl benzyl phthalate	0.657	USEPA 2007	Regression-based BAF [2]	1.773	USEPA 2007	Modeled BAF [7]
Metals:						
Barium	0.156	USEPA 2007	Median BAF [5]	0.091	USEPA 2007	Median BAF [8]
Beryllium	$\ln(C_p) = 0.7345[\ln(C_s)] - 0.5361$	USEPA 2007	Uptake equation [3]	0.045	USEPA 2007	Median BAF [8]
Cadmium	$\ln(C_p) = 0.546[\ln(C_s)] - 0.475$	USEPA 2007	Uptake equation [4]	$\ln(C_e) = 0.795[\ln(C_s)] + 2.114$	USEPA 2007	Uptake equation [9]
Chromium, total	0.041	USEPA 2007	Median BAF [5]	0.306	USEPA 2007	Median BAF [10]
Copper	$\ln(C_p) = 0.394[\ln(C_s)] + 0.668$	USEPA 2007	Uptake equation [4]	$\ln(C_e) = 0.264[\ln(C_s)] + 1.675$	Sample et al. 1998	Median BAF [11]
Lead	$\ln(C_p) = 0.561[\ln(C_s)] - 1.328$	USEPA 2007	Uptake equation [4]	$\ln(C_e) = 0.807[\ln(C_s)] - 2.18$	USEPA 2007	Uptake equation [9]
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 [12]
Nickel	$\ln(C_p) = 0.748[\ln(C_s)] - 2.224$	USEPA 2007	Uptake equation [9]	1.059	Sample et al. 1998	Median BAF [16]
Selenium	$\ln(C_p) = 0.1.104[\ln(C_s)] - 0.678$	USEPA 2007	Uptake equation [4]	$\ln(C_e) = 0.733[\ln(C_s)] - 0.075$	USEPA 2007	Uptake equation [9]
Silver	0.014	USEPA 2007	Median BAF [5]	2.045	USEPA 2007	Median BAF [8]
Thallium	0.004	Baes et al. 1984	Geometric mean	1.00	---	Assumed BAF
Vanadium	0.00485	USEPA 2007	Median BAF [5]	0.042	USEPA 2007	Median BAF [8]
Zinc	$\ln(C_p) = 0.554[\ln(C_s)] + 1.575$	USEPA 2007	Uptake equation [4]	$\ln(C_e) = 0.328[\ln(C_s)] + 4.449$	USEPA 2007	Uptake equation [9]

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 the 95 percent UCL of the mean concentration exceeds the maximum concentration

(1) The chemicals listed are those detected in surface, subsurface soil, and/or sediment and identified as ecological COPCs in the Step 2 screening level risk calculation for the American robin and/or mourning dove.
(2) 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.
(3) 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).
(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]) developed by Bechtel Jacobs (1998) and cited in Table 4a of USEPA (2007).
(5) 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).
(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).

TABLE 7-24
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
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(7) 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 soilds [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 patition coefficient (K_{oc} value listed in Table 7-3)

(8) 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).

(9) 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).

(10) 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).

(11) 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).

(12) 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.

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. 1999. Literature-Derived Bioaccumulation Models for Earthworms: Development and Validation. Enviorn. Toxicol. Chem. 18:2110-2120.
Table References (continued):

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.

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 Derivatior of Wildlife Eco-SSLs. Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-55.

USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

TABLE 7-25
SOIL BIOACCUMULATION FACTORS AND BIOACCUMULATION UPTAKE EQUATIONS USED TO ESTIMATE CHEMICAL CONCENTRATIONS IN SMALL MAMMAL TISSUE: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Soil-Small Mammal BAF (dry weight)		
Chemical [1]	**BAF Value/Uptake Equation**	**Source Document**	**Description**
Semi-Volatile Organics:			
Butyl benzyl phthalate	$C_m = [(BAF_d)(DI)]/0.32$	---	See Section 7.5.2.2.1 [2]
Metals:			
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 in the Step 2 screening level risk calculation for the red-tailed hawk.
[2] 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.
[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). 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.

TABLE 7-26
FREQUENCY AND RANGE OF SURFACE SOIL DATA (95 PERCENT UCL OF THE MEAN CONCENTRATIONS) COMPARED TO SOIL SCREENING VALUES FOR PLANTS AND INVERTEBRATES
SWMU 56 - HANGAR 200 APRON
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)**	**95% UCL of the Mean [1]**	**Value used in Step 3a Screen [2]**	**Soil Screening Value (SSV)**	**Reference [3]**	**95% UCL of the Mean HQ [4]**	**Comments**
Metals (mg/kg)										
Cobalt	8/8	2.6 - 50J	ND	19.45	30.29	30.29	13	USEPA 2005f	2.33	HQ > 1.0
Copper	8/8	31J -130J	ND	73.38	94.04	94.04	70	USEPA 2007c	1.34	HQ > 1.0
Lead	14/14	0.88 - 210	ND	25.78	177.20	177.20	120	USEPA 2005g	1.48	HQ > 1.0
Selenium	20/20	0.33J - 3.5	ND	1.44	1.75	1.75	0.52	USEPA 2007e	3.37	HQ > 1.0
Vanadium	14/14	55 - 430	ND	221.07	267.30	267.30	10	USEPA 2005h	26.73	HQ > 1.0

Notes:

USEPA = United States Environmental Protection Agency
mg/kg = milligram per kilogram
J = Detected (estimated value)
SSV = Soil Screening Value
HQ = Hazard Quotient

(1) 95% UCL of the mean concentrations were calculated using USEPA ProUCL Version 4.00.04 software (USEPA, 2009).
(2) For a given chemical, the 95 percent UCL of the mean concentration was used to derive refined risk estimates.
(3) See Table 7-4 for reference citations.
(4) For a given chemical, the hazard quotient (HQ) is the 95 percent UCL of the mean concentration divided by the soil screening value.

Table References:

USEPA, 2009. ProUCLVersion 4.00.04. February, 2009. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-27
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
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 (9)	Slippage Test
Beryllium	SWMU 56	8/8	0.053J -0.34	ND	0.1924	0.03	0.258	---	Normal at α = 0.05 (p = 0.8343)	Lognormal at α = 0.05 (p = 0.4860)	Test was not performed (11)	Gehan test (13); G(1.466) < Z (1.645); Not elevated a α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	36/38	0.052B - 0.81	0.04U - 0.1U	0.2876	0.0290	0.338	0.65	Not normal at α = 0.05 (p = 0.0357)	Not lognormal at α = 0.05 (p = 0.0361)				
Cadmium	SWMU 56	7/8	0.055J -3.3J	0.038UJ -0.038UJ	0.5155	0.40	3.028	---	Test was not performed (10)	Test was not performed (10)	Test was not performed (12)	Test was not performed (14)	Test was not performed (17)	Test was not performed (18)
	Background Airfield Soil	13/41	0.099J - 0.92J	0.059U - 1.2U	0.2431	0.0318	NA	0.65	Test was not performed (10)	Test was not performed (10)				
Chromium	SWMU 56	8/8	6.3 -54J	NA	28.4125	5.59	39.01	---	Normal at α = 0.05 (p = 0.4661)	Lognormal at α = 0.05 (p = 0.3155)	Variances are equal at α = 0.05 (p = 0.8237)	Two sample t-test (15); Not elevated at α = 0.05 (p = 0.3421) Power = 0.1072	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	38/38	3.9 - 101J	NA	27.5474	3.3469	42.14	68.81	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.3437)				
Cobalt	SWMU 56	8/8	2.6 -50J	NA	19.45	5.72	30.29	---	Normal at α = 0.05 (p = 0.3192)	Lognormal at α = 0.05 (p = 0.5902)	Variances are equal at α = 0.05 (p = 1.0677)	Two sample t-test (15); Not elevated at α = 0.05 (p = 0.3836); Power = 0.0883	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	37/38	0.83B - 64	1.2U - 1.2U	17.4245	2.3524	27.68	46.43	Not normal at α = 0.05 (p = 0.0008)	Lognormal at α = 0.05 (p = 0.0502)				
Copper	SWMU 56	8/8	31J -130J	NA	73.375	10.91	94.04	---	Normal at α = 0.05 (p = 0.8983)	Lognormal at α = 0.05 (p = 0.9840)	Variances are equal at α = 0.05 (p = 0.1697)	Two sample t-test (15); Not elevated at α = 0.05 (p = 0.6457); Power = 0.0219	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	37/37	13N - 260J	NA	94.6081	10.5580	112.3	223.05	Not normal at α = 0.05 (p = 0.0025)	Lognormal at α = 0.05 (p = 0.6430)				
Lead	SWMU 56	14/14	0.88 -210	NA	25.7843	15.21	177.2	---	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p = 0.0048)	Test was not performed (11)	Wilcoxon Rank Sum test (16); Elevated at α = 0.05 (p = 0.0119)	Elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	38/38	0.27J - 21J	NA	5.7308	0.9029	9.666	16.86	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p = 0.0361)				
Mercury	SWMU 56	7/8	0.015J -0.066J	0.0047U -0.0047U	0.0312	0.01	0.0448	---	Normal at α = 0.05 (p = 0.9867)	Lognormal at α = 0.05 (p = 0.0814)	Test was not performed (11)	Gehan test (13); G(-0.366) < Z (1.645); Not elevated a α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	24/40	0.012B - 0.12J	0.0051UJ - 0.06U	0.0379	0.0046	0.0461	0.10	Not normal at α = 0.05 (p = 0.0022)	Not lognormal at α = 0.05 (p = 0.0027)				
Nickel	SWMU 56	8/8	1.1 -14J	NA	8.6375	1.56	11.6	---	Normal at α = 0.05 (p = 0.7446)	Not lognormal at α = 0.05 (p = 0.0276)	Test was not performed (11)	Wilcoxon Rank Sum test (16); Not elevated at α = 0.05 (p = 0.3915)	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	38/38	1.1J - 35.6	NA	9.1447	1.1213	14.03	22.97	Not normal at α = 0.05 (p = 0.0001)	Lognormal at α = 0.05 (p = 0.4218)				
Selenium	SWMU 56	20/20	0.33J -3.5	NA	1.4355	0.18	1.753	---	Test was not performed (10)	Test was not performed (10)	Test was not performed (12)	Test was not performed (14)	Test was not performed (17)	Not elevated at α = 0.05
	Background Airfield Soil	11/41	0.22J - 3.8J	0.13UJ - 2.1UJ	0.5887	0.0987	NA	1.85	Test was not performed (10)	Test was not performed (10)				
Vanadium	SWMU 56	14/14	55 -430	NA	221.0714	26.12	267.3	---	Normal at α = 0.05 (p = 0.3371)	Lognormal at α = 0.05 (p = 0.1267)	Variances are equal at α = 0.05 (p = 0.4536)	Two sample t-test (15); Not elevated at α = 0.05 (p = 0.0621); Power = 0.4594	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	37/37	25 - 410	NA	175.9757	15.7166	202.5	367.18	Not normal at α = 0.05 (p = 0.0110)	Lognormal at α = 0.05 (p = 0.0699)				
Zinc	SWMU 56	8/8	7.5J -77J	NA	44.4375	8.31	60.18	---	Normal at α = 0.05 (p = 0.6608)	Lognormal at α = 0.05 (p = 0.0976)	Variances are equal at α = 0.05 (p =0.9419)	Two sample t-test (15); Not elevated at α = 0.05 (p = 0.4756); Power = 0.0566	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background Airfield Soil	38/39	3.9 - 140J	27U - 27U	46.9308	5.2228	69.75	112.16	Not normal at α = 0.05 (p = 0.0045)	Lognormal at α = 0.05 (p = 0.1862)				

TABLE 7-27
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
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
ULM = Upper Limit of the Mean

(1) Background airfield soil data taken from Addendum B of 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 4.00.04 software (USEPA, 2009).
(5) Upper limit of the mean concentration is equal to the mean plus two standard deviations. Value taken from Addendum B of the Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. (Baker, 2010).
(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 56 and and background) has less than fifteen percent non-detected results (see Figure 7-9 and NFESC, 2002).
(7) Homogeneity of variance verified by F test. For a given metal, the test for homogeneity of variance was performed if both data sets (SWMU 56 and background) exhibit either a normal distribution or lognormal distribution. If the test for normality does not indicate a normal or lognormal distribution, or if the conditions identified in Note 6 above were not met (i.e., less than 15 percent non-detected results), the test for homogeneity of varience was not performed (see Figure 7-9 and 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).
or background data set were non-detect (see Figure 7-9).
(9) Navy guidance (NFESC, 2002) recommends a minimum of ten data points for each data set in order to perform the quantile test. Although the SWMU 56 data set for each metal has only eight data points, distributional statistics for each metal included the quantile test.
(10) Test for normality/lognormality were not performed because the number of non-detected results in the background data set exceeds fifteen percent (see Figure 7-9 and NFESC, 2002).
(11) Test for homogeneity of variance was not performed because the tests for normality/lognormality could not be performed (greater than 15 percent non-detected results in the background data set; see Item 10, Figure 7-9, and NFESC [2002]).
(12) Test for homogeneity of variance was not performed because both data sets (SWMU 56 and background) do not exhibit either a normal or lognormal distribution.
(13) The Gehan test was used because: (a) both data sets (SWMU 56 and background) do not exhibit either a normal or lognormal distribution; (b) the number of non-detected results in the combined data set (SWMU 56 and background) is less than fifty percent; and (c) there is more than one reporting limit for the non-detected values within the background data set (see Figure 7-9 and NFESC, 2002).
(14) Statistical evaluation of the mean/median of the distributions could not be performed because the there are greater than 50 percent non-detected results in the combined data set (see Figure 7-9 and NFESC, 2002).
(15) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (SWMU 56 and background); (b) each data set exhibits either a normal or lognormal distribution; and (c) the SWMU 56 and background data set distributions have have equal variances (see Figure 7-9 and NFESC, 2002).
(16) The Wilcoxon rank sum test (non-parametric test) was used because (a) both data sets (SWMU 56 and background) do not exhibit either a normal or lognoraml distribution; (b) the combined data set has less than 40 percent non-detected results; and (c) there is not more than one reporting limit for the non-detected values (see Figure 7-9 and NFESC, 2002).
(17) Quantile test was not performed because non-detected results withint he SWMU 56 and/or background data set are greater than the smallest of the "r" largest detected results in the combined data set.
(18) The slippage test was not performed because the largest detected results for the background data set is less than the largest non-detected result (see Figure 7-9 and 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. July 30, 2010.

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, 2009. ProUCLVersion 4.00.04. February, 2009. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-28
COMPARISON OF SWMU 56 AND BACKGROUND SUBSURFACE SOIL ANALYTICAL DATA FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Ecological COPC [1]	SWMU 56 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	2/3	0.046J - 0.17	0.071U - 0.071U	0.08	36/38	0.052B - 0.81	0.04U - 0.1U	0.65	No
Chromium	2/2	13 - 15	NA	14.00	38/38	3.9 - 101J	NA	68.81	No
Copper	3/3	40J - 75J	NA	53.33	37/37	13N - 260J	NA	223.05	No
Mercury	3/3	0.042 - 0.078J	NA	0.06	24/40	0.012B - 0.12J	0.0051UJ - 0.06U	0.10	No
Selenium	3/3	0.72 - 2.9	NA	1.97	11/41	0.22J - 3.8J	0.13UJ - 2.1UJ	1.85	Yes
Vanadium	2/2	110J - 120	NA	115.00	37/37	25 - 410	NA	367.18	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 Rico
July 30, 2010.

TABLE 7-29
COMPARISON OF SWMU 56 AND BACKGROUND GROUNDWATER ANALYTICAL DATA FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Ecological COPC [1]	SWMU 56 Ecological COPC Frequency/Range				Background Frequency/Range [2]				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	
Total Metals (ug/L)									
Copper	1/8	8.3 - 8.3	1.2U - 2.7U	1.81	11/13	8.5 - 352	0.5U - 0.5U	324.11	No
Vanadium	7/8	7.9 - 20	2.7U - 2.7U	11.67	11/13	1.7J - 549	0.8U - 8.5U	484.66	No
Dissolved Metals (ug/L)									
Copper	0/8	ND	1.2U - 2.5U	0.73	6/14	3.3 - 496J	0.5U - 7.5U	29.06	NA
Vanadium	6/8	1.7J -14	2.5U - 3.6U	7.04	6/14	8.1 - 265	0.8U - 8.5U	20.96	No

Notes:

COPC = Chemical of Potential Concern
ug/L = microgram per liter
J = Detected (estimated value)
U = Not Detected
NA = Not Applicable
ND = Not Detected

(1) The chemicals listed are those identified as ecological COPCs for aquatic receptor groups in Step 2 of the screening level ecological risk assessment.
(2) Background subsurface soil analytical data taken from Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2010).

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.

TABLE 7-30
FREQUENCY AND RANGE OF DRAINAGE DITCH SEDIMENT DATA (95 PERCENT UCL OF THE MEAN CONCENTRATIONS) COMPARED TO FRESHWATER SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Ecological COPC	Contaminant Frequency/Range: Frequency of Detection	Range of Positive Detections	Range of Non-Detects	Arithmetic Mean (Half Non-Detects)	95% UCL of the Mean (1)	Value used in Step 3a Screen (2)	Sediment Screening Values (SDSV)	Reference (3)	95% UCL of the Mean HQ (4)	Comments
Metals (mg/kg)										
Arsenic	13/14	0.96J - 10.4J	1.1UJ -1.1UJ	3.12	4.34	4.34	9.8	MacDonald et al. 2000	0.44	HQ < 1.0
Barium	14/14	42 - 571J	NA	125.66	279.9	279.9	20.0	MacDonald et al. 2003	14.00	HQ > 1.0
Chromium	14/14	19.8J - 51J	NA	32.57	36.62	36.62	43.4	MacDonald et al. 2000	0.84	HQ < 1.0
Cobalt	14/14	18J - 91.4J	NA	40.19	50.3	50.3	50.0	MacDonald et al. 2003	1.01	HQ > 1.0
Copper	14/14	75.1J - 130J	NA	100.27	108.1	108.1	31.6	MacDonald et al. 2000	3.42	HQ > 1.0
Lead	14/14	13J - 280J	NA	60.88	98.14	98.14	35.8	MacDonald et al. 2000	2.74	HQ > 1.0
Mercury	13/14	0.052J - 0.38J	0.039UJ -0.039UJ	0.11	0.21	0.21	0.18	MacDonald et al. 2000	1.14	HQ > 1.0
Selenium	9/14	0.99J - 4.2J	0.46UJ -1.4UJ	1.33	1.94	1.94	2.0	Lemley 2002	0.97	HQ < 1.0
Tin	8/14	4.6J -16J	7.8UJ -23UJ	9.05	11.6	11.6	3.4	Buchman 2008	3.41	HQ > 1.0
Vanadium	14/14	147J -260J	NA	196.21	212.2	212.2	57.0	Buchman 2008	3.72	HQ > 1.0
Zinc	14/14	69.2J -140J	NA	97.13	105.6	105.6	121.0	MacDonald et al. 2000	0.87	HQ < 1.0

Notes:

USEPA = United States Environmental Protection Agency
mg/kg = milligram per kilogram
J = Detected (estimated value)
SDSV = Soil Screening Value
HQ = Hazard Quotient
NA = Not Applicable
UJ = Not detected, estimated value
J = Estimated value

(1) 95% UCL of the mean concentrations were calculated using USEPA ProUCL Version 4.00.04 software (USEPA, 2009).
(2) For a given chemical, the 95 percent UCL of the mean concentration was used to derive refined risk estimates.
(3) See Table 7-7 for reference citations.
(4) For a given chemical, the hazard quotient (HQ) is the 95 percent UCL of the mean concentration divided by the sediment screening value.

TABLE 7-31
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN DRAINAGE DITCH SEDIMENT
SWMU 56 - HANGAR 200 APRON
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
Arsenic	SWMU 56	13/14	0.96J - 10.4J	1.1UJ - 1.1UJ	3.12	0.65	4.343	---	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan test [12]; G(3.155) > Z (1.645); Elevated a α = 0.05	Elevated at α = 0.05	Elevated at α = 0.05
	Drainage Ditch Background	15/20	0.55J - 3.8	0.41U - 1.9UJ	1.16	0.19	1.54	2.88	Test was not performed [9]	Test was not performed [9]				
Barium	SWMU 56	14/14	42 - 571J	NA	125.66	35.39	279.9	---	Not normal at α = 0.05 (p < 0.0001)	Not lognormal at α = 0.05 (p = 0.0419)	Test was not performed [11]	Wilcoxon rank sum test [13]; Not elevated at α = 0.05 (p = 0.7063)	Not elevated at α = 0.05	Not elevated at α = 0.05
	Drainage Ditch Background	20/20	37.1J - 227J	NA	109.24	11.69	131.9	213.80	Not normal at α = 0.05 (p = 0.0263)	Lognormal at α = 0.05 (p = 0.6975)				
Beryllium	SWMU 56	4/14	0.21J - 0.3J	0.25UJ - 1.2UJ	0.26	0.03	---	---	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [14]	Test was not performed [17]	Test was not performed [18]
	Drainage Ditch Background	3/20	0.23 - 0.28	0.1U - 0.58U	0.20	0.02	---	0.36	Test was not performed [9]	Test was not performed [9]				
Cadmium	SWMU 56	6/14	0.39J - 3.9J	0.04U - 0.13UJ	0.65	0.31	1.371	---	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [14]	Test was not performed [17]	Test was not performed [18]
	Drainage Ditch Background	2/20	0.13J - 0.32	0.04U - 0.46UJ	0.07	0.02	0.164	0.23	Test was not performed [9]	Test was not performed [9]				
Chromium	SWMU 56	14/14	19.8J - 51J	NA	32.57	2.29	36.62	---	Normal at α = 0.05 (p = 0.4010)	Lognormal at α = 0.05 (p = 0.9382)	Variances are equal at α = 0.05 (p = 0.1867)	Two sample t-test [15]; Not elevated at α = 0.05 (p = 0.7467) Power = 0.0107	Not elevated at α = 0.05	Not elevated at α = 0.05
	Drainage Ditch Background	20/20	17J - 68.8J	NA	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)				
Cobalt	SWMU 56	14/14	18J - 91.4J	NA	40.19	5.21	50.3	---	Not normal at α = 0.05 (p = 0.0402)	Lognormal at α = 0.05 (p = 0.9188)	Variances are equal at α = 0.05 (p = 0.8751)	Two sample t-test [15]; Elevated at α = 0.05 (p = 0.0002) Power = 0.9891	Elevated at α = 0.05	Not elevated at α = 0.05
	Drainage Ditch Background	20/20	8.3J - 65.8	NA	21.72	2.78	26.39	46.54	Not normal at α = 0.05 (p = 0.0002)	Lognormal at α = 0.05 (p = 0.3619)				
Copper	SWMU 56	14/14	75.1J - 130J	NA	100.27	4.43	108.1	---	Normal at α = 0.05 (p = 0.4788)	Lognormal at α = 0.05 (p = 0.6964)	Variances are not equal at α = 0.05 (p = 0.0022)	Satterthwaite t-test [16]; Elevated at α = 0.05 (p = 0.0418); Power = 0.5424	Elevated at α = 0.05	Not elevated at α = 0.05
	Drainage Ditch Background	20/20	42.1J - 183	NA	89.43	8.36	105	164.24	Not normal at α = 0.05 (p = 0.0137)	Lognormal at α = 0.05 (p = 0.3963)				
Lead	SWMU 56	14/14	13J - 280J	NA	60.88	19.59	98.14	---	Not normal at α = 0.05 (p < 0.0001)	Lognormal at α = 0.05 (p = 0.2377)	Variances are not equal at α = 0.05 (p = 0.0080)	Satterthwaite t-test [16]; Elevated at α = 0.05 (p < 0.0001); Power = 0.9999	Elevated at α = 0.05	Elevated at α = 0.05
	Drainage Ditch Background	20/20	3.8 - 29.9J	NA	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 56	13/14	0.052J - 0.38J	0.039UJ - 0.039UJ	0.11	0.02	0.206	---	Not normal at α = 0.05 (p = 0.0001)	Lognormal at α = 0.05 (p = 0.1218)	Variances are equal at α = 0.05 (p = 0.1387)	Two sample t-test [15]; Not elevated at α = 0.05 (p = 0.3314) Power = 0.1124	Test was not performed [17]	Not elevated at α = 0.05
	Drainage Ditch 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 56	14/14	8.7J - 19.1J	NA	13.05	1.01	14.98	---	Not normal at α = 0.05 (p = 0.0312)	Lognormal at α = 0.05 (p = 0.1204)	Variances are equal at α = 0.05 (p = 0.6082)	Two sample t-test [15]; Not elevated at α = 0.05 (p = 0.0981); Power = 0.3621	Not elevated at α = 0.05	Not elevated at α = 0.05
	Drainage Ditch Background	20/20	6.2J - 17.7J	NA	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 56	9/14	0.99J - 4.2J	0.46UJ - 1.4UJ	1.33	0.27	1.943	---	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Gehan test [12]; G(-0.368) < Z (1.645); Not elevated a α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	Drainage Ditch Background	17/20	0.72J - 4.3J	0.5U - 0.61UJ	1.53	0.24	1.954	3.72	Test was not performed [9]	Test was not performed [9]				

TABLE 7-31
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN DRAINAGE DITCH SEDIMENT
SWMU 56 - HANGAR 200 APRON
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
Silver	SWMU 56	6/14	0.18J - 4.6J	0.05U - 0.16UJ	0.48	0.32	1.136	---	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [14]	Test was not performed [17]	Test was not performed [19]
	Drainage Ditch Background	0/20	ND	0.043U - 0.64UJ	0.06	0.02	---	0.20	Test was not performed [9]	Test was not performed [9]				
Thallium	SWMU 56	0/14	ND	0.23UJ - 1.8UJ	0.49	0.08	---	---	Test was not performed [9]	Test was not performed [9]	Test was not performed [10]	Test was not performed [14]	Test was not performed [17]	Test was not performed [18]
	Drainage Ditch Background	5/20	0.19J - 1.6J	0.19U - 2.7UJ	0.54	0.09	---	1.32	Test was not performed [9]	Test was not performed [9]				
Vanadium	SWMU 56	14/14	147J - 260J	NA	196.21	9.04	212.2	---	Normal at $\alpha = 0.05$ ($p = 0.1648$)	Lognormal at $\alpha = 0.05$ ($p = 0.3935$)	Variances are equal at $\alpha = 0.05$ ($p = 0.2515$)	Two sample t-test [15]; Elevated at $\alpha = 0.05$ ($p = 0.0022$); Power = 0.9113	Elevated at $\alpha = 0.05$	Not elevated at $\alpha = 0.05$
	Drainage Ditch Background	20/20	77J - 230	NA	151.81	10.34	169.7	244.32	Normal at $\alpha = 0.05$ ($p = 0.2813$)	Lognormal at $\alpha = 0.05$ ($p = 0.0696$)				
Zinc	SWMU 56	14/14	69.2J - 140J	NA	97.13	4.81	105.6	---	Normal at $\alpha = 0.05$ ($p = 0.5276$)	Lognormal at $\alpha = 0.05$ ($p = 0.9671$)	Variances are not equal at $\alpha = 0.05$ ($p = 0.0098$)	Satterthwaite t-test [16]; Elevated at $\alpha = 0.05$ ($p = 0.0067$); Power = 0.8224	Not elevated at $\alpha = 0.05$	Not elevated at $\alpha = 0.05$
	Drainage Ditch Background	20/20	41.2J - 203J	NA	79.90	8.04	93.5	151.82	Not normal at $\alpha = 0.05$ ($p = 0.0006$)	Lognormal at $\alpha = 0.05$ ($p = 0.3527$)				

Notes:

J = Detected (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
ULM = Upper Limit of the Mean

(1) Background freshwater drainage ditch sediment data taken from Addendum C of 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 4.00.04 software (USEPA, 2009).
(5) Upper limit of the mean concentration is equal to the mean plus two standard deviations. Value taken from Addendum C of Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico (Baker, 2010).
(6) Normality and lognormality verified by the Shapiro-Wilk test. For a given metal, the test for normality and lognormality was performed if each data set (SWMU 56 and and background) has less than fifteen percent non-detected results (see Figure 7-9).
(7) Homogeneity of variance verified by F test. For a given metal, the test for homogeneity of variance was performed if both data sets (SWMU 56 and background) exhibit either a normal distribution or lognormal distribution. If the test for normality does not indicate a normal or lognormal distribution, or if the conditions identified in Note 5 above were not met (i.e., less than 15 percent non-detected results), the test for homogeneity of variance was not performed (see Figure 7-9).
(8) Quantile and slippage tests only determine if a particular inorganic chemical is likely present at equivalent or elevated concentrations relative to background (NFESC, 2003).
(9) Test for normality was not performed because the number of non-detected results in the background and/or SWMU 56 data set exceeds fifteen percent (see Figure 7-9).
(10) Test for homogeneity of variance was not performed because the test for normality could not be performed (greater than 15 percent non-detected results in the background and/or SWMU 56 data set; see Item 9 above and Figure 7-9).
(11) Test for homogeneity of variance was not performed because both data sets (SWMU 56 and background) do not exhibit either a normal or lognormal distribution.
(12) The Gehan test was used because: (a) there is more than one reporting limit for the non-detected values within the background and/or SWMU 56 data set; and (2) the number of non-detected results in the combined data set (SWMU 56 and background) is less than fifty percent (see Figure 7-9).
(13) The Wilcoxon rank sum test (non-parametric test) was used because (a) both data sets (SWMU 56 and background) do not exhibit either a normal or lognormal distribution; and (b) the combined data set has less than 40 percent non-detected results (see Figure 7-9).
(14) Statistical evaluation of the mean/median of the distributions could not be performed because there are greater than 50 percent non-detected results in the combined data sets (see Figure 7-9).
(15) Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (SWMU 56 and background); (b) each data set exhibits either a normal or lognormal distribution; and (c) the SWMU 56 and background data set distributions have equal variances (see Figure 7-9).

TABLE 7-31
SUMMARY OF DESCRIPTIVE AND DISTRIBUTIONAL STATISTICS FOR INORGANIC ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN DRAINAGE DITCH SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(16) The Satterthwaite t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data set (SWMU 56 and background); (b) each data set has a normal or lognormal distribution; and (c) the SWMU 56 and background data set distributions don't have equal variances (see Figure 7-9).
(17) Quantile test was not performed because non-detected results within the SWMU 56 and/or background data set are greater than the smallest of the "r" largest detected results in the combined data set (SWMU 56 and background) (see Figure 7-9)
(18) Slippage test was not performed because the largest detected result for the background data set is less than the largest non-detected result (see Figure 7-9).
(19) Slippage test was not performed because this metal was not detected within the background data set (se Figure 7-9).

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.

Naval Facilities Engineering Service Center (NFESC). 2003. Guidance for Environmental Background Analysis. Volume II: Sediment. NFESC User’s Guide UG-2054-ENV. April 2003.

USEPA, 2009. ProUCLVersion 4.00.04. February 2009. http://www.epa.gov/esd/tsc/software.htm.

TABLE 7-32
ACID VOLATILE SULFIDE AND SIMULTANEOUSLY EXTRACTED METALS ANALYTICAL DATA FOR DRAINAGE DITCH SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITIY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56 SD15	56 SD16	56 SD17	56 SD18	56 SD19	56 SD20	56 SD21	56 SD22	56 SD22
Sample ID	56 SD15	56 SD16	56 SD17	56 SD18	56 SD19	56 SD20	56 SD21	56 SD22	56 SD22D
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (in bgs)	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4
AVS (µmole/g):	2.3 J	0.38 UJ	0.29 UJ	0.47 UJ	0.17 UJ	3.7 J	4.6 J	1.29 J	2 J
SEM (µmole/g)									
Cadmium	0.0059 J	0.0086 J	0.0054 J	0.0079 J	0.00554 J	0.0044 J	0.0055 J	0.0052 J	0.0063 J
Copper	0.616 J	0.835 J	0.494 J	0.512 J	0.429 J	0.449 J	0.735 J	0.500 J	0.595 J
Lead	0.115 J	0.184 J	0.137 J	0.077 J	0.31 J	0.057 J	0.097 J	0.065 J	0.066 J
Nickel	0.049 J	0.071 J	0.05 J	0.058 J	0.062 J	0.057 J	0.080 J	0.067 J	0.077 J
Silver	0.0196 J	0.0043 J	0.0065 J	0.0048 UJ	0.0017 UJ	0.0120 J	0.0031 J	0.0165 J	0.0111 J
Zinc	0.79 J	1.08 J	0.587 J	0.93 J	0.68 J	0.57 J	0.85 J	0.63 J	0.68 J
Total SEM (µmole/g) [1][2]	1.5857	2.1808	1.2767	1.5873	1.4874	1.1434	1.7691	1.2755	1.4299
SEM-to-AVS [3]	0.6894	5.7388	4.4022	3.3772	8.7494	0.3090	0.3846	0.9887	0.7149

Notes:

AVS = Acid Volatile Sulfide
SEM = Simultaneously Extracted Metals
µmole/g = micromole per gram
in bgs = feet below ground surface
UJ = Not Detected (estimated value)
J = Detected (estimated value)

(1) The total SEM concentration was derived using the following formula: $[SEM]_{total} = [SEM]_{Cd} + [SEM]_{Cu} + [SEM]_{Pb} + [SEM]_{Ni} + [SEM]_{Zn} + (0.5)[SEM]_{Ag}$ (one-half the molar concentration of silver was added into the SEM totals due to silver being largely in a monovalent state)

(2) If a given sediment sample had non-detected results for individual SEM metals, the non-detected results were used in the derivation of the total SEM molar concentration.

(3) If a given sediment sample had a non-detected result for AVS, the non-detected result was used in the derivation of the SEM-to-AVS ratio.

TABLE 7-33
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN SURFACE SOIL: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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
Semi-Volatile Organics:									
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals:									
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1.52	0.35	0.73	0.12	0.03	0.06	--- (1)	--- (1)	--- (1)
Chromium, total	0.66	0.11	0.27	0.19	0.03	0.08	--- (1)	--- (1)	--- (1)
Copper	0.77	0.26	0.45	0.56	0.19	0.32	--- (1)	--- (1)	--- (1)
Lead	1.77	0.88	1.25	1.18	0.59	0.84	--- (1)	--- (1)	--- (1)
Mercury	0.36	0.12	0.21	0.37	0.12	0.21	--- (1)	--- (1)	--- (1)
Nickel	0.22	0.08	0.13	0.03	<0.01	0.02	--- (1)	--- (1)	--- (1)
Selenium	0.63	0.31	0.44	0.49	0.24	0.34	--- (1)	--- (1)	0.16
Vanadium	12.51	6.25	8.84	6.08	3.04	4.30	0.65	0.33	0.46
Zinc	0.56	0.22	0.35	0.10	0.04	0.06	--- (1)	--- (1)	--- (1)

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) No unacceptable risk identified in Step 2 of the SERA. Therefore, a refined risk estimate was not calculated in Step 3a of the BERA.

TABLE 7-34
HAZARD QUOTIENT VALUES FOR AVIAIN DIETARY EXPOSURES TO CHEMICALS IN SUBSURFACE SOIL: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
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	0.26	0.04	0.11	0.07	0.01	0.03	--- (1)	--- (1)	--- (1)
Copper	0.69	0.23	0.40	0.49	0.16	0.28	--- (1)	--- (1)	--- (1)
Mercury	0.62	0.21	0.36	0.50	0.17	0.29	--- (1)	--- (1)	--- (1)
Selenium	0.93	0.47	0.66	0.84	0.42	0.60	--- (1)	--- (1)	--- (1)
Vanadium	5.62	2.81	3.97	2.73	1.37	1.93	--- (1)	--- (1)	--- (1)

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) No unacceptable risk identified in Step 2 of the SERA. Therefore, a refined risk estimate was not calculated in Step 3a of the BERA.

TABLE 7-35
HAZARD QUOTIENT VALUES FOR AVIAN DIETARY EXPOSURES TO CHEMICALS IN DRAINAGE DITCH SEDIMENT: STEP 3A RISK CALCULATION
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	American robin		
	NOAEL	**LOAEL**	**MATC**
Semi-Volatile Organics:			
Butyl benzyl phthalate	NA	NA	NA
Di-n-butyl phthalate	0.62	0.12	0.28
Metals:			
Barium	0.31	0.15	0.22
Beryllium	NA	NA	NA
Cadmium	0.81	0.19	0.39
Chromium, total	0.62	0.11	0.26
Cobalt	0.16	0.07	0.11
Copper	0.83	0.28	0.48
Lead	1.02	0.51	0.72
Mercury	1.61	0.54	0.93
Nickel	0.29	0.10	0.17
Selenium	0.68	0.34	0.48
Silver	0.13	0.01	0.04
Thallium	0.62	0.12	0.28
Vanadium	9.93	4.97	7.02
Zinc	0.68	0.26	0.42

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
SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN AND ECOLOGICAL CHEMICALS OF CONCERN
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Lower Trophic Level Receptor Groups					Upper Trophic Level Avian Receptors		
Chemcials	**Surface Soil**	**Subsurface Soil**	**Groundwater**	**Drainage Ditch Surface Water**	**Drainage Ditch Sediment**	**Surface Soil**	**Subsurface Soil**	**Drainage Ditch Sediment**
Ecological Chemicals of Concern Recommended for Corrective Action Measures (1)	Lead	None	None	None	Barium Cadmium Chromium Lead Zinc	Cadmium Lead	None	Lead
Ecological Chemicals of Potential Concern Recommended for Further Evaluation in Step 3a of the Baseline Ecological Risk Assessment	Acetone Carbon disulfide Chloromethane Iodomethane Cobalt Copper Lead Selenium Vanadium 23 non-detected VOCs (2) 54 non-detected SVOCs(2)	Acetone Iodomethane Copper Selenium Vanadium 26 non-detected VOCs (3) 53 non-detected SVOCs (3)	Copper Vanadium 6 non-detected VOCs (4) 18 non-detected SVOCs (4)	Cadmium Copper Lead Vanadium 1 non-detected VOC (5)	Acetone Carbon disulfide Iodomethane Benzo(a)anthracene Benzo(a)pyrene Benzo(k)fluoranthene Bis(2-ethylhexyl)phthalate Chrysene Dibenzo(a,h)anthracene Pyrene Arsenic Barium Beryllium Cadmium Chromium Cobalt Copper Lead Mercury Selenium Silver Tin Vanadium Zinc 5 non-detected VOCs (6) 45 non-detected SVOCs (6) 1 non-detected metal (6)	Butyl benzyl phthalate Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Vanadium Zinc 9 non-detected VOCs (7) 28 non-detected SVOCs (7)	Beryllium Chromium Copper Mercury Selenium Vanadium 9 non-detected VOCs (8) 28 non-detected SVOCs (8)	Beryllium Barium Cadmium Chromium Cobalt Copper Lead Mercury Nickel Selenium Silver Vanadium Zinc 9 non-detected VOCs (9) 29 non-detected SVOCs (9) 1 non-detected metal

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 7.9.1.6. 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.
(2) 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 surface soil.
(3) 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 subsurface soil.

TABLE 7-36
SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN AND ECOLOGICAL CHEMICALS OF CONCERN
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes (continued):

(4) 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 groundwater.

(5) 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 drainage ditch surface water.

(6) See Table 7-17 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for drainage ditch sediment.

(7) See Table 7-18 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for avian dietary exposures to chemicals in surface soil.

(8) See Table 7-19 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for avian dietary exposures to chemicals in subsurface soil.

(9) See Table 7-20 for specific non-detected chemicals identified as ecological chemicals of potential concern in Step 2 of the screening level ecological risk assessment for avian dietary exposures to chemicals in drainage ditch sediment.

TABLE 7-37
ECOLOGICAL-BASED CORRECTIVE ACTION OBJECTIVES FOR SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Surface Soil Corrective Action Objective (mg/kg)			Final Corrective Action Objective (mg/kg)
Chemcial	Terrestrial Invertebrates and Plants	American Robin (Avian Omnivore)	Background [1]	
Cadmium	NA	1.8 [3]	0.65	1.8
Lead	120 [2]	96 [3]	16.9	96

Notes:

NA = Not applicable (chemical does not present an unacceptable risk to receptor group/species).

(1) Background airfield soil upper limit of the mean concentration presented in Addendum B of Baker (2010).

(2) The value shown is an ecological soil screening level for terrestrial plants. (USEPA, 2005a).

(3) 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).

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. 2005a. Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

TABLE 7-38
ECOLOGICAL-BASED CORRECTIVE ACTION OBJECTIVES FOR DRAINAGE DITCH SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemcial	Sediment Corrective Action Objective (mg/kg)			Final Corrective Action Objective (mg/kg)	Applicable Drainage Ditch Segment [2]
	Aquatic Invertebrates and Plants	American Robin (Avian Omnivore)	Background [1]		
Barium	20 [3]	NA	213.80	214	A-B
Cadmium	0.99 [4]	NA	0.23	0.99	A-B and C-D
Chromium	43.4 [4]	NA	65.02	65.0	A-B
Lead	35.8 [4]	96 [5]	20.03	35.8	A-B, C-D, and E-F
Zinc	121 [4]	NA	151.82	152	A-B

Notes:

NA = Not applicable (chemical does not present an unacceptable risk to receptor group/species).

(1) Background airfield drainage ditch sediment upper limit of the mean concentration presented in Addendum C of Baker (2010).
(2) Location within the drainage ditch system where corrective action objective are applicable based on the evaluation presented in Section 7.9.1.5.
(3) The value shown is a Threshold Effect Concentration (MacDonald et al., 2003).
(4) The value shown is a consensus-based Threshold Effect Concentration (MacDonald et al., 2000).
(5) 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).

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.

MacDonald, D.D, C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, G. Sloane, and T. Biernacki. 2003. Development andEvaluation 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.

Revised: September 29, 2011

TABLE 8-1

SURFACE SOIL DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Criteria [1]	Chemical Frequency / Range / Location			Background [2]	COPC Selection		Exposure Concentration Selection		
Chemical	RegionaI 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)										
Acetone	6,100,000	7/8	23 J - 280	56SB08	ND	NO	BSL	NA	NA	NA
Benzene	1,100	2/8	0.95 J - 0.99 J	56SB08	ND	NO	BSL	NA	NA	NA
Carbon disulfide	82,000	1/8	1.9 J	56SB07	ND	NO	BSL	NA	NA	NA
Chloromethane	12,000	1/8	2.2 J	56SB03	ND	NO	BSL	NA	NA	NA
Iodomethane	NE	4/8	1 J - 2.4 J	56SB07	ND	YES	NSC	1.85 (NP)	1.85	95% KM (t) UCL
Semivolatile Organic Compounds (ug/kg)										
2-Methylnaphthalene	31,000	1/8	19	56SB08	ND	NO	BSL	NA	NA	NA
Benzo[a]anthracene *	150	3/8	2.4 J - 9.2 J	56SB03	ND	YES	CHEM	NC	9.2	Max (Less than 4 detections)
Benzo[a]pyrene	15.0	3/8	2.8 J - 20 J	56SB03	ND	YES	ASL	NC	20	Max (Less than 4 detections)
Benzo[b]fluoranthene *	150	3/8	3.1 J - 44 J	56SB03	ND	YES	CHEM	NC	44	Max (Less than 4 detections)
Benzo[g,h,i]perylene	170,000 [5]	2/8	3.1 J - 17 J	56SB03	ND	NO	BSL	NA	NA	NA
Benzo[k]fluoranthene *	1,500	1/8	1.5 J	56SB07	ND	YES	CHEM	NC	8.6	See Total Soil Exposure
Butyl benzyl phthalate	260,000	1/8	10 J	56SB03	ND	NO	BSL	NA	NA	NA
Chrysene *	15,000	3/8	2.2 J - 36 J	56SB03	ND	YES	CHEM	NC	36	Max (Less than 4 detections)
Dibenz(a,h)anthracene *	15.0	1/8	2.9 J	56SB03	ND	YES	CHEM	NC	2.9	Max (Less than 4 detections)
Fluoranthene	230,000	2/8	5 J - 9.2 J	56SB03	ND	NO	BSL	NA	NA	NA
Indeno[1,2,3-cd]pyrene *	150	2/8	1.9 J - 7.5 J	56SB03	ND	YES	CHEM	NC	7.5	Max (Less than 4 detections)
Naphthalene	3,600	2/8	1.9 J - 4.3 J	56SB08	ND	NO	BSL	NA	NA	NA
Phenanthrene	170,000 [5]	2/8	2.3 J - 2.5 J	56SB08	ND	NO	BSL	NA	NA	NA
Pyrene	170,000	3/8	5.1 J - 16 J	56SB03	ND	NO	BSL	NA	NA	NA
Metals (mg/kg)										
Antimony	3.10	1/8	2	56SB01	2.43	NO	BSL	NA	NA	NA
Arsenic	0.390	8/8	0.59 J - 3.4	56SB05	2.37	YES	ASL	2.88 (N)	2.88	95% Student's-t UCL
Barium	1,500	8/8	15 J - 190 J	56SB07	233	NO	BSL	NA	NA	NA
Beryllium	16.0	8/8	0.053 J - 0.34	56SB07	0.717	NO	BSL	NA	NA	NA
Cadmium	7.0	7/8	0.055 J - 3.3 J	56SB01	0.655	NO	BSL	NA	NA	NA
Chromium	12,000 [6]	8/8	6.3 - 54 J	56SB07	87.6	NO	BSL	NA	NA	NA
Cobalt	2.30	8/8	2.6 - 50 J	56SB07	51.9	YES	ASL	30.3 (N)	30.3	95% Student's-t UCL
Copper	310	8/8	31 J - 130 J	56SB07	225	NO	BSL	NA	NA	NA
Lead	400 [7]	14/14	0.88 - 210	56SB01	28.2	NO	BSL	NA	NA	NA
Mercury	0.560	7/8	0.015 J - 0.066 J	56SB07	0.112	NO	BSL	NA	NA	NA
Nickel	150	8/8	1.1 - 14 J	56SB07	27.0	NO	BSL	NA	NA	NA

TABLE 8-1 (Continued)

SURFACE SOIL DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
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		
	RegionaI 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) (Cont)										
Selenium	39.0	20/20	0.33 J - 3.5	56SS04	1.85	NO	BSL	NA	NA	NA
Silver	39.0	2/8	0.032 J - 0.24 J	56SB01	ND	NO	BSL	NA	NA	NA
Thallium	NE	3/8	0.15 J - 0.25 J	56SB07	0.775	YES	NSC	NC	0.65	See Total Soil Exposure
Vanadium	0.550	14/14	55 - 430	56SS09	367	YES	ASL	267 (N)	267	95% Student's-t UCL
Zinc	2,300	8/8	7.5 J - 77 J	56SB01	113	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated
ND - Not Detected
NE - Not Established

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, 2008): 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) 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.
(5) Value for pyrene used as a surrogate.
(6) Value for chromium III used as a surrogate.
(7) USEPA Residential Soil Action Level

TABLE 8-2

TOTAL SOIL DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
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		
		RegionaI 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)											
Acetone		6,100,000	21/24	8.3 J - 280	56SB08	ND	NO	BSL	NA	NA	NA
Benzene		1,100	2/24	0.95 J - 0.99 J	56SB08	ND	NO	BSL	NA	NA	NA
Carbon disulfide		82,000	2/24	1.9 J - 1.9 J	56SB07, 56SB07	ND	NO	BSL	NA	NA	NA
Chloromethane		12,000	1/24	2.2 J	56SB03	ND	NO	BSL	NA	NA	NA
Iodomethane		NE	7/24	1 J - 2.6 J	56SB08	ND	YES	NSC	1.42 (NP)	1.85	See Surface Soil Exposure
Semivolatile Organic Compounds (ug/kg)											
2-Methylnaphthalene		31,000	2/24	6.2 J - 19	56SB08	ND	NO	BSL	NA	NA	NA
Benzo[a]anthracene	*	150	4/24	2.4 J - 9.2 J	56SB03	ND	YES	CHEM	3.33 (NP)	9.2	See Surface Soil Exposure
Benzo[a]pyrene		15.0	5/24	1.2 J - 20 J	56SB03	ND	YES	ASL	3.73 (NP)	20	See Surface Soil Exposure
Benzo[b]fluoranthene	*	150	4/24	1 J - 44 J	56SB03	ND	YES	CHEM	6.66 (NP)	44	See Surface Soil Exposure
Benzo[g,h,i]perylene		170,000 (5)	2/24	3.1 J - 17 J	56SB03	ND	NO	BSL	NA	NA	NA
Benzo[k]fluoranthene	*	1,500	2/24	1.5 J - 8.6 J	56SB04	ND	YES	CHEM	NC	8.6	Max (Less than 4 detections)
Butyl benzyl phthalate		260,000	1/24	10 J	56SB03	ND	NO	BSL	NA	NA	NA
Chrysene	*	15,000	5/24	1 J - 36 J	56SB03	ND	YES	CHEM	5.62 (NP)	36	See Surface Soil Exposure
Dibenz(a,h)anthracene	*	15.0	1/24	2.9 J	56SB03	ND	YES	CHEM	NC	2.9	See Surface Soil Exposure
Di-n-butyl phthalate		610,000	1/24	41 J	56SB05	ND	NO	BSL	NA	NA	NA
Fluoranthene		230,000	3/24	5 J - 9.2 J	56SB03	ND	NO	BSL	NA	NA	NA
Indeno[1,2,3-cd]pyrene	*	150	2/24	1.9 J - 7.5 J	56SB03	ND	YES	CHEM	NC	7.5	See Surface Soil Exposure
Naphthalene		3,600	2/24	1.9 J - 4.3 J	56SB08	ND	NO	BSL	NA	NA	NA
Phenanthrene		170,000 (5)	2/24	2.3 J - 2.5 J	56SB08	ND	NO	BSL	NA	NA	NA
Pyrene		170,000	4/24	5.1 J - 16 J	56SB03	ND	NO	BSL	NA	NA	NA
Metals (mg/kg)											
Antimony		3.10	1/24	2	56SB01	2.43	NO	BSL	NA	NA	NA
Arsenic		0.390	22/23	0.48 J - 3.4	56SB05, 56SB03	2.37	YES	ASL	2.12 (NP)	2.88	See Surface Soil Exposure
Barium		1,500	24/24	7.9 J - 470 J	56SB05	233	NO	BSL	NA	NA	NA
Beryllium		16.0	22/24	0.046 J - 0.43	56SB05	0.717	NO	BSL	NA	NA	NA
Cadmium		7.0	11/24	0.055 J - 3.3 J	56SB01	0.655	NO	BSL	NA	NA	NA
Chromium		12,000 (6)	23/23	3.6 - 120 J	56SB05	87.6	NO	BSL	NA	NA	NA
Cobalt		2.30	24/24	0.5 J - 55 J	56SB08	51.9	YES	ASL	28.6 (NP)	30.3	See Surface Soil Exposure
Copper		310	24/24	18 J - 140 J	56SB06	225	NO	BSL	NA	NA	NA
Lead		400 (7)	29/29	0.39 J - 210	56SB01	28.2	NO	BSL	NA	NA	NA
Mercury		0.560	18/24	0.0056 J - 0.74 J	56SB03	0.112	YES	ASL	0.202 (NP)	0.202	95% KM (Chebyshev) UCL
Nickel		150	24/24	1.1 - 17 J	56SB07	27.0	NO	BSL	NA	NA	NA

TABLE 8-2 (Continued)

TOTAL SOIL DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
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) (Cont)										
Selenium	39.0	36/36	0.33 J - 3.5	56SS04	1.85	NO	BSL	NA	NA	NA
Silver	39.0	10/24	0.028 J - 0.24 J	56SB01	ND	NO	BSL	NA	NA	NA
Thallium	NE	6/24	0.15 J - 0.65	56SB05	0.775	YES	NSC	265 (NP)	0.65	Max (UCL>Max)
Vanadium	0.550	29/29	29 J - 470 J	56SB03	367	YES	ASL	265 (NP)	267	See Surface Soil Exposure
Zinc	2,300	24/24	7.5 J - 77 J	56SB01	113	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NC - Not Calculated
ND - Not Detected
NE - Not Established

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, 2008): 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) 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.
(5) Value for pyrene used as a surrogate.
(6) Value for chromium III used as a surrogate.
(7) USEPA Residential Soil Action Level

TABLE 8-3

GROUNDWATER DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Criteria (1)	Contaminant Frequency / Range / Location			Background (2)	COPC Selection		Exposure Concentration Selection		
Contaminant	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)										
Acetone	2,200	2/7	5.2 J - 7.1 J	56GW05	NA	NO	BSL	NA	NA	NA
Chloromethane	19.0	1/7	1.8 J	56GW03	NA	NO	BSL	NA	NA	NA
Semivolatile Organic Compounds (ug/L)										
1,4-Dichlorobenzene	0.430	1/8	0.16 J	56GW02	NA	NO	BSL	NA	NA	NA
3 & 4 Methylphenol	93.0	1/8	0.63 J	56GW08	NA	NO	BSL	NA	NA	NA
Anthracene	1,100	1/8	0.033 J	56GW07	NA	NO	BSL	NA	NA	NA
Bis(2-ethylhexyl) phthalate	4.80	1/8	0.98	56GW02	NA	NO	BSL	NA	NA	NA
Diethyl phthalate	2,900	1/8	0.32 J	56GW02	NA	NO	BSL	NA	NA	NA
Fluoranthene	150	1/8	0.056 J	56GW07	NA	NO	BSL	NA	NA	NA
Fluorene	150	1/8	0.055 J	56GW07	NA	NO	BSL	NA	NA	NA
Phenanthrene	110 (4)	2/8	0.05 J - 0.39	56GW07	NA	NO	BSL	NA	NA	NA
Dissolved Metals (ug/L)										
Antimony	1.50	1/8	0.38 J	56GW03	ND	NO	BSL	NA	NA	NA
Arsenic	0.0450	1/8	0.5 J	56GW03	ND	YES	ASL	NA	NA	NA
Barium	730	8/8	7.1 - 140	56GW08	ND	NO	BSL	NA	NA	NA
Cobalt	1.10	5/6	1.4 J - 31	56GW08	ND	YES	ASL	NA	NA	NA
Mercury	0.0570	1/8	0.098 J	56GW04	ND	YES	ASL	NA	NA	NA
Nickel	73.0	7/8	0.4 J - 2.6	56GW08	ND	NO	BSL	NA	NA	NA
Selenium	18.0	2/8	0.65 J - 0.7 J	56GW05	ND	NO	BSL	NA	NA	NA
Vanadium	0.260	6/8	1.7 J - 14 J	56GW02, 56GW03	ND	YES	ASL	NA	NA	NA
Zinc	1,100	2/8	7.4 J - 8 J	56GW08	ND	NO	BSL	NA	NA	NA
Total Metals (ug/L)										
Arsenic	0.0450	2/8	0.42 J - 0.52 J	56GW03	ND	YES	ASL	NA	0.52	Max (Less than 4 detections)
Barium	730	8/8	7.1 - 170	56GW08	ND	NO	BSL	NA	NA	NA
Chromium	5,500 (5)	1/8	2.3 J	56GW08	ND	NO	BSL	NA	NA	NA
Cobalt	1.10	5/6	1.2 J - 38	56GW08	ND	YES	ASL	NA	38	Max (Less than 8 samples)
Copper	150	1/8	8.3	56GW08	ND	NO	BSL	NA	NA	NA
Nickel	73.0	5/8	0.35 J - 3.9	56GW08	ND	NO	BSL	NA	NA	NA
Selenium	18.0	1/8	0.79 J	56GW04	ND	NO	BSL	NA	NA	NA
Vanadium	0.260	7/8	7.9 - 20	56GW04	ND	YES	ASL	15.7 (NP)	15.7	95% KM (t) UCL
Zinc	1,100	2/8	8.7 J - 18 J	56GW08	ND	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
UCL - Upper Confidence Limit
PRG - Preliminary Remediation Goal
COPC - Chemical of Potential Concern
ug/L - microgram per liter
J - Analyte present - Reported value is estimated

Rationale Codes:

(ASL) Above Screening Level
(BSL) Below Screening Level

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, 2008): Upper Limit of Mean (Mean+2 Std Dev)
(3) ProUCL was used to calculate the 95% UCL and distribution:
(NP) - Nonparametric distribution
(4) Value for pyrene used as a surrogate.
(5) Value for chromium III used as a surrogate.

TABLE 8-4

SURFACE WATER DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Contaminant	Criteria [1]	Contaminant Frequency / Range / Location			Background	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 [2] (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Dissolved Metals (ug/L)										
Barium	730	5/5	12 - 84	56SW05	NA	NO	BSL	NA	NA	NA
Cobalt	1.10	1/1	3.7	56SW01	NA	YES	ASL	NA	NA	NA
Copper	150	3/5	1.9 J - 2.6 J	56SW03	NA	NO	BSL	NA	NA	NA
Lead	15.0 [3]	2/5	0.17 J - 0.47 J	56SW04	NA	NO	BSL	NA	NA	NA
Nickel	73.0	5/5	0.82 J - 2.1	56SW01	NA	NO	BSL	NA	NA	NA
Zinc	1,100	2/5	6.7 J - 8.8 J	56SW01	NA	NO	BSL	NA	NA	NA
Total Metals (ug/L)										
Arsenic	0.0450	1/5	3.2	56SW01	NA	YES	ASL	NA	3.2	Max (Less than 8 samples)
Barium	730	5/5	13 - 86	56SW05	NA	NO	BSL	NA	NA	NA
Cadmium	1.80	1/5	1.1 J	56SW01	NA	NO	BSL	NA	NA	NA
Chromium	5,500 [3]	1/5	6.3	56SW01	NA	NO	BSL	NA	NA	NA
Cobalt	1.10	1/1	3.1	56SW01	NA	YES	ASL	NA	3.1	Max (Less than 8 samples)
Copper	150	5/5	1.4 J - 13	56SW01	NA	NO	BSL	NA	NA	NA
Lead	15.0 [4]	5/5	0.21 J - 16	56SW01	NA	YES	ASL	NA	16	Max (Less than 8 samples)
Nickel	73.0	5/5	0.43 J - 3.8	56SW01	NA	NO	BSL	NA	NA	NA
Selenium	18.0	1/5	0.71 J	56SW01	NA	NO	BSL	NA	NA	NA
Vanadium	0.260	4/5	5.2 - 22	56SW01	NA	YES	ASL	NA	22	Max (Less than 8 samples)
Zinc	1,100	4/5	6.5 J - 46	56SW01	NA	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
UCL - Upper Confidence Limit
PRG - Preliminary Remediation Goal
COPC - Chemical of Potential Concern
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) Sample set was not large enough to use ProUCL
(3) Value for MCL
(4) Value for chromium III used as a surrogate.

TABLE 8-5

SEDIMENT DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
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		
	RegionaI 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
Volatile Organic Compounds (ug/kg)										
2-Butanone (MEK)	2,800,000	1/3	65 J	56SD03	NA	NO	BSL	NA	NA	NA
Acetone	6,100,000	3/3	200 J - 1,200 J	56SD05	NA	NO	BSL	NA	NA	NA
Carbon disulfide	82,000	2/3	19 J - 800 J	56SD05	NA	NO	BSL	NA	NA	NA
Iodomethane	NE	1/3	36 J	56SD05	NA	YES	NSC	NA	36	Max (Less than 8 samples)
Semivolatile Organic Compound (ug/kg)										
Benzo[a]anthracene	150	2/3	58 J - 270 J	56SD03	NA	YES	ASL	NA	270	Max (Less than 8 samples)
Benzo[a]pyrene	15.0	2/3	85 J - 300 J	56SD03	NA	YES	ASL	NA	300	Max (Less than 8 samples)
Benzo[b]fluoranthene *	150	1/3	77 J	56SD04	NA	YES	CHEM	NA	77	Max (Less than 8 samples)
Benzo[g,h,i]perylene	170,000 [4]	2/3	46 J - 150 J	56SD03	NA	NO	BSL	NA	NA	NA
Benzo[k]fluoranthene *	1,500	2/3	160 J - 630 J	56SD03	NA	YES	CHEM	NA	630	Max (Less than 8 samples)
Benzyl alcohol	610,000	1/3	47 J	56SD05	NA	NO	BSL	NA	NA	NA
Bis(2-ethylhexyl) phthalate	35,000	1/3	260 J	56SD03	NA	NO	BSL	NA	NA	NA
Butyl benzyl phthalate	260,000	1/3	22 J	56SD03	NA	NO	BSL	NA	NA	NA
Chrysene *	15,000	3/3	7.1 J - 410 J	56SD03	NA	YES	CHEM	NA	410	Max (Less than 8 samples)
Dibenz(a,h)anthracene	15.0	1/3	52 J	56SD03	NA	YES	ASL	NA	52	Max (Less than 8 samples)
Fluoranthene	230,000	2/3	79 J - 350 J	56SD03	NA	NO	BSL	NA	NA	NA
Indeno[1,2,3-cd]pyrene *	150	2/3	32 J - 110 J	56SD03	NA	YES	CHEM	NA	110	Max (Less than 8 samples)
Phenanthrene	170,000 [4]	2/3	19 J - 21 J	56SD03	NA	NO	BSL	NA	NA	NA
Phenol	1,800,000	1/3	19 J	56SD04	NA	NO	BSL	NA	NA	NA
Pyrene	170,000	2/3	110 J - 570 J	56SD03	NA	NO	BSL	NA	NA	NA
Total Metals (mg/kg)										
Antimony	3.10	1/14	0.92 J	56SD18	ND	NO	BSL	NA	NA	NA
Arsenic	0.390	13/14	0.96 J - 10.4 J	56SD22	ND	YES	ASL	6.48 (NP)	6.48	95% KM (Chebyshev) UCL
Barium	1,500	14/14	42 - 571 J	56SD22	ND	NO	BSL	NA	NA	NA
Beryllium	16.0	4/14	0.21 J - 0.3 J	56SD14	ND	NO	BSL	NA	NA	NA
Cadmium	7.0	6/14	0.39 J - 3.9 J	56SD04	ND	NO	BSL	NA	NA	NA
Chromium	12,000 [5]	14/14	19.8 J - 51 J	56SD14	ND	NO	BSL	NA	NA	NA
Cobalt	2.30	14/14	18 J - 91.4 J	56SD22	ND	YES	ASL	54.7 (N)	54.7	95% Student's-t UCL
Copper	310	14/14	75.1 J - 130 J	6SD03, 56SD0	ND	NO	BSL	NA	NA	NA
Lead	400 [6]	14/14	13 J - 280 J	56SD03	ND	NO	BSL	NA	NA	NA

TABLE 8-5 (Continued)

SEDIMENT DATA AND COPC SELECTION SUMMARY
SWMU 56 (HANGER 200 APRON)
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		
	RegionaI 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
Total Metals (mg/kg) (Cont)										
Mercury	0.560	13/14	0.052 J - 0.38 J	56SD16	ND	NO	BSL	NA	NA	NA
Nickel	150	14/14	8.7 J - 19.1 J	56SD22	ND	NO	BSL	NA	NA	NA
Selenium	39.0	9/14	0.99 J - 4.2 J	56SD04	ND	NO	BSL	NA	NA	NA
Silver	39.0	6/14	0.18 J - 4.6 J	56SD15	ND	NO	BSL	NA	NA	NA
Tin	4,700	8/14	4.6 J - 16 J	56SD22	ND	NO	BSL	NA	NA	NA
Vanadium	0.550	14/14	147 J - 260 J	56SD14	ND	YES	ASL	208 (N)	208	95% Student's-t UCL
Zinc	2,300	14/14	69.2 J - 140 J	56SD04	ND	NO	BSL	NA	NA	NA

Notes:

NA - Not Applicable
NE - Not Established

UCL - Upper Confidence Limit
PRG - Preliminary Remediation Goal
COPC - Chemical of Potential Concern

ug/kg - microgram per kilogram
mg/kg - milligram per kilogram

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, 2008): 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 pyrene used as a surrogate.
(5) Value for chromium III used as a surrogate.
(6) USEPA Residential Soil Action Level

Rationale Codes:

(ASL) Above Screening Level
(CHEM) Same Chemical Class
(NSC) No Screening Criteria
(BSL) Below Screening Level

TABLE 8-6

Revised: September 29, 2011

SUMMARY OF EXPOSURE PARAMETERS
SWMU 56 (HANGER 200 APRON)
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	Future Adult Residents RME	Future Young Child Residents RME	Future Adult Industrial / Commercial Workers RME	Future Adult Construction Workers RME	Current and Future Adult On-Site Workers RME
Soil								
Ingestion Rate of Soil (IR-S)	mg/day	100 USEPA, 1991	100 USEPA, 1991	100 USEPA, 1991	200 USEPA, 1991	100 USEPA, 2002	330 USEPA, 2002	100 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)	350 USEPA, 2004	350 USEPA, 2004	250 USEPA, 2004	250 USEPA, 2004	250 USEPA, 2004
Exposure Duration (ED)	years	24 USEPA, 1991	11 USEPA, 1991	24 USEPA, 1991	6 USEPA, 1991	25 USEPA, 2004	1 Prof Judge (3)	25 USEPA, 2004
Exposure Time (ET)	hours/day	2 USEPA, 1997 (4)	2 USEPA, 1997 (4)	24 Prof Judge (5)	24 Prof Judge (5)	8 Prof Judge (6)	8 Prof Judge (6)	8 Prof Judge (6)
Surface Area Available for Contact (SA	cm2/day	5,700 USEPA, 2004	3,200 USEPA, 1997	5,700 USEPA, 2004	2,800 USEPA, 2004	3,300 USEPA, 2004	3,300 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	8,760 USEPA, 1989	2,190 USEPA, 1989	9,125 USEPA, 1989	365 USEPA, 1989	9,125 USEPA, 1989
Groundwater								
Ingestion Rate of Groundwater (IR-W)	L/day	--	--	2 USEPA, 1991	1 USEPA, 1989	1 USEPA, 1991	0.02 VDEQ, 2009	--
Exposure Frequency (EF)	days/year	--	--	350 USEPA, 2004	350 USEPA, 2004	250 USEPA, 2004	50 Prof Judge (7)	--
Exposure Duration (ED)	years	--	--	24 USEPA, 1991	6 USEPA, 1991	25 USEPA, 2004	1 Prof Judge (3)	--
Exposure Time (ET)	hours/day	--	--	0.58 USEPA, 2004	1 USEPA, 2004	8 Prof Judge (6)	2 Prof Judge (8)	--
Surface Area Available for Contact (SA	cm2	--	--	18,000 USEPA, 2004	6,600 USEPA, 2004	3,300 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	1.00E-03 USEPA, 1989	--
Averaging Time (Non-Cancer) (AT-N)	days	--	--	8,760 USEPA, 1989	2,190 USEPA, 1989	9,125 USEPA, 1989	365 USEPA, 1989	--
Surface Water								
Ingestion Rate of Surface Water (IR-W)	L/hour	0.05 USEPA, 1989 (9)	0.05 USEPA, 1989 (9)	0.05 USEPA, 1989 (9)	0.05 USEPA, 1989 (9)	--	--	0.05 USEPA, 1989 (9)
Exposure Frequency (EF)	days/year	52 Prof Judge (2)	52 Prof Judge (2)	52 Prof Judge (2)	52 Prof Judge (2)	--	--	250 USEPA, 2004
Exposure Duration (ED)	years	24 USEPA, 1991	11 USEPA, 1991	24 USEPA, 1991	6 USEPA, 1991	--	--	25 USEPA, 2004
Exposure Time (ET)	hours/day	2 USEPA, 1997 (4)	2 USEPA, 1997 (4)	2 USEPA, 1997 (4)	2 USEPA, 1997 (4)	--	--	2 USEPA, 1997 (4)
Surface Area Available for Contact (SA	cm2	5,700 USEPA, 2004	3,200 USEPA, 1997	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	1.00E-03 USEPA, 1989	--	--	1.00E-03 USEPA, 1989
Averaging Time (Non-Cancer) (AT-N)	days	8,760 USEPA, 1989	4,015 USEPA, 1989	8,760 USEPA, 1989	2,190 USEPA, 1989	--	--	9,125 USEPA, 1989

TABLE 8-6 (Continued)

Revised: September 29, 2011

SUMMARY OF EXPOSURE PARAMETERS
SWMU 56 (HANGER 200 APRON)
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	Future Adult Residents RME	Future Young Child Residents RME	Future Adult Industrial / Commercial Workers RME	Future Adult Construction Workers RME	Current and Future Adult On-Site Workers RME
Sediment								
Ingestion Rate of Sediment (IR-S)	mg/day	100 USEPA, 1991	100 USEPA, 1991	100 USEPA, 1991	200 USEPA, 1991	--	--	100 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)
Exposure Frequency (EF)	days/year	52 Prof Judge (2)	52 Prof Judge (2)	52 Prof Judge (2)	52 Prof Judge (2)	--	--	250 USEPA, 2004
Exposure Duration (ED)	years	24 USEPA, 1991	11 USEPA, 1991	24 USEPA, 1991	6 USEPA, 1991	--	--	25 USEPA, 2004
Surface Area Available for Contact (SA	cm2/day	5,700 USEPA, 2004	3,200 USEPA, 1997	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
Averaging Time (Non-Cancer) (AT-N)	days	8,760 USEPA, 1989	4,015 USEPA, 1989	8,760 USEPA, 1989	2,190 USEPA, 1989	--	--	9,125 USEPA, 1989
Other Parameters								
Body Weight (BW)	kg	70 USEPA, 1997	45 USEPA, 1997	70 USEPA, 1997	15 USEPA, 1997	70 USEPA, 1997	70 USEPA, 1997	70 USEPA, 1997
Soil to Skin Adherence Factor (AF)	mg/cm2	0.07 USEPA, 2004	0.2 USEPA, 2004	0.07 USEPA, 2004	0.2 USEPA, 2004	0.2 USEPA, 2004	0.3 USEPA, 2002	0.2 USEPA, 2004
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	5.59E+06 USEPA, 2002	1.36E+09 USEPA, 2002
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 based on status of SWMU 56 as an inactive airfield
(3) Assumes a construction period of 1 year.
(4) Recommended outdoor activity factor for adults
(5) Conservatively assumes receptor remains at residence 24 hours/day
(6) Assumes an 8 hour work day.
(7) Assumes 20% of time spent in trench.
(8) Assumes 2 hours/event in trench.
(9) Ingestion rate for wading

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 201(

TABLE 8-7

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
SWMU 56 (HANGER 200 APRON)
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)
Volatiles									
Iodomethane	NA	NA	NA	NA	NA	NA	NA	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	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
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
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
Mercury	NA	NA	1.60E-04	3.00E-04	0.01	7%	D	(o) ImS, (i) CNS	(o) - ImS: Autoimmune effects; (i) - CNS: Hand tremor; increase in memory disturbances; slight subjective and objective evidence of autonomic dysfunction
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
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Known/Likely (EPA classes A, B1, B2, C)
Cannot be Determined (EPA class D)
Not Likely (EPA class E)

Target Organ Abbreviations:

CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

(1) - ABS - Absorption Factors
The following USEPA Region IV default absorbance factors will be applied in the absence of reference values from USEPA, 2004 to estimate dermal intake of COPCs in soil and sedin
0.1% - Inorganics
(2) - Oral to dermal adjustment taken from RAGS Part E (USEPA, 2004)

TABLE 8-8
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	4.7E-10	--	2.4E-10	--	7.1E-10	NA	--	--	--	--
			Benzo[a]pyrene	1.0E-08	--	5.3E-09	--	1.5E-08	NA	--	--	--	--
			Benzo[b]fluoranthene	2.2E-09	--	1.2E-09	--	3.4E-09	NA	--	--	--	--
			Benzo[k]fluoranthene	4.4E-11	--	2.3E-11	--	6.7E-11	NA	--	--	--	--
			Chrysene	1.8E-11	--	9.5E-12	--	2.8E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.5E-09	--	7.7E-10	--	2.2E-09	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	3.8E-10	--	2.0E-10	--	5.8E-10	NA	--	--	--	--
			Arsenic	3.0E-07	--	3.6E-08	--	3.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.78	--	1.19	1.97
			Chemical Total	3.2E-07	--	4.4E-08	--	3.6E-07		0.80	--	1.19	1.99
		Exposure Point Total						3.6E-07					1.99
	Exposure Medium Total							3.6E-07					1.99
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	2.3E-13	--	--	2.3E-13	NA	--	--	--	--
			Benzo[a]pyrene	--	2.6E-12	--	--	2.6E-12	NA	--	--	--	--
			Benzo[b]fluoranthene	--	9.5E-13	--	--	9.5E-13	NA	--	--	--	--
			Benzo[k]fluoranthene	--	8.8E-14	--	--	8.8E-14	NA	--	--	--	--
			Chrysene	--	5.9E-13	--	--	5.9E-13	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	1.7E-13	--	--	1.7E-13	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	4.3E-14	--	--	4.3E-14	NA	--	--	--	--
			Arsenic	--	3.7E-11	--	--	3.7E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	8.2E-10	--	--	8.2E-10	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	8.6E-10	--	--	8.6E-10		--	<0.01	--	<0.01
		Exposure Point Total						8.6E-10					<0.01
	Exposure Medium Total							8.6E-10					<0.01
Soil Total								**3.61E-07**					**1.99**

TABLE 8-8
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
Surface Water	Surface Water	Surface Water	Arsenic	3.3E-07	--	2.3E-08	--	3.6E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.06	--	0.23	0.29
			Chemical Total	3.3E-07	--	2.3E-08	--	3.6E-07		0.07	--	0.23	0.30
		Exposure Point Total						3.6E-07					0.30
	Exposure Medium Total							3.6E-07					0.30
Surface Water Total								**3.58E-07**					**0.30**
Sediment	Sediment	Sediment	Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	1.4E-08	--	3.1E-08	--	4.4E-08	NA	--	--	--	--
			Benzo[a]pyrene	1.5E-07	--	3.4E-07	--	4.9E-07	NA	--	--	--	--
			Benzo[b]fluoranthene	3.9E-09	--	8.7E-09	--	1.3E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	3.2E-09	--	7.1E-09	--	1.0E-08	NA	--	--	--	--
			Chrysene	2.1E-10	--	4.6E-10	--	6.7E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	2.6E-08	--	5.9E-08	--	8.5E-08	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	5.6E-09	--	1.2E-08	--	1.8E-08	NA	--	--	--	--
			Arsenic	6.8E-07	--	3.5E-07	--	1.0E-06	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Vanadium	--	--	--	--	--	GIS / Kidney	0.60	--	3.98	4.58
			Chemical Total	8.8E-07	--	8.1E-07	--	1.7E-06		0.65	--	3.99	4.63
		Exposure Point Total						1.7E-06					4.63
	Exposure Medium Total							1.7E-06					4.63
Sediment Total								**1.69E-06**					**4.63**
Adult Trespassers Total								**2.41E-06**					**6.92**

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

	Total Risk		Total Hazard Index
Total Risk Across Soil	3.6E-07	Total Hazard Index Across Soil	**2.0**
Total Risk Across Surface Water	3.6E-07	Total Hazard Index Across Surface Water	0.30
Total Risk Across Sediment	1.7E-06	Total Hazard Index Across Sediment	**4.6**
Total Risk Across All Media and All Exposure Routes	2.4E-06	Total Hazard Index Across All Media and All Exposure Routes	**6.9**

	Inhalation	Oral/Dermal	Total
Skin HI =		0.01	0.01
Kidney HI =		**6.8**	**6.8**
Respiratory System HI =	<0.01		<0.01
Central Nervous System HI =	<0.01		<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**6.8**	**6.8**
Cardiovascular System HI =		0.08	0.08

TABLE 8-9
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	3.3E-10	--	2.8E-10	--	6.1E-10	NA	--	--	--	--
			Benzo[a]pyrene	7.3E-09	--	6.0E-09	--	1.3E-08	NA	--	--	--	--
			Benzo[b]fluoranthene	1.6E-09	--	1.3E-09	--	2.9E-09	NA	--	--	--	--
			Benzo[k]fluoranthene	3.1E-11	--	2.6E-11	--	5.7E-11	NA	--	--	--	--
			Chrysene	1.3E-11	--	1.1E-11	--	2.4E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.1E-09	--	8.8E-10	--	1.9E-09	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	2.7E-10	--	2.3E-10	--	5.0E-10	NA	--	--	--	--
			Arsenic	2.1E-07	--	4.1E-08	--	2.6E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.03	--	<0.01	0.03
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	1.21	--	2.97	4.18
			Chemical Total	2.3E-07	--	5.0E-08	--	2.8E-07		1.24	--	2.98	4.22
		Exposure Point Total						2.8E-07					4.22
	Exposure Medium Total							2.8E-07					4.22
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	1.1E-13	--	--	1.1E-13	NA	--	--	--	--
			Benzo[a]pyrene	--	1.2E-12	--	--	1.2E-12	NA	--	--	--	--
			Benzo[b]fluoranthene	--	4.3E-13	--	--	4.3E-13	NA	--	--	--	--
			Benzo[k]fluoranthene	--	4.0E-14	--	--	4.0E-14	NA	--	--	--	--
			Chrysene	--	2.7E-13	--	--	2.7E-13	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	8.0E-14	--	--	8.0E-14	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	2.0E-14	--	--	2.0E-14	NA	--	--	--	--
			Arsenic	--	1.7E-11	--	--	1.7E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	3.7E-10	--	--	3.7E-10	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	3.9E-10	--	--	3.9E-10		--	<0.01	--	<0.01
		Exposure Point Total						3.9E-10					<0.01
	Exposure Medium Total							3.9E-10					<0.01
Soil Total								**2.76E-07**					**4.22**

TABLE 8-9
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	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 Water	Surface Water	Surface Water	Arsenic	2.4E-07	--	9.2E-09	--	2.5E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.10	--	0.20	0.30
			Chemical Total	2.4E-07	--	9.2E-09	--	2.5E-07		0.11	--	0.20	0.31
		Exposure Point Total						2.5E-07					0.31
	Exposure Medium Total							2.5E-07					0.31
Surface Water Total								**2.48E-07**					**0.31**
Sediment	Sediment	Sediment	Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	9.8E-09	--	1.2E-08	--	2.2E-08	NA	--	--	--	--
			Benzo[a]pyrene	1.1E-07	--	1.4E-07	--	2.4E-07	NA	--	--	--	--
			Benzo[b]fluoranthene	2.8E-09	--	3.5E-09	--	6.3E-09	NA	--	--	--	--
			Benzo[k]fluoranthene	2.3E-09	--	2.9E-09	--	5.1E-09	NA	--	--	--	--
			Chrysene	1.5E-10	--	1.9E-10	--	3.3E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.9E-08	--	2.4E-08	--	4.2E-08	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	4.0E-09	--	5.0E-09	--	9.0E-09	NA	--	--	--	--
			Arsenic	4.8E-07	--	1.4E-07	--	6.2E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.06	--	<0.01	0.06
			Vanadium	--	--	--	--	--	GIS / Kidney	0.94	--	3.47	4.41
			Chemical Total	6.3E-07	--	3.2E-07	--	9.5E-07		1.01	--	3.48	4.49
		Exposure Point Total						9.5E-07					4.49
	Exposure Medium Total							9.5E-07					4.49
Sediment Total								**9.53E-07**					**4.49**
Youth Trespassers Total								**1.48E-06**					**9.01**

Notes:

Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Soil	2.8E-07
Total Risk Across Surface Water	2.5E-07
Total Risk Across Sediment	9.5E-07
Total Risk Across All Media and All Exposure Routes	1.5E-06

Total Hazard Index Across Soil	**4.2**
Total Hazard Index Across Surface Water	0.31
Total Hazard Index Across Sediment	**4.5**
Total Hazard Index Across All Media and All Exposure Routes	**9.0**

	Inhalation	Oral/Dermal	Total
Skin HI =		0.02	0.02
Kidney HI =		**8.9**	**8.9**
Respiratory System HI =	<0.01		<0.01

	Inhalation	Oral/Dermal	Total
Central Nervous System HI =	<0.01		<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**8.9**	**8.9**
Cardiovascular System HI =		0.12	0.12

TABLE 8-10
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	1.1E-07	--	4.1E-08	--	1.5E-07	NA	--	--	--	--
			Benzo[a]pyrene	2.4E-06	--	9.0E-07	--	3.3E-06	NA	--	--	--	--
			Benzo[b]fluoranthene	5.2E-07	--	2.0E-07	--	7.2E-07	NA	--	--	--	--
			Benzo[k]fluoranthene	1.0E-08	--	3.9E-09	--	1.4E-08	NA	--	--	--	--
			Chrysene	4.2E-09	--	1.6E-09	--	5.9E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	3.4E-07	--	1.3E-07	--	4.7E-07	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.1E-07	--	3.4E-08	--	1.4E-07	NA	--	--	--	--
			Arsenic	2.0E-06	--	2.4E-07	--	2.3E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.14	--	<0.01	0.14
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	5.23	--	8.02	13.24
			Chemical Total	5.5E-06	--	1.6E-06	--	7.0E-06		5.38	--	8.03	13.40
		Exposure Point Total						7.0E-06					13.40
	Exposure Medium Total							7.0E-06					13.40
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	1.3E-10	--	--	1.3E-10	NA	--	--	--	--
			Benzo[a]pyrene	--	1.5E-09	--	--	1.5E-09	NA	--	--	--	--
			Benzo[b]fluoranthene	--	5.5E-10	--	--	5.5E-10	NA	--	--	--	--
			Benzo[k]fluoranthene	--	5.2E-11	--	--	5.2E-11	NA	--	--	--	--
			Chrysene	--	3.5E-10	--	--	3.5E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	1.0E-10	--	--	1.0E-10	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	2.5E-11	--	--	2.5E-11	NA	--	--	--	--
			Arsenic	--	3.0E-09	--	--	3.0E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	6.6E-08	--	--	6.6E-08	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	7.2E-08	--	--	7.2E-08		--	<0.01	--	<0.01
		Exposure Point Total						7.2E-08					<0.01
	Exposure Medium Total							7.2E-08					<0.01
Soil Total								**7.10E-06**					**13.41**

TABLE 8-10
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	7.3E-06	--	2.3E-08	--	7.3E-06	Skin / CVS	0.05	--	<0.01	0.05
			Cobalt	--	--	--	--	--	CVS	3.47	--	0.01	3.48
			Vanadium	--	--	--	--	--	GIS / Kidney	6.14	--	1.01	7.16
			Chemical Total	7.3E-06	--	2.3E-08	--	7.3E-06		9.66	--	1.03	10.69
		Exposure Point Total						7.3E-06					10.69
	Exposure Medium Total							7.3E-06					10.69
Groundwater Total								**7.35E-06**					**10.69**
Surface Water	Surface Water	Surface Water	Arsenic	3.3E-07	--	2.3E-08	--	3.6E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.06	--	0.23	0.29
			Chemical Total	3.3E-07	--	2.3E-08	--	3.6E-07		0.07	--	0.23	0.30
		Exposure Point Total						3.6E-07					0.30
	Exposure Medium Total							3.6E-07					0.30
Surface Water Total								**3.58E-07**					**0.30**

TABLE 8-10
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Sediment	Sediment											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	4.7E-07	--	3.5E-07	--	8.2E-07	NA	--	--	--	--
			Benzo[a]pyrene	5.2E-06	--	3.9E-06	--	9.1E-06	NA	--	--	--	--
			Benzo[b]fluoranthene	1.3E-07	--	1.0E-07	--	2.3E-07	NA	--	--	--	--
			Benzo[k]fluoranthene	1.1E-07	--	8.2E-08	--	1.9E-07	NA	--	--	--	--
			Chrysene	7.2E-09	--	5.3E-09	--	1.2E-08	NA	--	--	--	--
			Dibenz(a,h)anthracene	9.1E-07	--	6.7E-07	--	1.6E-06	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.9E-07	--	1.4E-07	--	3.4E-07	NA	--	--	--	--
			Arsenic	6.8E-07	--	3.5E-07	--	1.0E-06	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.04	--	<0.01	0.04
			Vanadium	--	--	--	--	--	GIS / Kidney	0.60	--	3.98	4.58
			Chemical Total	7.8E-06	--	5.6E-06	--	1.3E-05		0.65	--	3.99	4.63
		Exposure Point Total						1.3E-05					4.63
	Exposure Medium Total							1.3E-05					4.63
Sediment Total								**1.33E-05**					**4.63**
Adult Residents Total								**2.81E-05**					**29.03**

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Soil	7.1E-06	Total Hazard Index Across Soil	**13.4**
Total Risk Across Groundwater	7.3E-06	Total Hazard Index Across Groundwater	**10.7**
Total Risk Across Surface Water	3.6E-07	Total Hazard Index Across Surface Water	0.30
Total Risk Across Sediment	1.3E-05	Total Hazard Index Across Sediment	**4.6**
Total Risk Across All Media and All Exposure Routes	2.8E-05	al Hazard Index Across All Media and All Exposure Routes	**29.0**

	Inhalation	Oral/Dermal	Total
Central Nervous System HI =	<0.01		<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**25.3**	**25.3**
Cardiovascular System HI =		**3.7**	**3.7**
Skin HI =		0.07	0.07
Kidney HI =		**25.3**	**25.3**
Respiratory System HI =	<0.01		<0.01

TABLE 8-11
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	9.6E-08	--	3.5E-08	--	1.3E-07	NA	--	--	--	--
			Benzo[a]pyrene	2.1E-06	--	7.6E-07	--	2.8E-06	NA	--	--	--	--
			Benzo[b]fluoranthene	4.6E-07	--	1.7E-07	--	6.2E-07	NA	--	--	--	--
			Benzo[k]fluoranthene	8.9E-09	--	3.3E-09	--	1.2E-08	NA	--	--	--	--
			Chrysene	3.7E-09	--	1.4E-09	--	5.1E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	3.0E-07	--	1.1E-07	--	4.1E-07	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	9.6E-08	--	2.8E-08	--	1.2E-07	NA	--	--	--	--
			Arsenic	4.7E-06	--	4.0E-07	--	5.1E-06	Skin / CVS	0.12	--	0.01	0.13
			Cobalt	--	--	--	--	--	CVS	1.29	--	0.04	1.33
			Mercury	--	--	--	--	--	ImS	0.02	--	<0.01	0.02
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	48.77	--	52.52	101.29
			Chemical Total	7.8E-06	--	1.5E-06	--	9.3E-06		50.20	--	52.57	102.77
		Exposure Point Total						9.3E-06					102.77
	Exposure Medium Total							9.3E-06					102.77
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	6.0E-11	--	--	6.0E-11	NA	--	--	--	--
			Benzo[a]pyrene	--	6.8E-10	--	--	6.8E-10	NA	--	--	--	--
			Benzo[b]fluoranthene	--	2.5E-10	--	--	2.5E-10	NA	--	--	--	--
			Benzo[k]fluoranthene	--	2.3E-11	--	--	2.3E-11	NA	--	--	--	--
			Chrysene	--	1.6E-10	--	--	1.6E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	4.6E-11	--	--	4.6E-11	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	1.1E-11	--	--	1.1E-11	NA	--	--	--	--
			Arsenic	--	7.5E-10	--	--	7.5E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.8E-08	--	--	1.8E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.8E-08					<0.01
	Exposure Medium Total							1.8E-08					<0.01
Soil Total								**9.29E-06**					**102.77**

TABLE 8-11
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
Groundwater	Groundwater	Tap	Arsenic	4.3E-06	--	1.7E-08	--	4.3E-06	Skin / CVS	0.11	--	<0.01	0.11
			Cobalt	--	--	--	--	--	CVS	8.10	--	0.04	8.14
			Vanadium	--	--	--	--	--	GIS / Kidney	14.34	--	2.99	17.33
			Chemical Total	4.3E-06	--	1.7E-08	--	4.3E-06		22.55	--	3.03	25.58
		Exposure Point Total						4.3E-06					25.58
	Exposure Medium Total							4.3E-06					25.58
Groundwater Total								**4.29E-06**					**25.58**
Surface Water	Surface Water	Surface Water	Arsenic	3.9E-07	--	1.3E-08	--	4.0E-07	Skin / CVS	0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.30	--	0.53	0.83
			Chemical Total	3.9E-07	--	1.3E-08	--	4.0E-07		0.32	--	0.53	0.85
		Exposure Point Total						4.0E-07					0.85
	Exposure Medium Total							4.0E-07					0.85
Surface Water Total								**4.04E-07**					**0.85**

TABLE 8-11
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Sediment	Sediment											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	4.2E-07	--	2.3E-07	--	6.4E-07	NA	--	--	--	--
			Benzo[a]pyrene	4.6E-06	--	2.5E-06	--	7.2E-06	NA	--	--	--	--
			Benzo[b]fluoranthene	1.2E-07	--	6.5E-08	--	1.8E-07	NA	--	--	--	--
			Benzo[k]fluoranthene	9.7E-08	--	5.3E-08	--	1.5E-07	NA	--	--	--	--
			Chrysene	6.3E-09	--	3.5E-09	--	9.8E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	8.0E-07	--	4.4E-07	--	1.2E-06	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.7E-07	--	9.3E-08	--	2.6E-07	NA	--	--	--	--
			Arsenic	1.6E-06	--	2.0E-07	--	1.8E-06	Skin / CVS	0.04	--	<0.01	0.05
			Cobalt	--	--	--	--	--	CVS	0.35	--	0.01	0.36
			Vanadium	--	--	--	--	--	GIS / Kidney	5.64	--	9.12	14.76
			Chemical Total	7.8E-06	--	3.6E-06	--	1.1E-05		6.03	--	9.14	15.17
		Exposure Point Total						1.1E-05					15.17
	Exposure Medium Total							1.1E-05					15.17
Sediment Total								**1.14E-05**					**15.17**
Young Child Residents Total								**2.54E-05**					**144.37**

Notes:
<u>Target Organ Abbreviations:</u>
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Soil	9.3E-06	Total Hazard Index Across Soil	**103**
Total Risk Across Groundwater	4.3E-06	Total Hazard Index Across Groundwater	**25.6**
Total Risk Across Surface Water	4.0E-07	Total Hazard Index Across Surface Water	0.85
Total Risk Across Sediment	1.1E-05	Total Hazard Index Across Sediment	**15.2**
Total Risk Across All Media and All Exposure Routes	2.5E-05	al Hazard Index Across All Media and All Exposure Routes	**144**

	Inhalation	Oral/Dermal	Total
Central Nervous System HI =	<0.01		<0.01
Immune System HI =		0.02	0.02
Gastrointestinal System HI =		**134**	**134**
Cardiovascular System HI =		**10.1**	**10.1**
Skin HI =		0.30	0.30
Kidney HI =		**134**	**134**
Respiratory System HI =	<0.01		<0.01

TABLE 8-12
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	2.3E-09	--	2.0E-09	--	4.4E-09	NA	--	--	--	--
			Benzo[a]pyrene	5.1E-08	--	4.4E-08	--	9.5E-08	NA	--	--	--	--
			Benzo[b]fluoranthene	1.1E-08	--	9.6E-09	--	2.1E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	2.2E-10	--	1.9E-10	--	4.1E-10	NA	--	--	--	--
			Chrysene	9.2E-11	--	7.9E-11	--	1.7E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	7.4E-09	--	6.3E-09	--	1.4E-08	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.9E-09	--	1.6E-09	--	3.6E-09	NA	--	--	--	--
			Arsenic	1.5E-06	--	3.0E-07	--	1.8E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.11
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.73	--	9.58	**13.31**
			Chemical Total	1.6E-06	--	3.6E-07	--	1.9E-06		3.84	--	9.59	**13.43**
		Exposure Point Total						1.9E-06					**13.43**
	Exposure Medium Total							1.9E-06					**13.43**
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	4.6E-12	--	--	4.6E-12	NA	--	--	--	--
			Benzo[a]pyrene	--	5.2E-11	--	--	5.2E-11	NA	--	--	--	--
			Benzo[b]fluoranthene	--	1.9E-11	--	--	1.9E-11	NA	--	--	--	--
			Benzo[k]fluoranthene	--	1.8E-12	--	--	1.8E-12	NA	--	--	--	--
			Chrysene	--	1.2E-11	--	--	1.2E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	3.5E-12	--	--	3.5E-12	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	8.7E-13	--	--	8.7E-13	NA	--	--	--	--
			Arsenic	--	7.4E-10	--	--	7.4E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Soil Total								**1.96E-06**					**13.43**

TABLE 8-12
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	2.7E-06	--	0.0E+00	--	2.7E-06	Skin / CVS	0.02	--	<0.01	0.02
			Cobalt	--	--	0.0E+00	--	0.0E+00	CVS	1.24	--	<0.01	**1.24**
			Vanadium	--	--	0.0E+00	--	0.0E+00	GIS / Kidney	2.19	--	<0.01	**2.19**
			Chemical Total	2.7E-06	--	--	--	2.7E-06		3.45	--	--	**3.45**
		Exposure Point Total						2.7E-06					**3.45**
	Exposure Medium Total							2.7E-06					**3.45**
Groundwater Total								**2.73E-06**					**3.45**
Industrial / Commercial Workers Total								**4.69E-06**					**16.88**

Total Risk Across Soil	2.0E-06
Total Risk Across Groundwater	2.7E-06
Total Risk Across All Media and All Exposure Routes	4.7E-06

Total Hazard Index Across Soil	**13.4**
Total Hazard Index Across Groundwater	**3.5**
Total Hazard Index Across All Media and All Exposure Routes	**16.9**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**15.5**	**15.5**
Cardiovascular System HI =		**1.4**	**1.4**
Skin HI =		0.03	0.03
Kidney HI =		**15.5**	**15.5**
Central Nervous System HI =	<0.01		<0.01
Respiratory System HI =	<0.01		<0.01

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

TABLE 8-13
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	3.1E-10	--	1.2E-10	--	4.3E-10	NA	--	--	--	--
			Benzo[a]pyrene	6.7E-09	--	2.6E-09	--	9.4E-09	NA	--	--	--	--
			Benzo[b]fluoranthene	1.5E-09	--	5.8E-10	--	2.1E-09	NA	--	--	--	--
			Benzo[k]fluoranthene	2.9E-11	--	1.1E-11	--	4.0E-11	NA	--	--	--	--
			Chrysene	1.2E-11	--	4.7E-12	--	1.7E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	9.8E-10	--	3.8E-10	--	1.4E-09	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	2.5E-10	--	9.8E-11	--	3.5E-10	NA	--	--	--	--
			Arsenic	2.0E-07	--	1.8E-08	--	2.2E-07	Skin / CVS	0.03	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.33	--	<0.01	0.34
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	12.32	--	14.21	26.53
			Chemical Total	2.1E-07	--	2.2E-08	--	2.3E-07		12.68	--	14.23	26.90
		Exposure Point Total						2.3E-07					26.90
	Exposure Medium Total							2.3E-07					26.90
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	7.7E-13	--	--	7.7E-13	NA	--	--	--	--
			Benzo[a]pyrene	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo[b]fluoranthene	--	3.6E-12	--	--	3.6E-12	NA	--	--	--	--
			Benzo[k]fluoranthene	--	6.2E-13	--	--	6.2E-13	NA	--	--	--	--
			Chrysene	--	7.0E-13	--	--	7.0E-13	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	2.2E-12	--	--	2.2E-12	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	5.1E-13	--	--	5.1E-13	NA	--	--	--	--
			Arsenic	--	7.2E-09	--	--	7.2E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-07	--	--	1.6E-07	RsS	--	0.21	--	0.21
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	0.11	--	0.11
			Chemical Total	--	1.7E-07	--	--	1.7E-07		--	0.32	--	0.32
		Exposure Point Total						1.7E-07					0.32
	Exposure Medium Total							1.7E-07					0.32
Soil Total								**3.97E-07**					**27.23**

TABLE 8-13
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	4.4E-10	--	8.7E-11	--	5.2E-10	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	<0.01	--	0.09	0.10
			Chemical Total	4.4E-10	--	8.7E-11	--	5.2E-10		0.01	--	0.09	0.11
		Exposure Point Total						5.2E-10					0.11
	Exposure Medium Total							5.2E-10					0.11
Groundwater Total								**5.23E-10**					**0.11**
Construction Workers Total								**3.98E-07**					**27.33**

Total Risk Across Soil	4.0E-07	Total Hazard Index Across Soil	**27.2**
Total Risk Across Groundwater	5.2E-10	Total Hazard Index Across Groundwater	0.11
Total Risk Across All Media and All Exposure Routes	4.0E-07	Total Hazard Index Across All Media and All Exposure Routes	**27.3**

	Inhalation	Oral/Dermal	Total
Central Nervous System HI =	<0.01		<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**26.6**	**26.6**
Cardiovascular System HI =		0.38	0.38
Skin HI =		0.03	0.03
Kidney HI =		**26.6**	**26.6**
Respiratory System HI =	0.21		0.21

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

TABLE 8-14
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	2.3E-09	--	2.0E-09	--	4.4E-09	NA	--	--	--	--
			Benzo[a]pyrene	5.1E-08	--	4.4E-08	--	9.5E-08	NA	--	--	--	--
			Benzo[b]fluoranthene	1.1E-08	--	9.6E-09	--	2.1E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	2.2E-10	--	1.9E-10	--	4.1E-10	NA	--	--	--	--
			Chrysene	9.2E-11	--	7.9E-11	--	1.7E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	7.4E-09	--	6.3E-09	--	1.4E-08	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.9E-09	--	1.6E-09	--	3.6E-09	NA	--	--	--	--
			Arsenic	1.5E-06	--	3.0E-07	--	1.8E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.11
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.73	--	9.58	**13.31**
			Chemical Total	1.6E-06	--	3.6E-07	--	1.9E-06		3.84	--	9.59	**13.43**
		Exposure Point Total						1.9E-06					**13.43**
	Exposure Medium Total							1.9E-06					**13.43**
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	4.6E-12	--	--	4.6E-12	NA	--	--	--	--
			Benzo[a]pyrene	--	5.2E-11	--	--	5.2E-11	NA	--	--	--	--
			Benzo[b]fluoranthene	--	1.9E-11	--	--	1.9E-11	NA	--	--	--	--
			Benzo[k]fluoranthene	--	1.8E-12	--	--	1.8E-12	NA	--	--	--	--
			Chrysene	--	1.2E-11	--	--	1.2E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	3.5E-12	--	--	3.5E-12	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	8.7E-13	--	--	8.7E-13	NA	--	--	--	--
			Arsenic	--	7.4E-10	--	--	7.4E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Soil Total								**1.96E-06**					**13.43**

TABLE 8-14
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
Surface Water	Surface Water	Surface Water	Arsenic	1.7E-06	--	1.1E-07	--	1.8E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.31	--	0.79	**1.10**
			Chemical Total	1.7E-06	--	1.1E-07	--	1.8E-06		0.33	--	0.79	**1.12**
		Exposure Point Total						1.8E-06					**1.12**
	Exposure Medium Total							1.8E-06					**1.12**
Surface Water Total								**1.79E-06**					**1.12**
Sediment	Sediment	Sediment	Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	6.9E-08	--	8.9E-08	--	1.6E-07	NA	--	--	--	--
			Benzo[a]pyrene	7.7E-07	--	9.8E-07	--	1.8E-06	NA	--	--	--	--
			Benzo[b]fluoranthene	2.0E-08	--	2.5E-08	--	4.5E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	1.6E-08	--	2.1E-08	--	3.7E-08	NA	--	--	--	--
			Chrysene	1.0E-09	--	1.3E-09	--	2.4E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.3E-07	--	1.7E-07	--	3.0E-07	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	2.8E-08	--	3.6E-08	--	6.4E-08	NA	--	--	--	--
			Arsenic	3.4E-06	--	1.0E-06	--	4.4E-06	Skin / CVS	0.02	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.18	--	0.02	0.20
			Vanadium	--	--	--	--	--	GIS / Kidney	2.91	--	11.19	**14.10**
			Chemical Total	4.4E-06	--	2.3E-06	--	6.8E-06		3.11	--	11.22	**14.32**
		Exposure Point Total						6.8E-06					**14.32**
	Exposure Medium Total							6.8E-06					**14.32**
Sediment Total								**6.76E-06**					**14.32**

TABLE 8-14
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
On-Site Workers Total								**1.05E-05**					**28.87**

Total Risk Across Soil	2.0E-06
Total Risk Across Surface Water	1.8E-06
Total Risk Across Sediment	6.8E-06
Total Risk Across All Media and All Exposure Routes	1.1E-05

Total Hazard Index Across Soil	**13.4**
Total Hazard Index Across Surface Water	**1.1**
Total Hazard Index Across Sediment	**14.3**
Total Hazard Index Across All Media and All Exposure Routes	**28.9**

Notes:
<u>Target Organ Abbreviations</u>:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**28.5**	**28.5**
Cardiovascular System HI =		0.36	0.36
Skin HI =		0.05	0.05
Kidney HI =		**28.5**	**28.5**
Liver HI =			ND
Central Nervous System HI =	<0.01		<0.01
Respiratory System HI =	<0.01		<0.01

TABLE 8-15

COMPARISON OF SITE-SPECIFIC AND BACKGROUND VANADIUM HIs
SWMU 56 (HANGAR 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Revised: September 29, 2011

Receptor	Airfield Soil		Groundwater		Sediment	
	SWMU 56 Vanadium HI	Background Vanadium HI	SWMU 56 Vanadium HI	Background Vanadium HI	SWMU 56 Vanadium HI	Background Vanadium HI
Adult Trespasser	1.97	1.53	NA		4.58	3.66
Youth Trespasser	4.18	3.24	NA		4.41	3.52
Adult Resident	13.24	10.3	7.16	106	4.58	3.66
Youth/Child Resident	101.29	78.5	17.33	256	14.76	11.8
Industrial/Commercial Worker	13.3	10.2	2.2	32	NA	
Construction Worker	26.53	20.6	0.11	1.48	NA	
On-site Worker	13.3	10.3	NA		14.1	11.25

Notes:
NA - Not applicable.

TABLE 8-16

SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT SWMU 56 (HANGER 200 APRON) 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 expsoure concentration term 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		
Exposure to lead in surface water not quantitatively evaluated.		Low	
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 8-16

SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT SWMU 56 (HANGER 200 APRON) 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 56.	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 9-1

CORRECTIVE ACTION OBJECTIVES (CAOs) FOR SURFACE SOIL AND SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Media	**Chemcial**	**Final Corrective Action Objective (mg/kg) [1]**	**Applicable Drainage Ditch Sediment**
Surface Soil	Lead	96	NA
	Cadmium	1.8	NA
Sediment	Barium	214	Segment A-B
	Cadmium	0.99	Segment A-B and C-D
	Chromium	65	Segment A-B
	Lead	35.8	Segment A-B, C-D, and E-F
	Zinc	152	Segment A-B

[1] Refer to Tables 7-37 and 7-38 for the source and derivation of the CAOs

TABLE 11-1

DESIGN CONSIDERATIONS
SWMU 56 – HANGAR 200 APRON
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 56. The Ports Authority has developed 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 and northwest of the Hangar 200 apron area. Site access is through the airfield and from the taxiways. Coordinate site access with the Puerto Rico Ports Authority.
Existing Structures	Hangar 200 is approximately 200 feet southeast of SWMU 56. Other than the hangar, concrete apron and various taxiways and drainage culverts, 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 Hangar 200 and at other areas of the airfield.
Utility Clearance	The remedial contractor will be responsible for clearing all sampling and excavation areas of utilities.
Extent of Contamination	The maximum extent of lead and cadmium contamination in the surface soil has been fully defined by the CMS Investigation. The maximum downgradient extent of sediment contamination (barium, cadmium, chromium, lead and zinc) above CAOs has been identified as sample location 56SW/SD05.
Staging and Decontamination Areas	Staging and decontamination areas may be placed on the 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 56 - HANGAR 200 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	$5,000.00	$5,000	Professional Judgement
Excavation of Pb/Cd Contaminated Soil	441	CY	$105.00	$46,305	Professional Judgement
Backfilling with clean fill, including delivery, spreading and compaction in 6" lifts (excavation volume plus 20%)	529	CY	$41.00	$21,697	Professional Judgement
Vegetative Cover	11,916	SF	$0.60	$7,150	Professional Judgement
Transportation	660	ton	$67.00	$44,202	Professional Judgement
Disposal	660	ton	$42.00	$27,709	Professional Judgement
E&S Controls and Dewatering	1	LS	$15,000.00	$15,000	Professional Judgement
Excavation and Dewatering of Contaminated Sediment	238	CY	$125.00	$29,688	Professional Judgement
Management/Treatment/Disposal of Liquid from Dewatered Sediment	4,797	Gal	$2.50	$11,991	Professional Judgement
Backfilling with clean clay backfill and riprap, including delivery, spreading and compaction in 6" lifts (excavation volume plus 20%)	285	CY	$75.00	$21,375	Professional Judgement
Vegetative Cover (assume six foot width along length of ditch)	7,847	SF	$1.00	$7,847	Professional Judgement
Sediment Transportation	355	ton	$67.00	$23,805	Professional Judgement
Sediment Disposal	355	ton	$42.00	$14,923	Professional Judgement
Subtotal - Direct Capital Costs				$276,692	
Scope and bid Contingency				$55,338	20% total contingency (10% scope and 10% bid contingencies)
Total Direct Capital Costs				**$332,030**	
Professional Services					
Project Management				$27,669	Assume 10% of total direct capital cost
Remedial Design/EngineeringSupport				$55,338	Assume 20% of total direct capital cost
Construction Oversight and Startup				$41,504	Assume 15% of total direct capital cost
Total Professional Services				**$124,511**	
TOTAL				**$456,541**	

FIGURES

111626_56CMS_01.dwg

1 inch = 4 miles

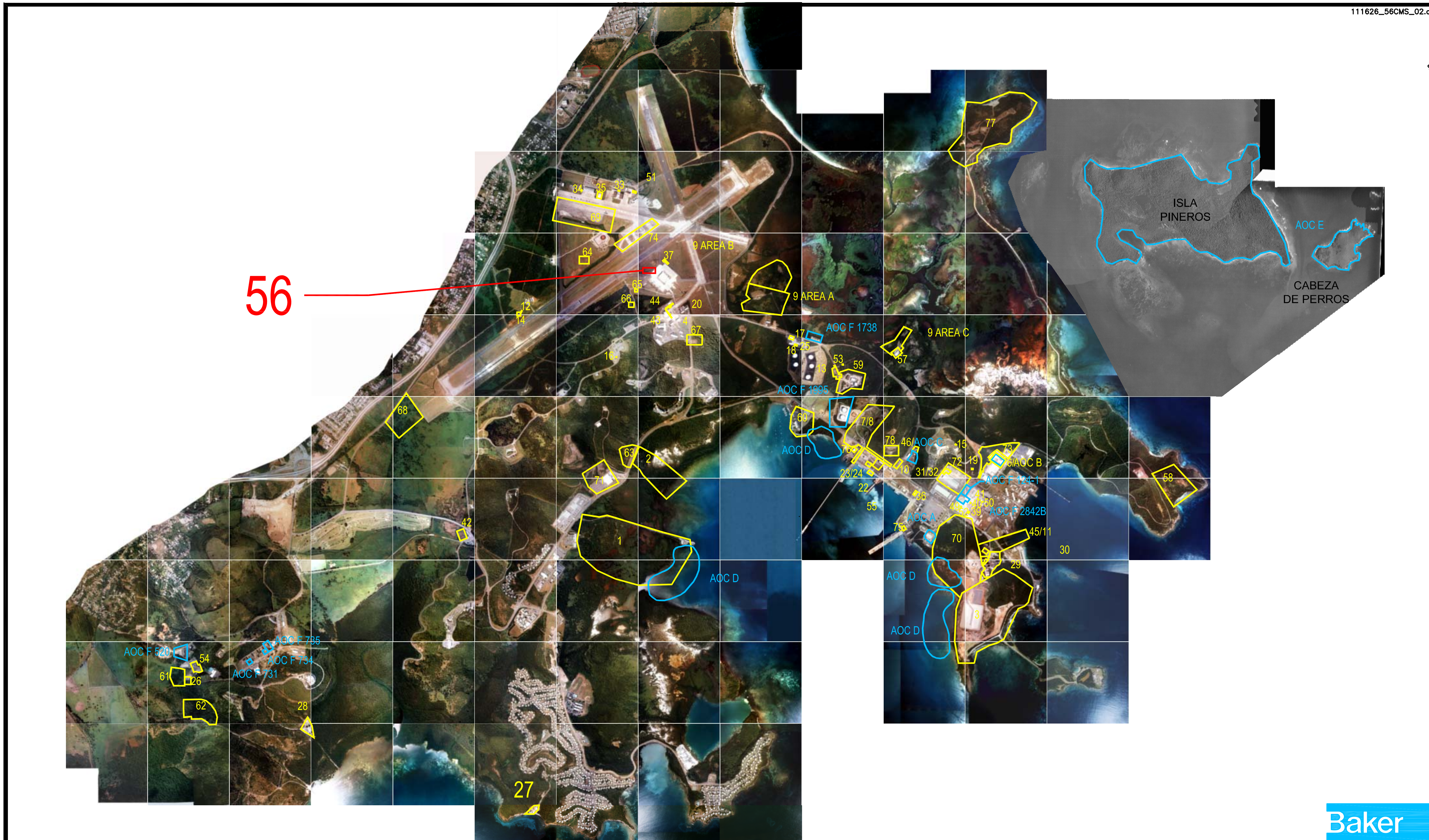
Baker

FIGURE 2-1
NAPR LOCATION MAP
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

SOURCE: METRODATA, INC., 1999.

NAVAL ACTIVITY PUERTO RICO

111626_56CMS_02.dwg



LEGEND

SWMUs — AREA TO WHICH THIS INVESTIGATION PERTAINS

AOC D — AOCs

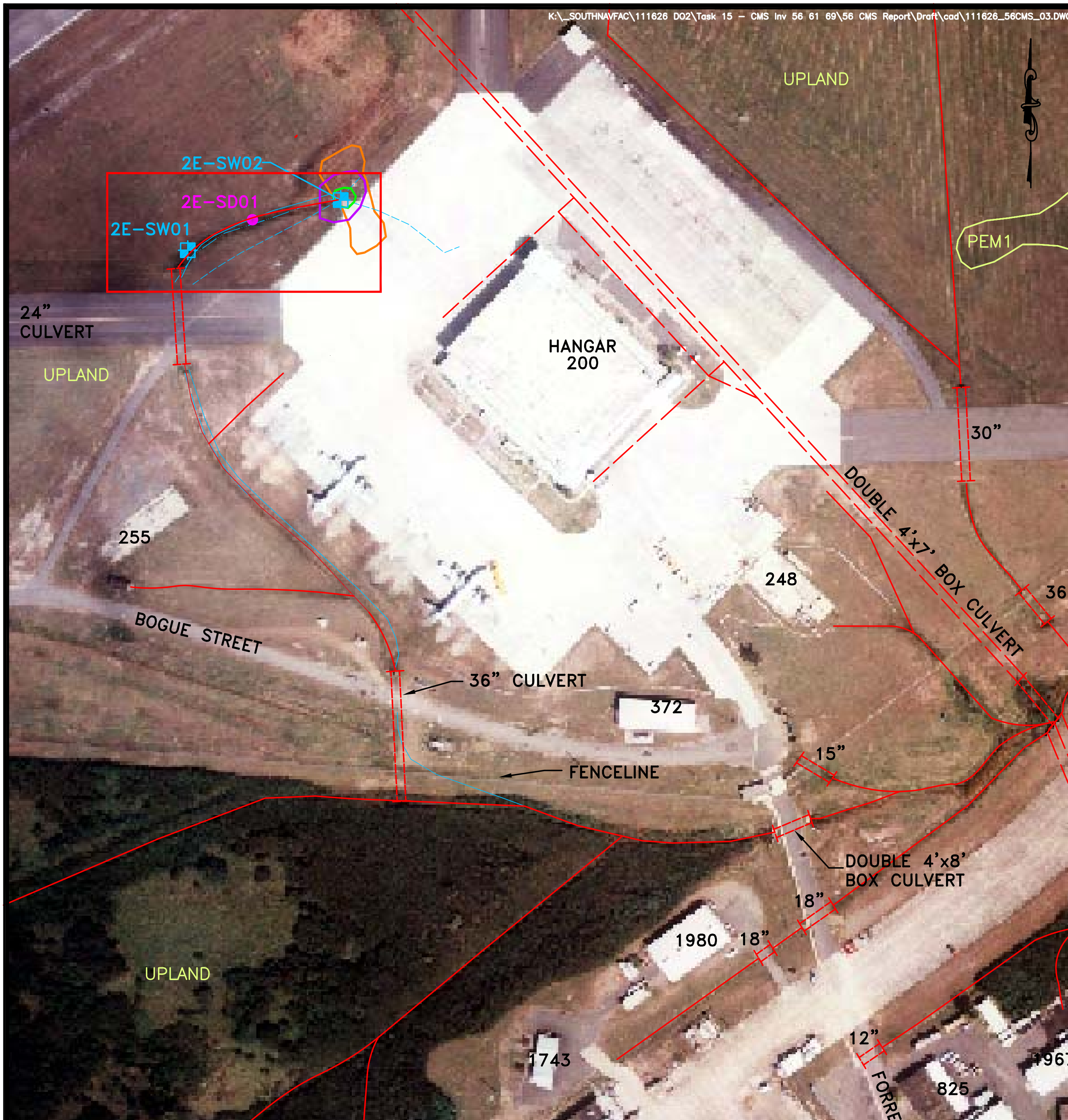
SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

3000 0 1500 3000

1 inch = 3000 ft.

FIGURE 2-2
SWMU/AOC LOCATION MAP
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

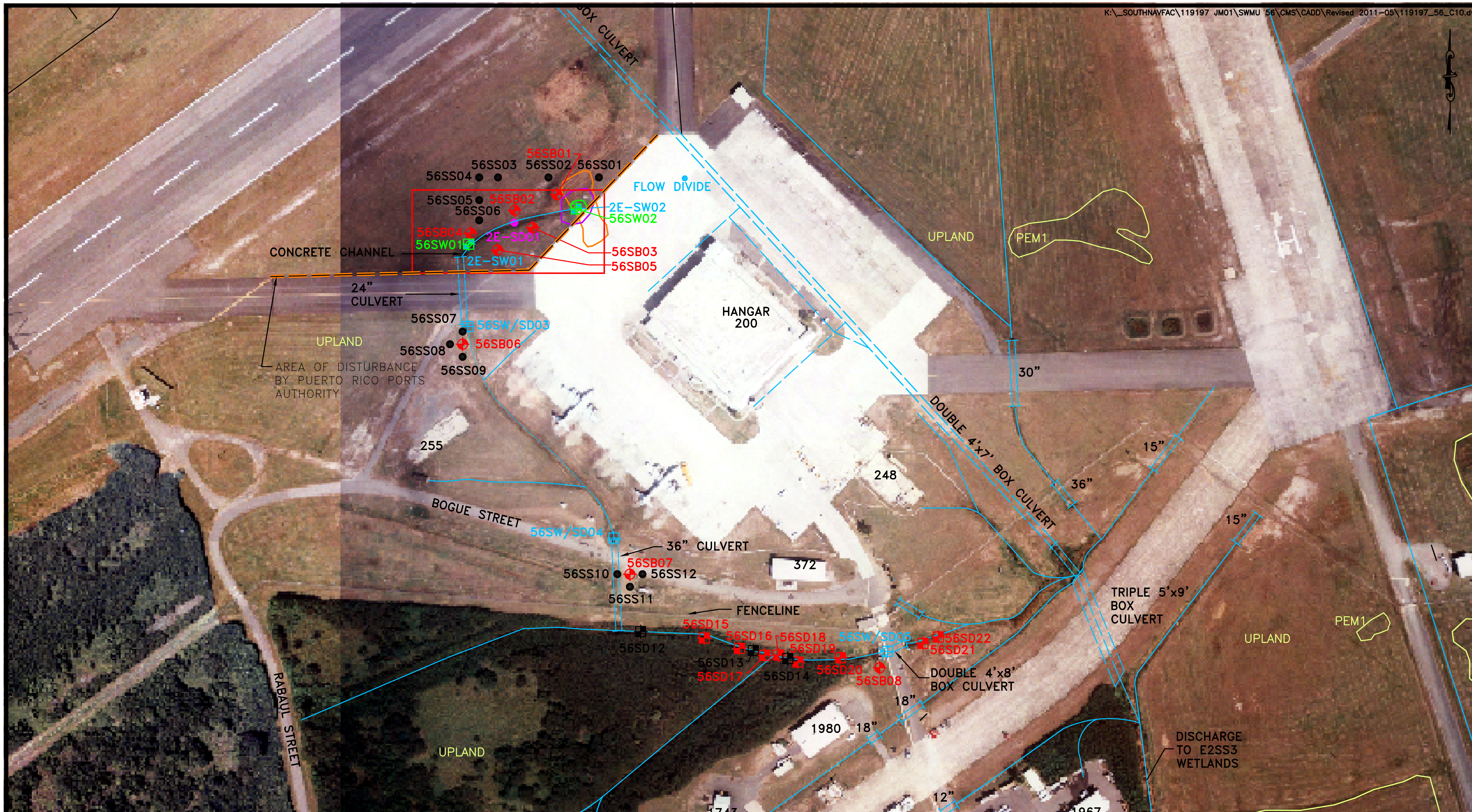
LEGEND

- 1958 POLYGON FEATURE
- 1961 POLYGON FEATURE
- 1964 POLYGON FEATURE
- DRAINAGE DITCH
- WETLAND DELINEATION
- SURFACE WATER SAMPLE LOCATION, 2004
- COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- SWMU BOUNDARY
- 1958 DRAINAGE
- 1961 DRAINAGE
- 1964 DRAINAGE

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

FIGURE 2-3
SITE LAYOUT AND 2004 ECP SAMPLE LOCATION MAP
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

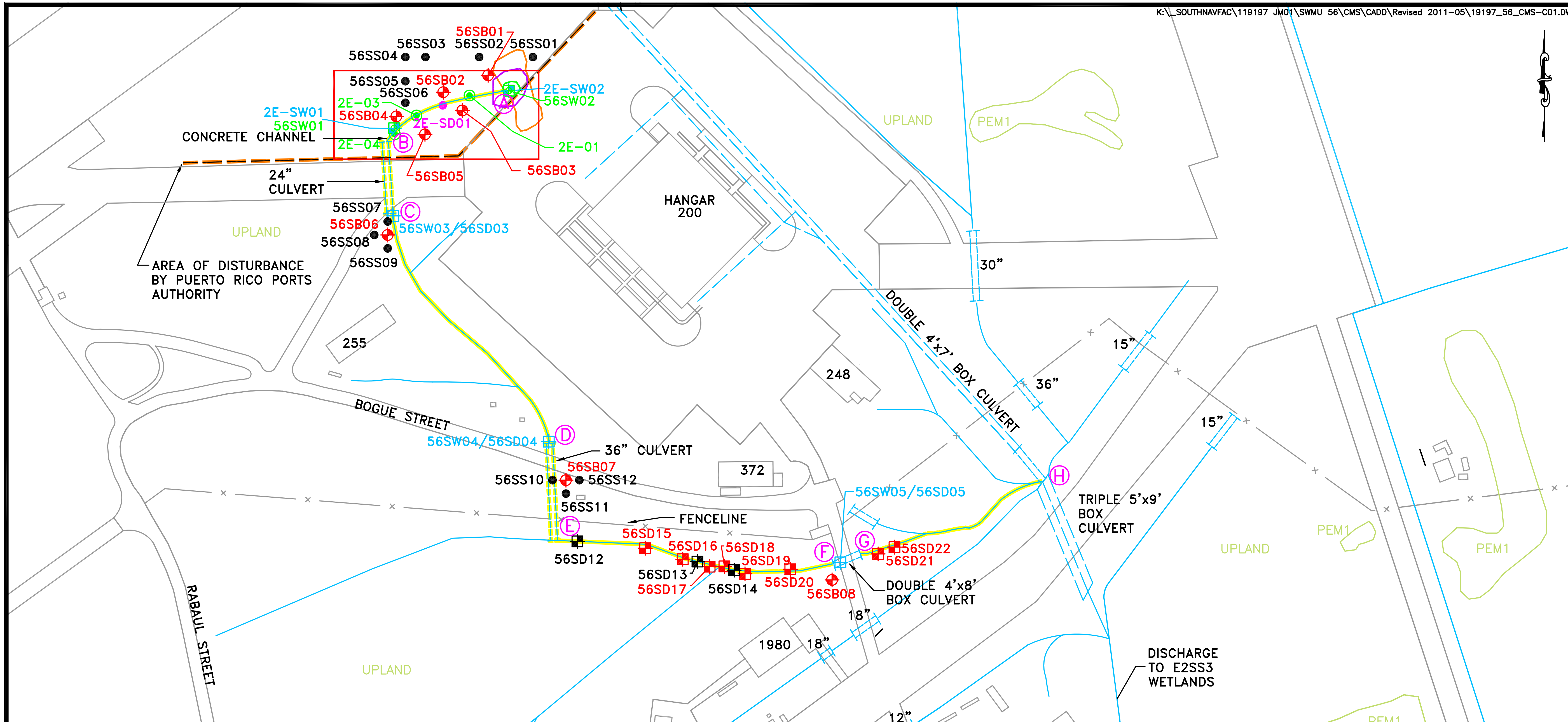
Baker

LEGEND

- PREVIOUS SURFACE WATER SAMPLE LOCATION (2004)
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH (2004)
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION (2008)
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS (2008)
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS (2008)
- SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- 1961 POLYGON FEATURE
- SWMU BOUNDARY
- 1958 POLYGON FEATURE
- 1964 POLYGON FEATURE
- WETLAND DELINEATION
- DRAINAGE DITCH
- CULVERTS
- AREA OF DISTURBANCE BY PUERTO RICO PORTS AUTHORITY

FIGURE 4-1
SAMPLE LOCATION MAP WITH 2000 AERIAL PHOTOGRAPH
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 56\CMS\CADD\Revised 2011-05\19197_56_CMS-C01.DWG



NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

DITCH SEGMENT	DESCRIPTION	APPROXIMATE LENGTH (FEET)	ESTIMATED WIDTH (FEET)	ESTIMATED DEPTH (FEET)
A - B	CONCRETE LINED	248.14	1.5	0.08
B - C	24" DIA CULVERT	133.4	2	0.08
C - D	SOIL	532.76	4	1.0
D - E	36" DIA. CULVERT	181.37	3	0.17
E - F	SOIL	526.85	4 TO 8	1.0
F - G	4x8' BOX CULVERT	53.48	8	–
G - H	SOIL	375.66	8 TO 10	VARIABLE

DRAINAGE DITCH / SEDIMENT CONTAMINATION

200 0 100 200
1 inch = 200 ft.

Baker

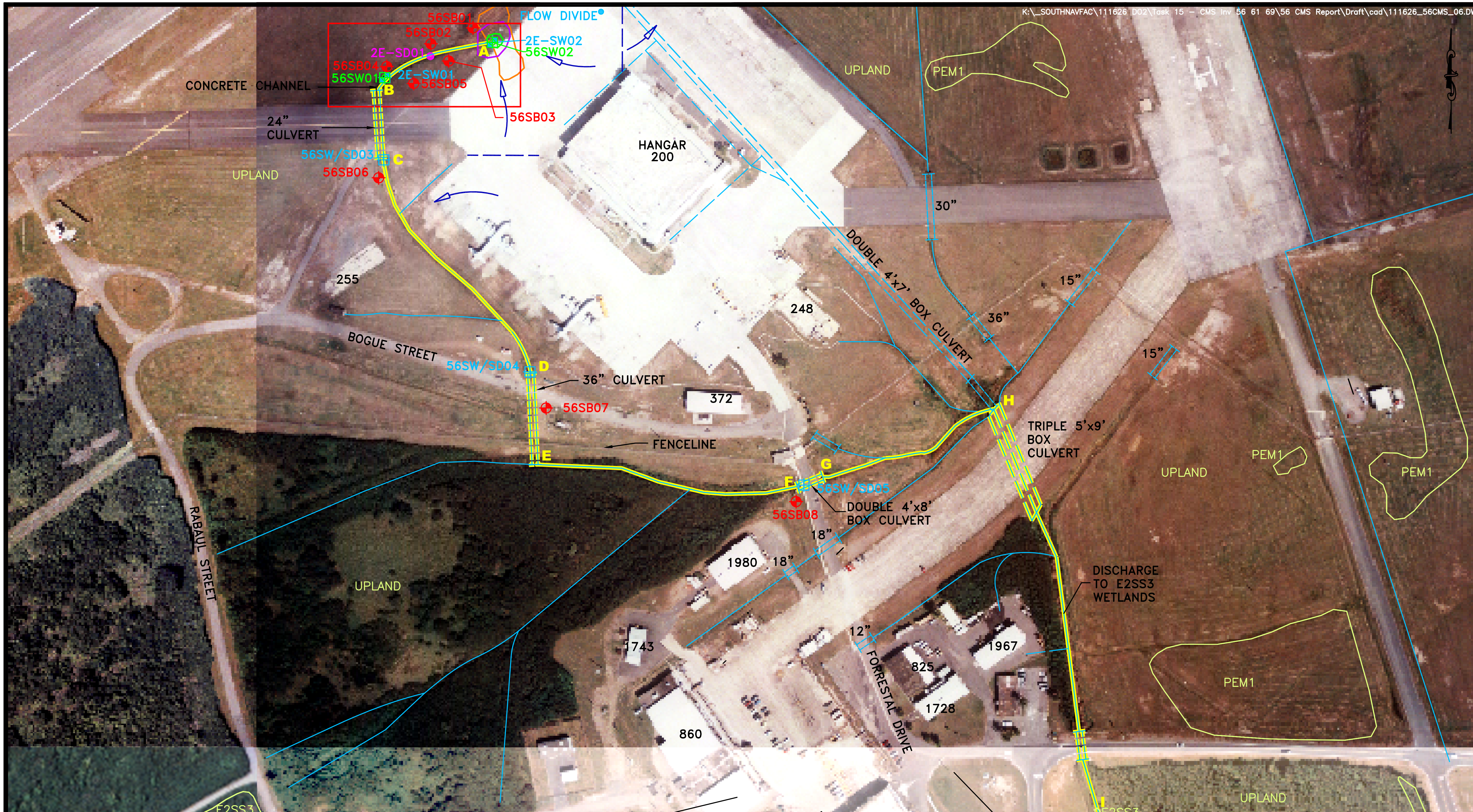
E2SS3

LEGEND

- PREVIOUS SURFACE WATER SAMPLE LOCATION (2004)
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH (2004)
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION (2008)
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS (2008)
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS (2008)
- SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- 1961 POLYGON FEATURE
- SWMU BOUNDARY
- 1958 POLYGON FEATURE
- 1964 POLYGON FEATURE
- WETLAND DELINEATION
- DRAINAGE DITCH
- CULVERTS
- AREA OF DISTURBANCE BY PUERTO RICO PORTS AUTHORITY

FIGURE 4-2
SAMPLE LOCATION MAP
WITHOUT AERIAL PHOTOGRAPH
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



DITCH SEGMENT	DESCRIPTION	APPROXIMATE LENGTH (FEET)	ESTIMATED WIDTH
A-B	CONCRETE LINED	248.14	1.5 FEET
B-C	24" DIA CULVERT	133.4	24" DIAMETER
C-D	SOIL	532.76	4 FEET
D-E	36"DIA. CULVERT	181.37	36" DIAMETER
E-F	SOIL	526.85	4 TO 8 FEET
F-G	4x8' BOX CULVERT	53.48	8 FEET
G-H	SOIL	375.66	8 TO 10 FEET
H-I	VARIABLE TO DISCHARGE	824.19	VARIABLE

DRAINAGE DITCH ASSOCIATED WITH SWMU 56 CMS INVESTIGATION
STORM SEWER

NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

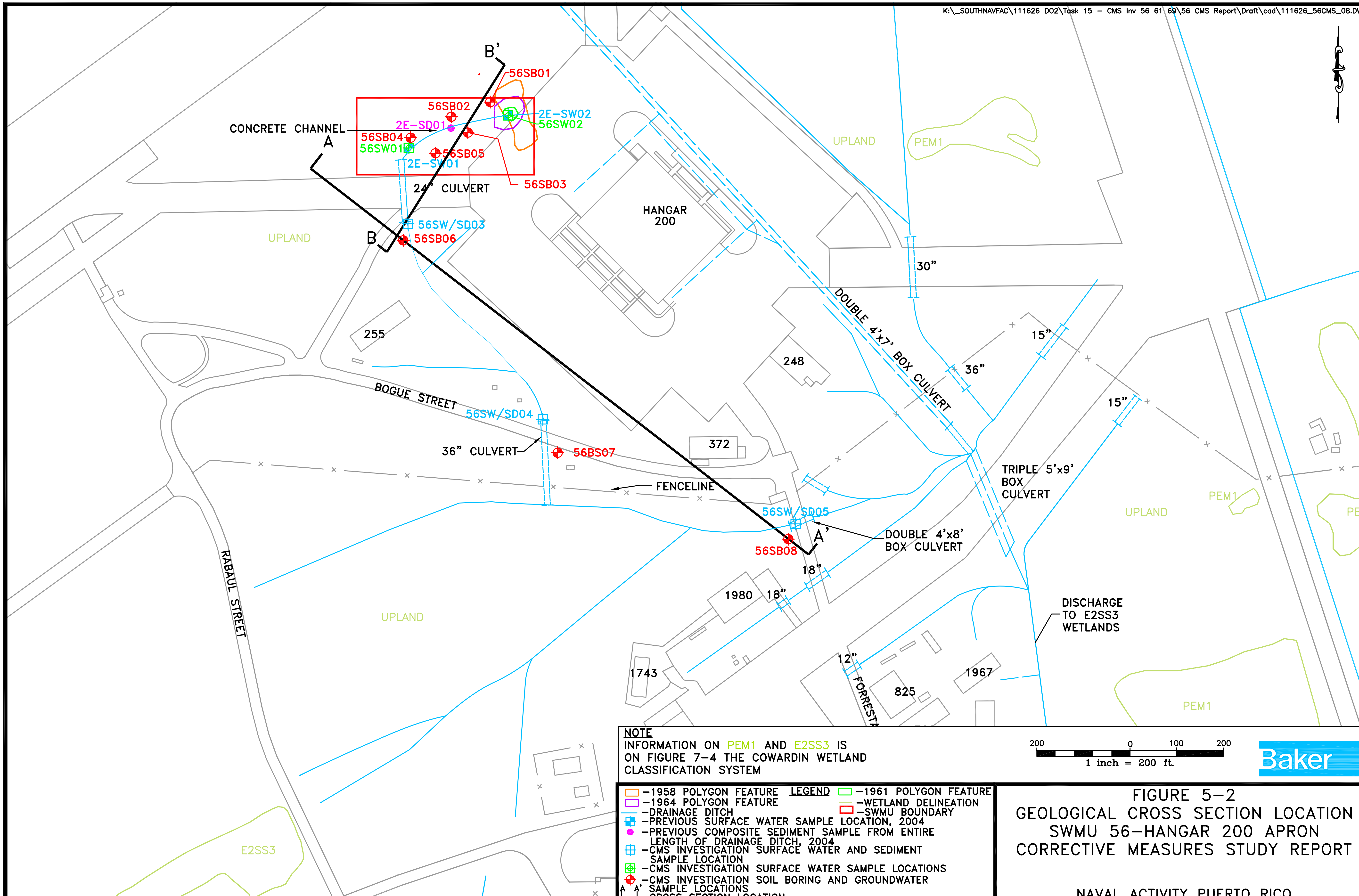
200 0 100 200
1 inch = 200 ft.

Baker

LEGEND
- 1958 POLYGON FEATURE
- 1961 POLYGON FEATURE
- 1964 POLYGON FEATURE
- WETLAND DELINEATION
- DRAINAGE DITCH
- SWMU BOUNDARY
- SURFACE WATER FLOW DIRECTION
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

FIGURE 5-1
SITE DRAINAGE FEATURES
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

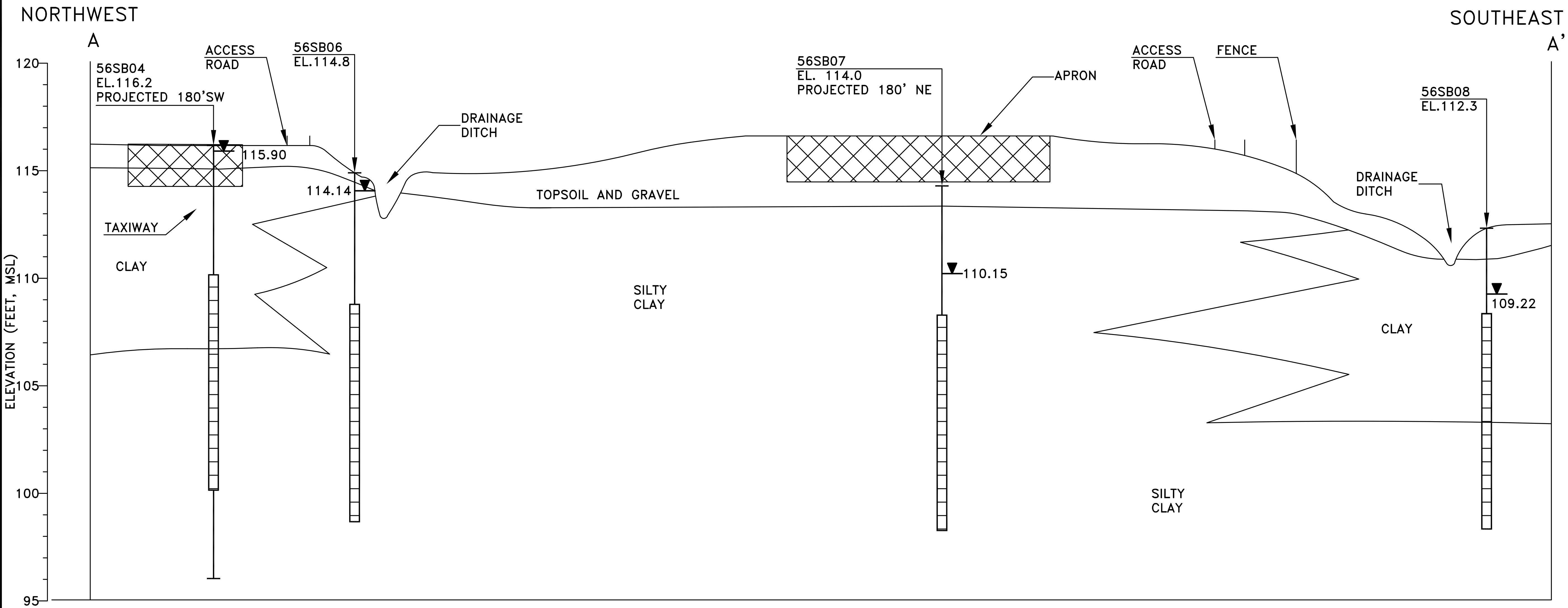
200 0 100 200
1 inch = 200 ft.

Baker

LEGEND
- 1958 POLYGON FEATURE
- 1964 POLYGON FEATURE
- DRAINAGE DITCH
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- A A' CROSS SECTION LOCATION
- 1961 POLYGON FEATURE
- WETLAND DELINEATION
- SWMU BOUNDARY

FIGURE 5-2
GEOLOGICAL CROSS SECTION LOCATION
SWMU 56–HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



GEOLOGIC CROSS–SECTION A–A'
LOOKING NORTH

Baker

LEGEND

ft.	FEET		WELL RISER
msl	MEAN SEA LEVEL		WELL SCREEN INTERVAL
———	ESTIMATED	------	PROJECTED
G.L.	GROUND SURFACE, ft. msl		
	GROUNDWATER ELEVATION ft. msl 05/07/08		

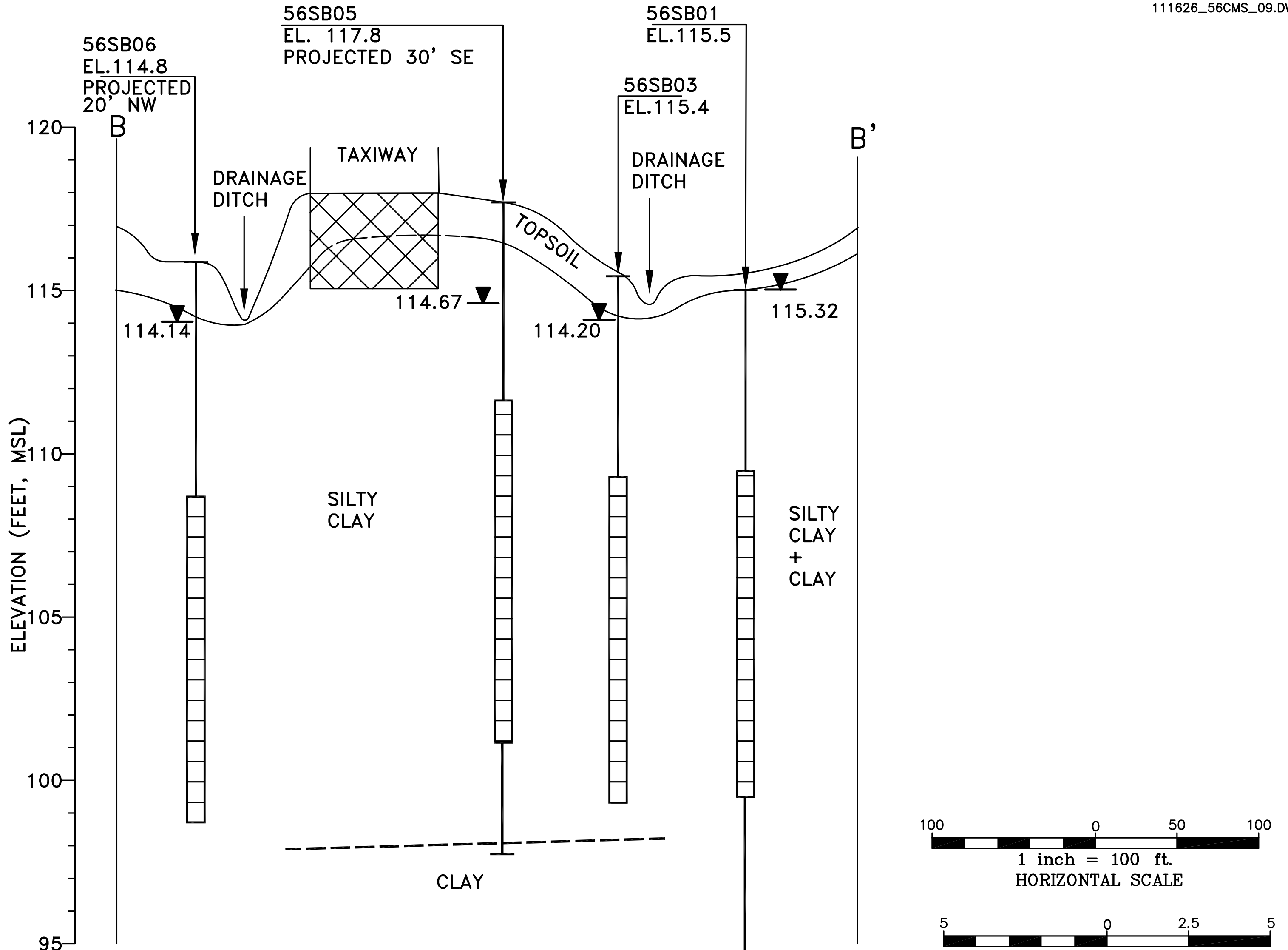
ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL PLUS 100 FEET

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 5–3
GEOLOGIC CROSS–SECTION A–A'
SWMU 56–HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

111626_56CMS_09.DWG



GEOLOGIC CROSS-SECTION B-B'

ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL PLUS 100 FEET

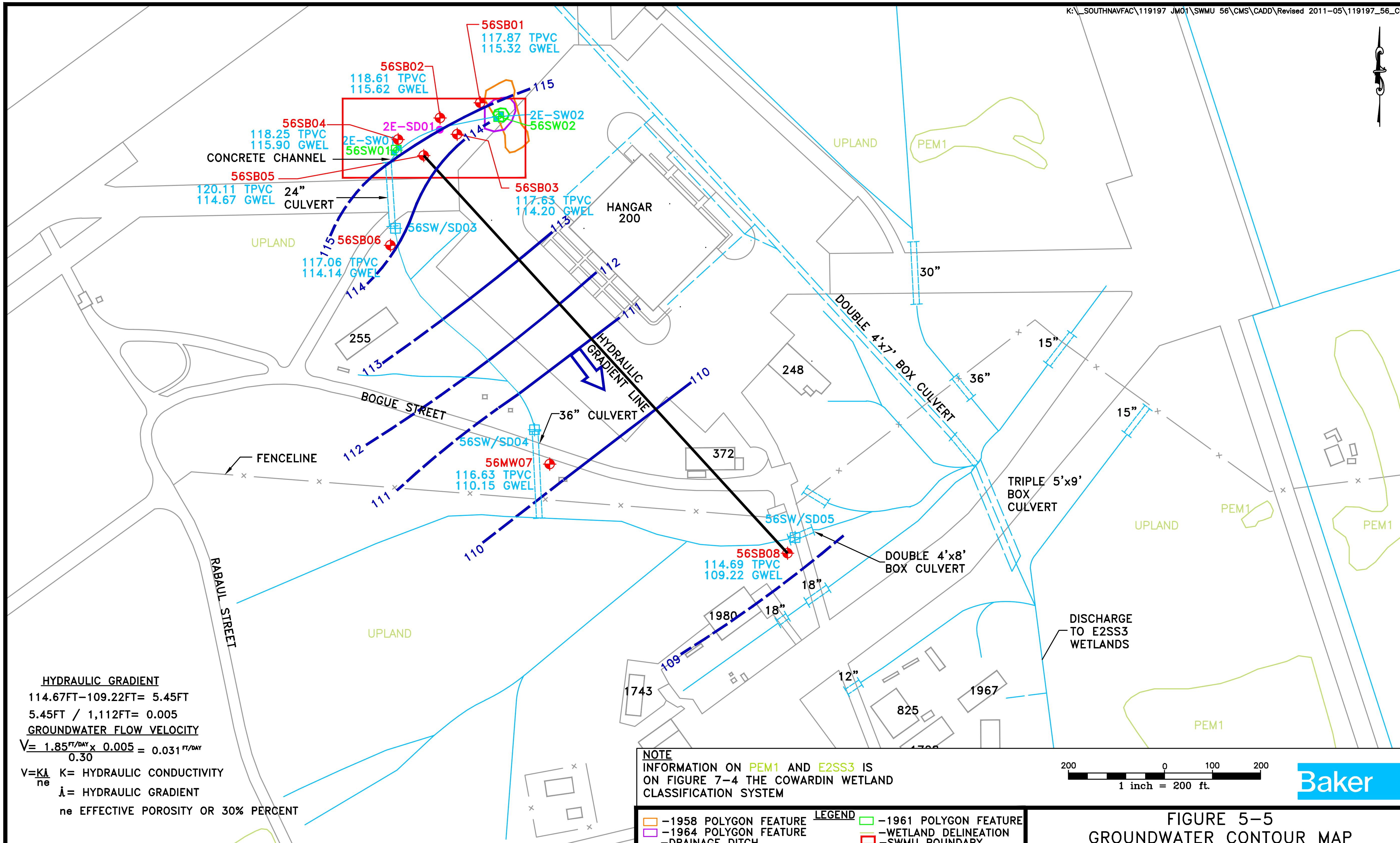
LEGEND

ft. FEET
msl MEAN SEA LEVEL —— PROJECTED
—— ESTIMATED
G.L. GROUND SURFACE, ft. msl
GROUNDWATER ELEVATION ft. msl 05/07/08
WELL RISER
WELL SCREEN INTERVAL

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 5-4
GEOLOGIC CROSS-SECTION B-B'
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



HYDRAULIC GRADIENT

114.67FT−109.22FT= 5.45FT

5.45FT / 1,112FT= 0.005

GROUNDWATER FLOW VELOCITY

$V= \frac{1.85^{FT/DAY} \times 0.005}{0.30} = 0.031^{FT/DAY}$

$V=\frac{Ki}{ne}$ K= HYDRAULIC CONDUCTIVITY

i= HYDRAULIC GRADIENT

ne EFFECTIVE POROSITY OR 30% PERCENT

GROUNDWATER LEGEND

— 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.

NOTE

INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200

1 inch = 200 ft.

Baker

LEGEND

- 1958 POLYGON FEATURE
- 1964 POLYGON FEATURE
- DRAINAGE DITCH
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- 1961 POLYGON FEATURE
- WETLAND DELINEATION
- SWMU BOUNDARY

FIGURE 5-5

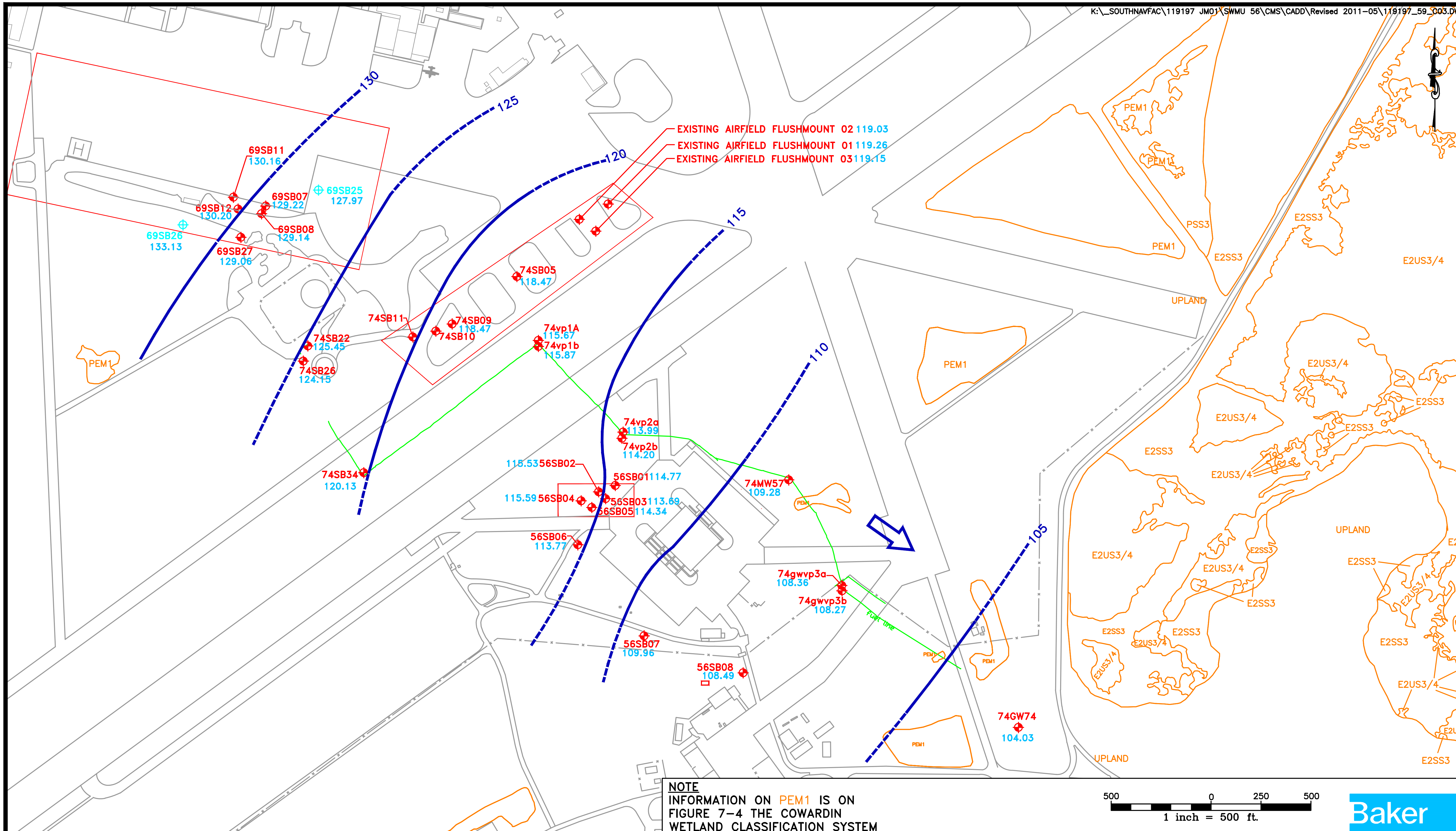
GROUNDWATER CONTOUR MAP

MAY 7, 2008

SWMU 56-HANGAR 200 APRON

CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

500 0 250 500
1 inch = 500 ft.

Baker

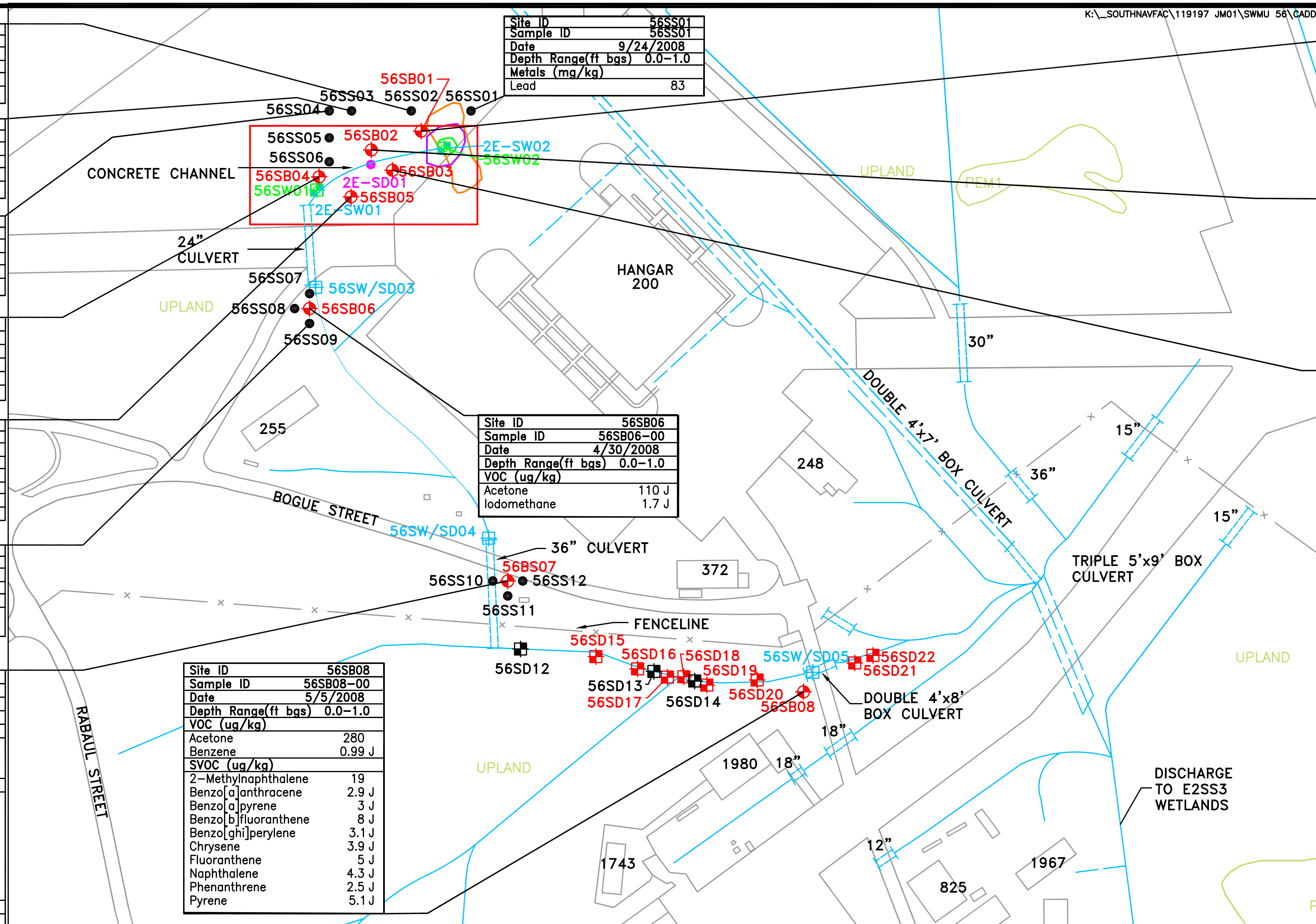
GROUNDWATER LEGEND
—ESTIMATED GROUNDWATER CONTOUR, FEET
—GROUNDWATER FLOW DIRECTION
ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL PLUS 100 FEET
DEPTH TO WATER MEASURED ON JULY 22, 2008

LEGEND
—SWMU BOUNDARY
108.49 —GROUNDWATER ELEVATION
—MONITORING WELL LOCATION (CMS 2008)
—SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS (CMS 2008)

FIGURE 5-6
REGIONAL GROUNDWATER CONTOUR MAP
JULY 22, 2008
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 56\CADD\Revised October 2010\119197_56CMS-F05.dwg



Site ID	56SS02
Sample ID	56SS02
Date	9/24/2008
Depth Range(ft bgs)	0.0-1.0
Metals (mg/kg)	
Selenium	2

Site ID	56SS03
Sample ID	56SS03
Date	9/24/2008
Depth Range(ft bgs)	0.0-1.0
Metals (mg/kg)	
Selenium	2.2

Site ID	56SS04
Sample ID	56SS04
Date	9/24/2008
Depth Range(ft bgs)	0.0-1.0
Metals (mg/kg)	
Selenium	3.5

Site ID	56SB04
Sample ID	56SB04-00
Date	4/28/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	23 J

Site ID	56SB05
Sample ID	56SB05-00
Date	4/29/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Benzene	0.95 J
Metals (mg/kg)	
Arsenic	3.4

Site ID	56SS09
Sample ID	56SS09
Date	9/24/2008
Depth Range(ft bgs)	0.0-1.0
Metals (mg/kg)	
Selenium	2.3
Vanadium	430

Site ID	56SB07
Sample ID	56SB07-00
Date	5/1/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	260
Carbon disulfide	1.9 J
Iodomethane	2.4 J
SVOC (ug/kg)	
Benzo[a]anthracene	2.4 J
Benzo[a]pyrene	2.8 J
Benzo[b]fluoranthene	3.1 J
Benzo[k]fluoranthene	1.5 J
Chrysene	2.2 J
Indeno[123-cd]pyrene	1.9 J
Naphthalene	1.9 J
Pyrene	5.4 J
Metals (mg/kg)	
Arsenic	3
Cobalt	50 J

Site ID	56SS01
Sample ID	56SS01
Date	9/24/2008
Depth Range(ft bgs)	0.0-1.0
Metals (mg/kg)	
Lead	83

Site ID	56SB06
Sample ID	56SB06-00
Date	4/30/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	110 J
Iodomethane	1.7 J

Site ID	56SB08
Sample ID	56SB08-00
Date	5/5/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	280
Benzene	0.99 J
SVOC (ug/kg)	
2-Methylnaphthalene	19
Benzo[a]anthracene	2.9 J
Benzo[a]pyrene	3 J
Benzo[b]fluoranthene	8 J
Benzo[ghi]perylene	3.1 J
Chrysene	3.9 J
Fluoranthene	5 J
Naphthalene	4.3 J
Phenanthrene	2.5 J
Pyrene	5.1 J

Site ID	56SB01
Sample ID	56SB01-00
Date	4/28/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	50 J
Iodomethane	1 J
Metals (mg/kg)	
Cadmium	3.3 J
Lead	210

Site ID	56SB02
Sample ID	56SB02-00
Date	4/28/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	89 J
Metals (mg/kg)	
Arsenic	2.4
Selenium	2.7

Site ID	56SB03
Sample ID	56SB03-00
Date	4/29/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	130 J
Chloromethane	1.1 J
Iodomethane	2.2 J
SVOC (ug/kg)	
Benzo[a]pyrene	3.6 J
Benzo[b]fluoranthene	9.2 J
Chrysene	2.9 J
Fluoranthene	2.2 J
Pyrene	3.6 J
Metals (mg/kg)	
Arsenic	2.9

Site ID	56SB03
Sample ID	56SB03-00D
Date	4/29/2008
Depth Range(ft bgs)	0.0-1.0
VOC (ug/kg)	
Acetone	270 J
Chloromethane	2.2 J
Iodomethane	1.8 J
SVOC (ug/kg)	
Benzo[a]anthracene	9.2 J
Benzo[a]pyrene	20 J
Benzo[b]fluoranthene	44 J
Benzo[ghi]perylene	17 J
Butyl benzyl phthalate	10 J
Chrysene	36 J
Dibenz(ah)anthracene	2.9 J
Fluoranthene	9.2 J
Indeno[123-cd]pyrene	7.5 J
Phenanthrene	2.3 J
Pyrene	16 J
Metals (mg/kg)	
Arsenic	2.8

NOTE

INFORMATION ON PEM1 IS ON FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

NAPR basewide background screening value not established for VOCs, SVOCs, or Silver.

J -Estimated value
ft bgs -feet below ground surface
ug/kg -micrograms per kilogram
mg/kg -miligrams per kilogram

LEGEND

- WETLAND DELINEATION
- SWMU BOUNDARY
- 1958 POLYGON FEATURE
- 1961 POLYGON FEATURE
- 1964 POLYGON FEATURE
- DRAINAGE DITCH
- SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

FIGURE 6-1
DETECTED ORGANICS AND DETECTED INORGANICS IN EXCESS OF BACKGROUND IN SURFACE SOIL
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

Site ID	56SB04
Sample ID	56SB04-03
Date	4/28/2008
Depth Range(ft bgs)	5.0-7.0
VOC (ug/kg)	
Acetone	17 J
SVOC (ug/kg)	
Benzo[a]anthracene	4 J
Benzo[a]pyrene	4.2 J
Benzo[k]fluoranthene	8.6 J
Chrysene	6.9 J
Fluoranthene	5.7 J
Pyrene	8.1 J

Site ID	56SB04
Sample ID	56SB04-04
Date	4/28/2008
Depth Range(ft bgs)	7.0-9.0
VOC (ug/kg)	
Acetone	11 J
Metals (mg/kg)	
Vanadium	380 J

Site ID	56SB05
Sample ID	56SB05-03
Date	4/29/2008
Depth Range(ft bgs)	5.0-7.0
VOC (ug/kg)	
Acetone	99 J

Site ID	56SB05
Sample ID	56SB05-05
Date	4/29/2008
Depth Range(ft bgs)	9.0-10.0
VOC (ug/kg)	
Acetone	95 J
SVOC (ug/kg)	
Di-n-butyl phthalate	41 J
Metals (mg/kg)	
Barium	470 J
Chromium	120 J

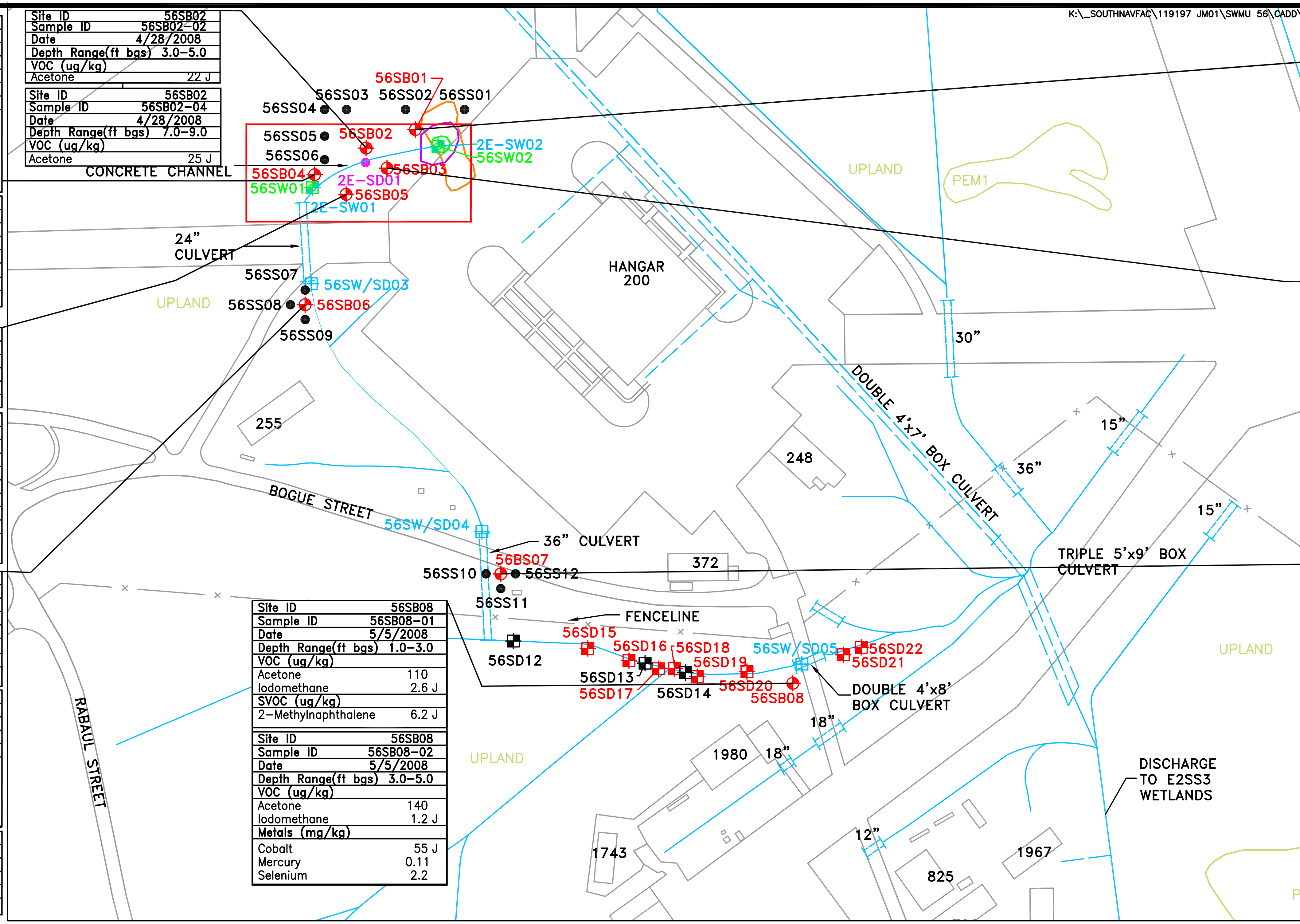
Site ID	56SB06
Sample ID	56SB06-01
Date	4/30/2008
Depth Range(ft bgs)	1.0-3.0
VOC (ug/kg)	
Acetone	50 J
Metals (mg/kg)	
Selenium	2.3 J

Site ID	56SB06
Sample ID	56SB06-03
Date	4/30/2008
Depth Range(ft bgs)	5.0-7.0
Metals (mg/kg)	
Arsenic	2.6
Chromium	70 J
Lead	11 J
Mercury	0.11 J
Vanadium	410 J

Site ID	56SB06
Sample ID	56SB06-01D
Date	4/30/2008
Depth Range(ft bgs)	5.0-7.0
Metals (mg/kg)	
Selenium	2.3 J

Site ID	56SB02
Sample ID	56SB02-02
Date	4/28/2008
Depth Range(ft bgs)	3.0-5.0
VOC (ug/kg)	
Acetone	22 J

Site ID	56SB02
Sample ID	56SB02-04
Date	4/28/2008
Depth Range(ft bgs)	7.0-9.0
VOC (ug/kg)	
Acetone	25 J



Site ID	56SB08
Sample ID	56SB08-01
Date	5/5/2008
Depth Range(ft bgs)	1.0-3.0
VOC (ug/kg)	
Acetone	110
Iodomethane	2.6 J
SVOC (ug/kg)	
2-Methylnaphthalene	6.2 J

Site ID	56SB08
Sample ID	56SB08-02
Date	5/5/2008
Depth Range(ft bgs)	3.0-5.0
VOC (ug/kg)	
Acetone	140
Iodomethane	1.2 J
Metals (mg/kg)	
Cobalt	55 J
Mercury	0.11
Selenium	2.2

Site ID	56SB01
Sample ID	56SB01-01
Date	4/28/2008
Depth Range(ft bgs)	1.0-3.0
VOC (ug/kg)	
Acetone	8.3 J
Metals (mg/kg)	
Selenium	2.9

Site ID	56SB01
Sample ID	56SB01-04
Date	4/28/2008
Depth Range(ft bgs)	7.0-9.0
VOC (ug/kg)	
Acetone	9.7 J

Site ID	56SB03
Sample ID	56SB03-02
Date	4/29/2008
Depth Range(ft bgs)	3.0-5.0
VOC (ug/kg)	
Acetone	120 J

Site ID	56SB03
Sample ID	56SB03-04
Date	4/29/2008
Depth Range(ft bgs)	7.0-9.0
VOC (ug/kg)	
Acetone	49 J
Metals (mg/kg)	
Arsenic	3.4
Mercury	0.74 J
Selenium	2.2 J
Vanadium	470 J

Site ID	56SB07
Sample ID	56SB07-02
Date	5/1/2008
Depth Range(ft bgs)	3.0-5.0
VOC (ug/kg)	
Acetone	260
Carbon disulfide	1.9 J
Iodomethane	1.7 J
SVOC (ug/kg)	
Benzo[a]pyrene	1.2 J
Benzo[b]fluoranthene	1 J
Chrysene	1 J
Metals (mg/kg)	
Arsenic	2.4
Mercury	0.13 J

NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

NAPR basewide background screening value not established for VOCs, SVOCs or Silver

J -Estimated value
ft bgs -feet below ground surface
ug/kg -micrograms per kilogram
mg/kg -miligrams per kilogram

LEGEND

- -WETLAND DELINEATION
- -SWMU BOUNDARY
- -1958 POLYGON FEATURE
- -1961 POLYGON FEATURE
- -1964 POLYGON FEATURE
- -DRAINAGE DITCH
- -SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- -SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- -SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- -PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- -PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- -CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- -CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- -CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

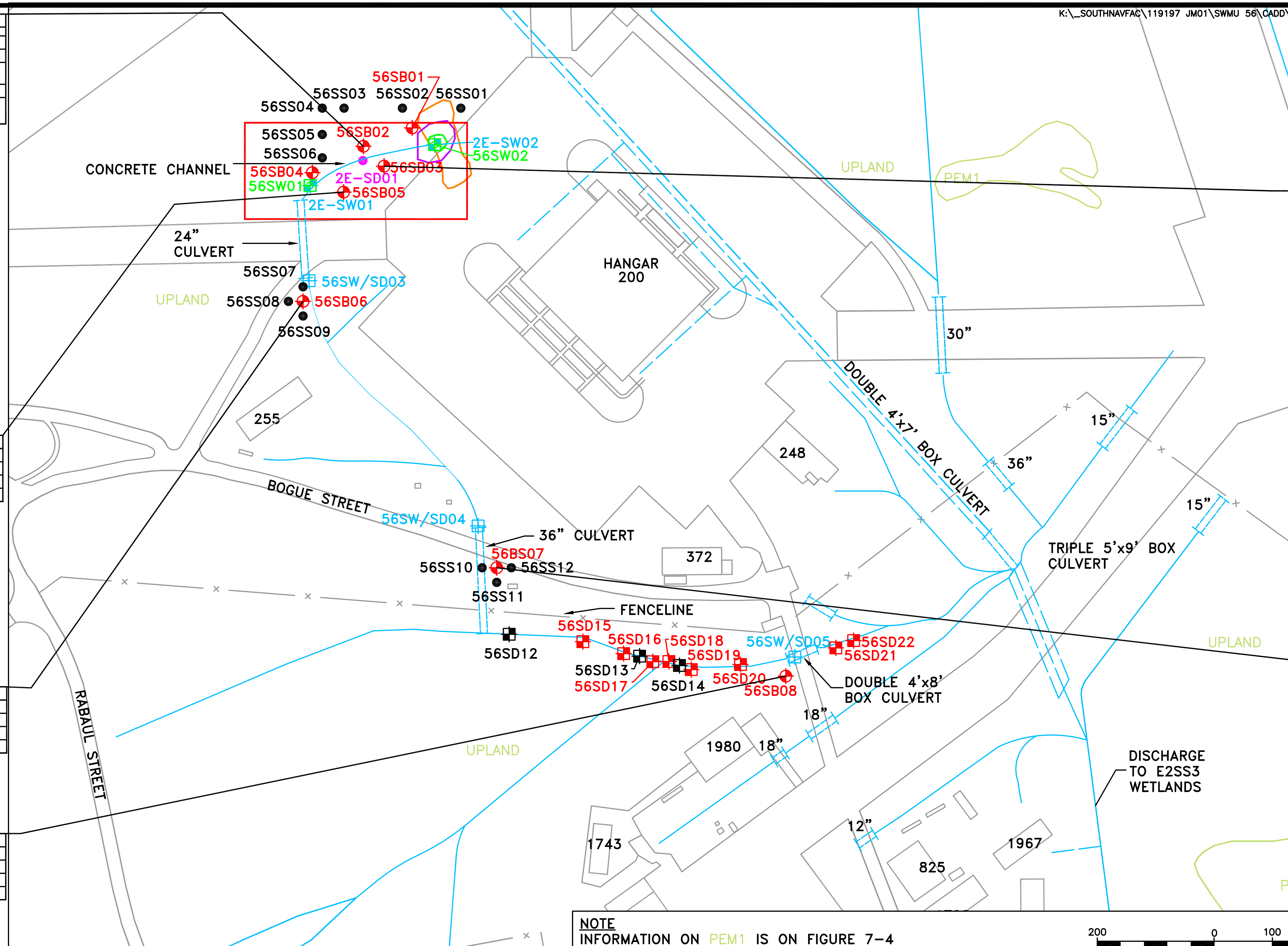
FIGURE 6-2
DETECTED ORGANICS AND DETECTED INORGANICS IN EXCESS OF BACKGROUND IN SUBSURFACE SOIL
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

Site ID	56SB02
Sample ID	56GW02
Date	5/1/2008
VOCs (ug/L)	
Acetone	5.2 J
1,4-Dichlorobenzene	0.16 J
SVOC (ug/L)	
Bis(2-ethylhexyl)phthalate	0.98
Diethyl phthalate	0.32 J

Site ID	56SB05
Sample ID	56GW05
Date	5/2/2008
VOCs (ug/L)	
Acetone	7.1 J

Site ID	56SB06
Sample ID	56GW06
Date	5/3/2008
SVOC (mg/L)	5/3/2008
Phenanthrene	0.05 J

Site ID	56SB08
Sample ID	56GW08
Date	5/7/2008
SVOC (mg/L)	
3 & 4 Methylphenol	0.63 J



Site ID	56SB03
Sample ID	56GW03
Date	5/1/2008
VOCs (ug/L)	
Chloromethane	1.8 J

Site ID	56SB07
Sample ID	56GW07
Date	5/3/2008
SVOC (mg/L)	
Anthracene	0.033 J
Fluoranthene	0.056 J
Fluorene	0.055 J
Phenanthrene	0.39

NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

NAPR basewide background screening value not established for VOCs, SVOCs or Thallium.

J -Estimated value
ft bgs -feet below ground surface
ug/L -micrograms per liter
mg/L -miligrams per liter

No detected inorganics exceeded the NAPR basewide background screening value for groundwater

LEGEND

- 1958 POLYGON FEATURE
- 1961 POLYGON FEATURE
- 1964 POLYGON FEATURE
- WETLAND DELINEATION
- DRAINAGE DITCH
- SWMU BOUNDARY
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

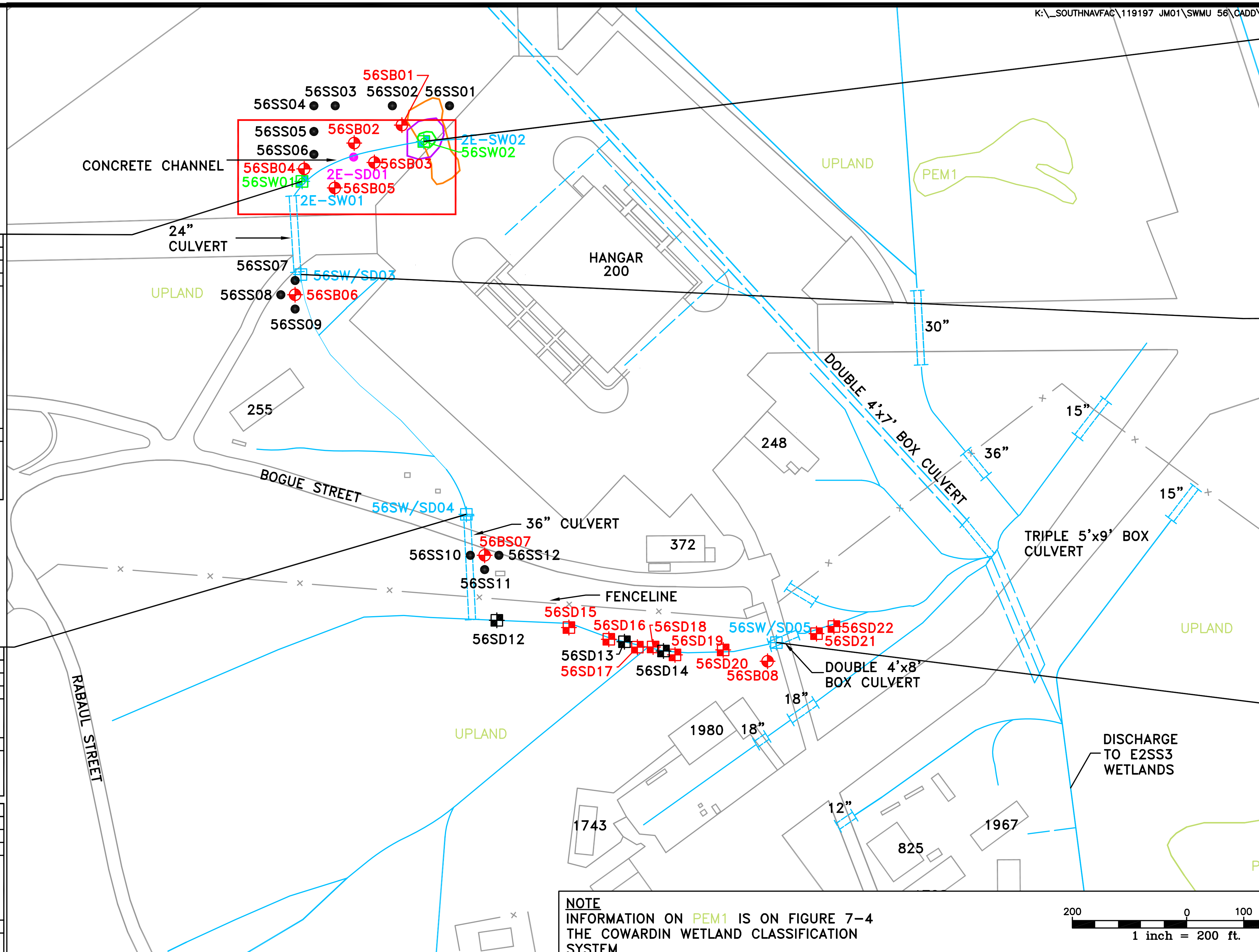
FIGURE 6-3
DETECTED ORGANICS AND DETECTED INORGANICS IN EXCESS OF BACKGROUND IN GROUNDWATER
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 56\CADD\Revised October 2010\119197_56CMS-F05.dwg

Site ID	56SW01
Sample ID	56SW01
Date	4/29/2008
Total Metals (ug/L)	
Arsenic	3.2
Barium	60
Cadmium	1.1 J
Chromium	6.3
Cobalt	3.1
Copper	13
Lead	16
Nickel	3.8
Selenium	0.71 J
Vanadium	22
Zinc	46
Dissolved Metals (ug/L)	
Barium	33
Cobalt	3.7
Nickel	2.1
Zinc	8.8 J

Site ID	56SW04
Sample ID	56SW04
Date	4/29/2008
Total Metals (ug/L)	
Barium	35
Lead	0.55 J
Nickel	0.43 J
Dissolved Metals (ug/L)	
Barium	33
Lead	0.47 J
Nickel	0.82 J

Site ID	56SW04D
Sample ID	56SW04D
Date	4/29/2008
Total Metals (ug/L)	
Barium	35
Copper	1.4 J
Lead	0.73 J
Nickel	0.43 J
Zinc	8.6 J
Dissolved Metals (ug/L)	
Barium	33
Nickel	0.47 J



Site ID	56SW02
Sample ID	56SW02
Date	4/29/2008
Total Metals (ug/L)	
Barium	15
Copper	2.3 J
Lead	0.25 J
Nickel	0.52 J
Vanadium	5.2
Dissolved Metals (ug/L)	
Barium	14
Copper	2 J
Lead	0.17 J
Nickel	1
Zinc	6.7 J

Site ID	56SW03
Sample ID	56SW03
Date	4/29/2008
Total Metals (ug/L)	
Barium	13
Copper	3.1 J
Lead	0.43 J
Nickel	0.53 J
Vanadium	6
Zinc	6.6 J
Dissolved Metals (ug/L)	
Barium	12
Copper	2.6 J
Nickel	1.2

Site ID	56SW05
Sample ID	56SW05
Date	4/29/2008
Total Metals (ug/L)	
Barium	86
Copper	2.4 J
Lead	0.21 J
Nickel	1.3
Vanadium	5.3
Zinc	6.5 J
Dissolved Metals (ug/L)	
Barium	84
Copper	1.9 J
Nickel	1.6

NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

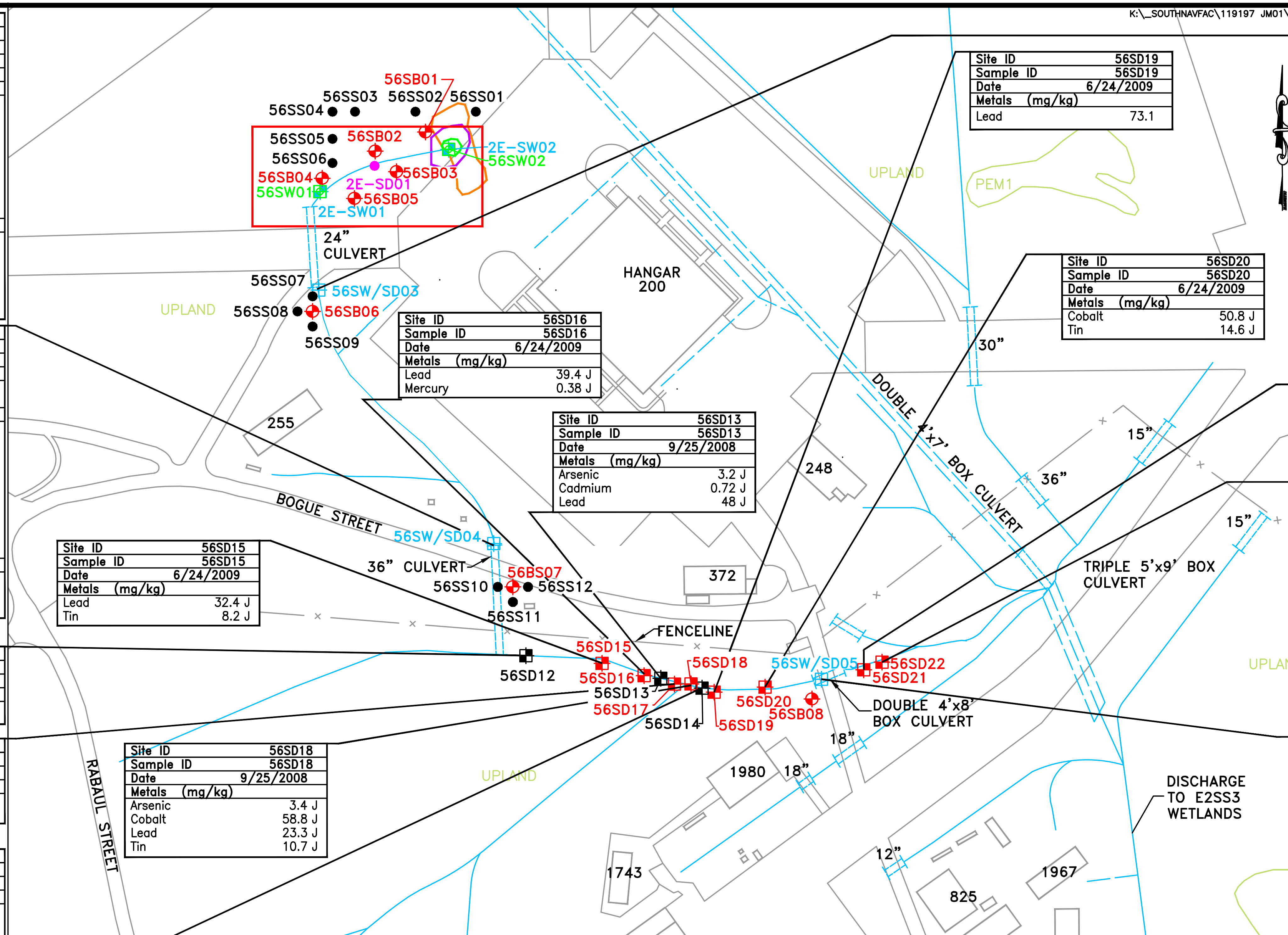
Baker

NAPR basewide background screening value not established for fresh surface water
J -Estimated value
ug/L -micrograms per liter

LEGEND
- -1958 POLYGON FEATURE
- -1961 POLYGON FEATURE
- -1964 POLYGON FEATURE
- -WETLAND DELINEATION
- -DRAINAGE DITCH
- -SWMU BOUNDARY
- -PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- -PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- -CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- -CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- -CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

FIGURE 6-4
DETECTED CONCENTRATIONS IN SURFACE WATER
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



Site ID	56SD04
Sample ID	56SD04
Date	4/29/2008
VOC (ug/kg)	
Carbon disulfide	19 J
SVOC (ug/kg)	
Benzo[a]anthracene	58 J
Benzo[a]pyrene	85 J
Benzo[ghi]perylene	46 J
Benzo[k]fluoranthene	160 J
Chrysene	87 J
Fluoranthene	79 J
Indeno[123-cd]pyrene	32 J
Phenanthrene	19 J
Pyrene	110 J
Metals (mg/kg)	
Arsenic	4.2 J
Cadmium	3.9 J
Lead	110 J
Nickel	19 J
Selenium	4.2 J
Vanadium	250 J

Site ID	56SD04D
Sample ID	56SD04D
Date	4/29/2008
VOC (ug/kg)	
Acetone	250 J
Carbon disulfide	15 J
SVOC (ug/kg)	
Benzo[a]anthracene	28 J
Benzo[a]pyrene	39 J
Benzo[b]fluoranthene	77 J
Benzo[ghi]perylene	31 J
Chrysene	36 J
Fluoranthene	32 J
Indeno[123-cd]pyrene	19 J
Phenanthrene	13 J
Phenol	19 J
Pyrene	51 J
Metals (mg/kg)	
Arsenic	3 J
Cadmium	3.4 J
Lead	160 J

Site ID	56SD12
Sample ID	56SD12
Date	9/25/2008
Metals (mg/kg)	
Cadmium	0.54 J

Site ID	56SD17
Sample ID	56SD17
Date	6/24/2009
Metals (mg/kg)	
Lead	45.7 J
Tin	13.6 J

Site ID	56SD14
Sample ID	56SD14
Date	9/25/2008
Metals (mg/kg)	
Arsenic	4 J
Cadmium	0.23 J
Cobalt	59 J
Lead	54 J
Nickel	19 J

Site ID	56SD14D
Sample ID	56SD14D
Date	9/25/2008
Metals (mg/kg)	
Arsenic	3.4 J
Cadmium	0.39 J
Lead	34 J
Tin	260 J

Site ID	56SD16
Sample ID	56SD16
Date	6/24/2009
Metals (mg/kg)	
Lead	39.4 J
Mercury	0.38 J

Site ID	56SD13
Sample ID	56SD13
Date	9/25/2008
Metals (mg/kg)	
Arsenic	3.2 J
Cadmium	0.72 J
Lead	48 J

Site ID	56SD15
Sample ID	56SD15
Date	6/24/2009
Metals (mg/kg)	
Lead	32.4 J
Tin	8.2 J

Site ID	56SD18
Sample ID	56SD18
Date	9/25/2008
Metals (mg/kg)	
Arsenic	3.4 J
Cobalt	58.8 J
Lead	23.3 J
Tin	10.7 J

Site ID	56SD19
Sample ID	56SD19
Date	6/24/2009
Metals (mg/kg)	
Lead	73.1

Site ID	56SD20
Sample ID	56SD20
Date	6/24/2009
Metals (mg/kg)	
Cobalt	50.8 J
Tin	14.6 J

Site ID	56SD03
Sample ID	56SD03
Date	4/29/2008
VOC (ug/kg)	
2-Butanone (MEK)	65 J
Acetone	200 J
SVOC (ug/kg)	
Benzo[a]anthracene	270 J
Benzo[a]pyrene	300 J
Benzo[ghi]perylene	150 J
Benzo[k]fluoranthene	630 J
Bis(2-ethylhexyl)phthalate	260 J
Butyl benzyl phthalate	22 J
Chrysene	410 J
Dibenz(ah)anthracene	52 J
Fluoranthene	350 J
Indeno[123-cd]pyrene	110 J
Phenanthrene	21 J
Pyrene	570 J
Metals (mg/kg)	
Arsenic	3.9 J
Cadmium	2.6 J
Lead	280 J

Site ID	56SD21
Sample ID	56SD21
Date	6/24/2009
Metals (mg/kg)	
Lead	19.7 J
Tin	10.1 J

Site ID	56SD22
Sample ID	56SD22
Date	6/24/2009
Metals (mg/kg)	
Arsenic	10.4 J
Barium	571 J
Cobalt	91.4 J
Lead	22 J
Nickel	19.1 J
Tin	16 J

Site ID	56SD22D
Sample ID	56SD22D
Date	6/24/2009
Metals (mg/kg)	
Cobalt	47.6 J
Tin	14.1 J

Site ID	56SD05
Sample ID	56SD05
Date	4/29/2008
VOC (ug/kg)	
Acetone	1200 J
Carbon disulfide	800 J
Iodomethane	36 J
SVOC (ug/kg)	
Benzyl alcohol	47 J
Chrysene	7.1 J
Metals (mg/kg)	
Arsenic	3.8 J
Cadmium	0.54 J
Lead	25 J

ug/kg -micrograms per kilogram
mg/kg -miligrams per kilogram

NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

LEGEND
- WETLAND DELINEATION
- SWMU BOUNDARY
- 1958 POLYGON FEATURE
- 1961 POLYGON FEATURE
- 1964 POLYGON FEATURE
- DRAINAGE DITCH
- SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

FIGURE 6-5
DETECTED CONCENTRATIONS IN SEDIMENT IN EXCESS OF BACKGROUND
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

Figure 7-1
Navy Ecological Risk Assessment Tiered Approach

Remedial Project Manager Input and Risk Management Consideration[3]

<u>Tier 1. Screening-Level Ecological Risk Assessment (SERA)</u>: Identify pathways and compare exposure point concentrations to bench marks.

Step 1: Site visit; Pathway Identification/Problem Formulation; Toxicity Evaluation

Step 2: Exposure Estimate; Risk Calculation (SMDP) [1]

Proceed to Exit Criteria for SERA

Exit Criteria for the Screening-Level Ecological Risk Assessment: Decision for exiting or continuing the ecological risk assessment.

1) Site passes screening-level risk assessment: A determination is made that the site poses acceptable risk and shall be closed out for ecological concerns.

2) Site fails screening-level risk assessment: The site must have both complete pathway and unacceptable risk. As a result the site will either have an interim cleanup or moves to the second tier.

<u>Tier 2. Baseline Ecological Risk Assessment (BERA)</u>: Detailed assessment of exposure and hazard to "assessment endpoints" (ecological qualities to be protected). Develop site specific values that are protective of the environment.

Step 3a: Refinement of Conservative Exposure Assumptions[2]
Proceed to Exit Criteria for Step 3a

Step 3b: Problem Formulation - Toxicity Evaluation; Assessment Endpoints; Conceptual Model; Risk Hypothesis (SMDP)

Step 4: Study Design/Data Quality Objectives - Lines of Evidence; Measurement Endpoints; Work Plan and Sampling & Analysis Plan (SMDP)

Step 5: Verification of Field Sampling Design (SMDP)

Step 6: Site Investigation and Data Analysis (SMDP)

Step 7: Risk Characterization

Proceed to Exit Criteria for BERA

Exit Criteria Step 3a Refinement

1) If re-evaluation of the conservative exposure assumptions support an acceptable risk determination then the site exits the ecological risk assessment process.

2) If re-evaluation of the conservative exposure assumptions do not support an acceptable risk determination then the site continues in the Baseline Ecological Risk Assessment process.

Proceed to Step 3b.

Exit Criteria Baseline Ecological Risk Assessment

1) If the site poses acceptable risk then no further evaluation and no remediation from an ecological perspective is warranted.

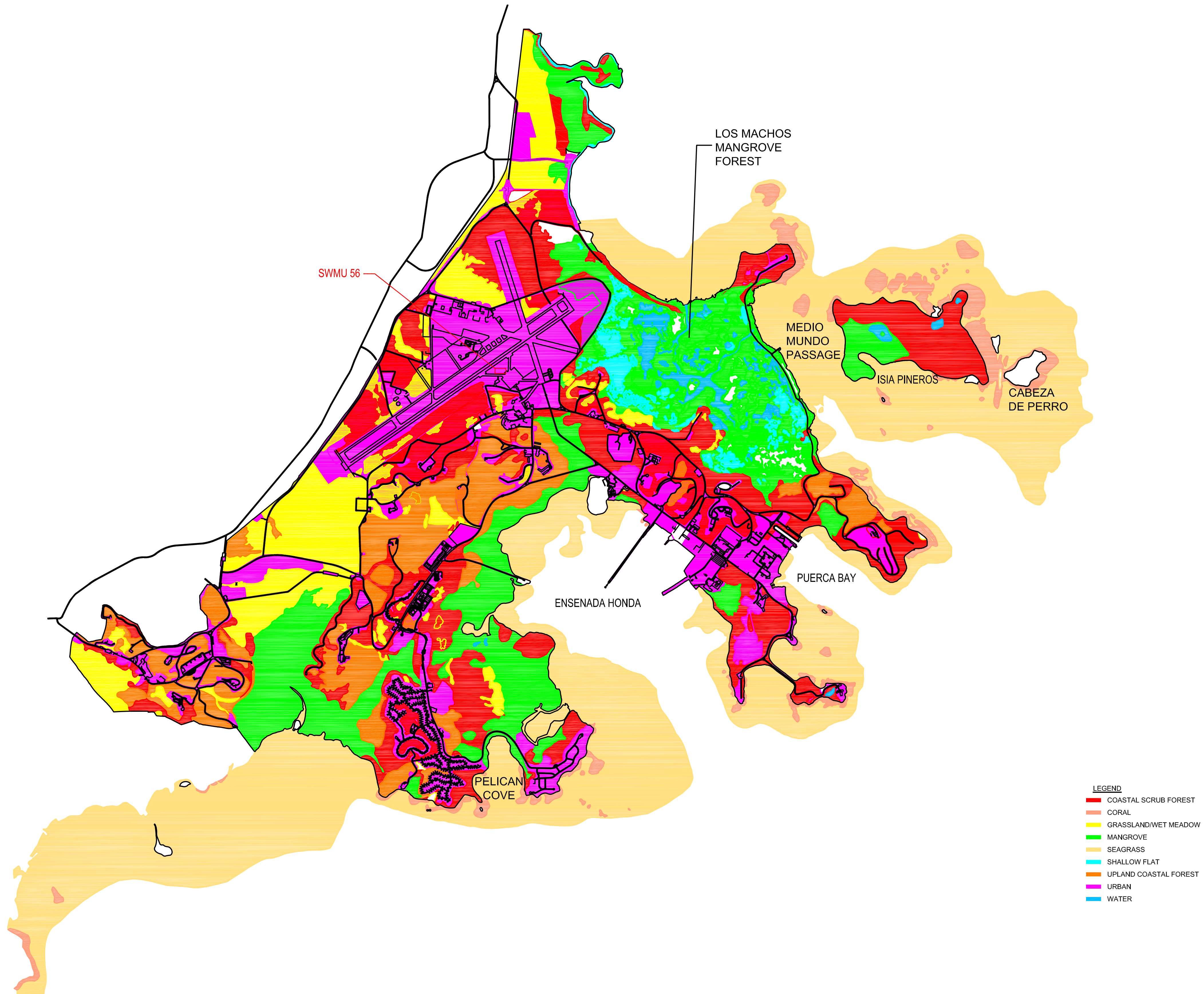
2) If the site poses unacceptable ecological risk and additional evaluation in the form of remedy development and evaluation is appropriate, proceed to third tier.

<u>Tier 3. Evaluation of Remedial Alternative (RAGs C)</u>

a. Develop site specific risk based cleanup values.

b. Qualitatively evaluate risk posed to the environment by implementation of each alternative (short term) impacts and estimate risk reduction provided by each (long-term) impacts; provide quantitative evaluation where appropriate. Weigh alternative using the remaining CERCLA 9 Evaluation Criteria. Plan for monitoring and site closeout.

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.



SOURCE: GEO-MARINE, INC. 1998

REVISIONS		
	DRAWN	RRR
	REVIEWED	MEK
	S.O.#	111626
	CADD#	111626_69CMS_21.dwg

NORTH

SWMU 56-HANGAR 200 APRON
NAVAL ACTIVITY PUERTO RICO

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

Baker

"TERRESTRIAL AND AQUATIC HABITAT OCCURRING AT NAVAL ACTIVITY PUERTO RICO"
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

SCALE FULLSIZE 1" = 600'

DATE SEPTEMBER 2008

FIGURE
7-2

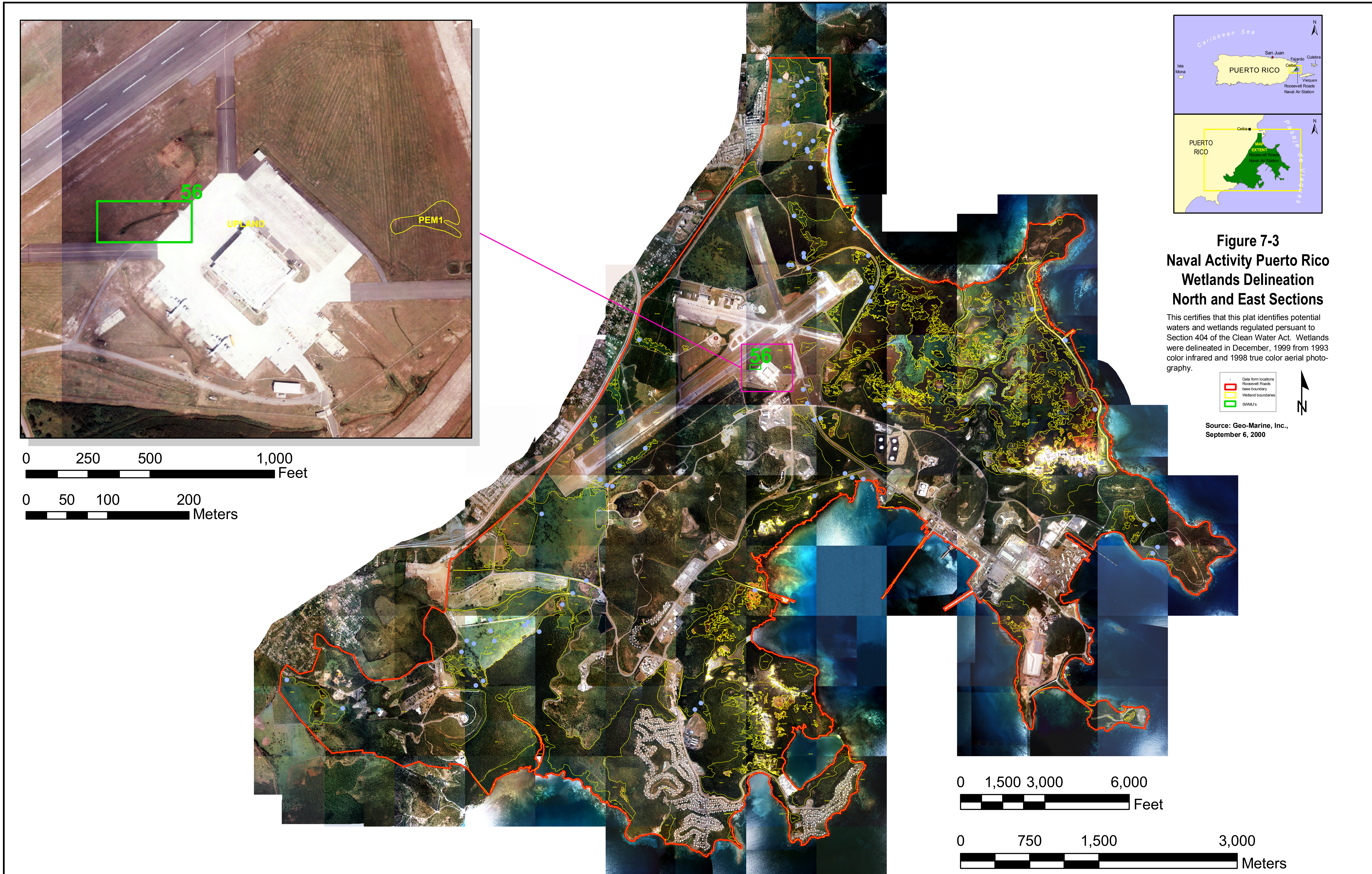
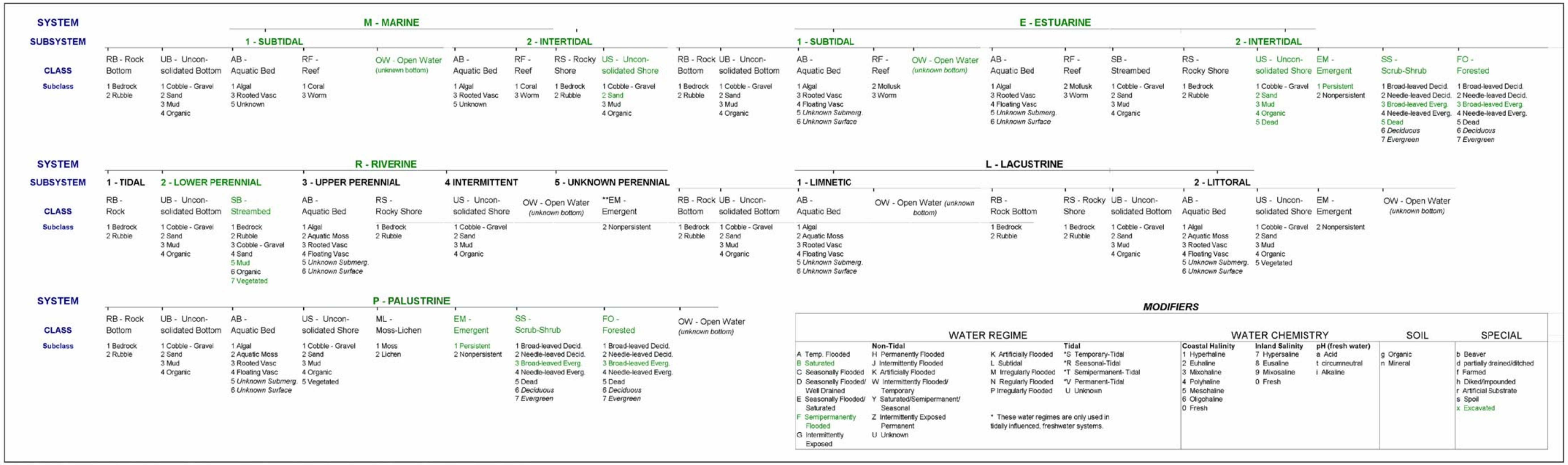


Figure 7-3
Naval Activity Puerto Rico
Wetlands Delineation
North and East Sections

This certifies that this plat identifies potential waters and wetlands regulated persuant to Section 404 of the Clean Water Act. Wetlands were delineated in December, 1999 from 1993 color infrared and 1998 true color aerial photography.

Source: Geo-Marine, Inc., September 6, 2000

111626_56CMS_13.DWG

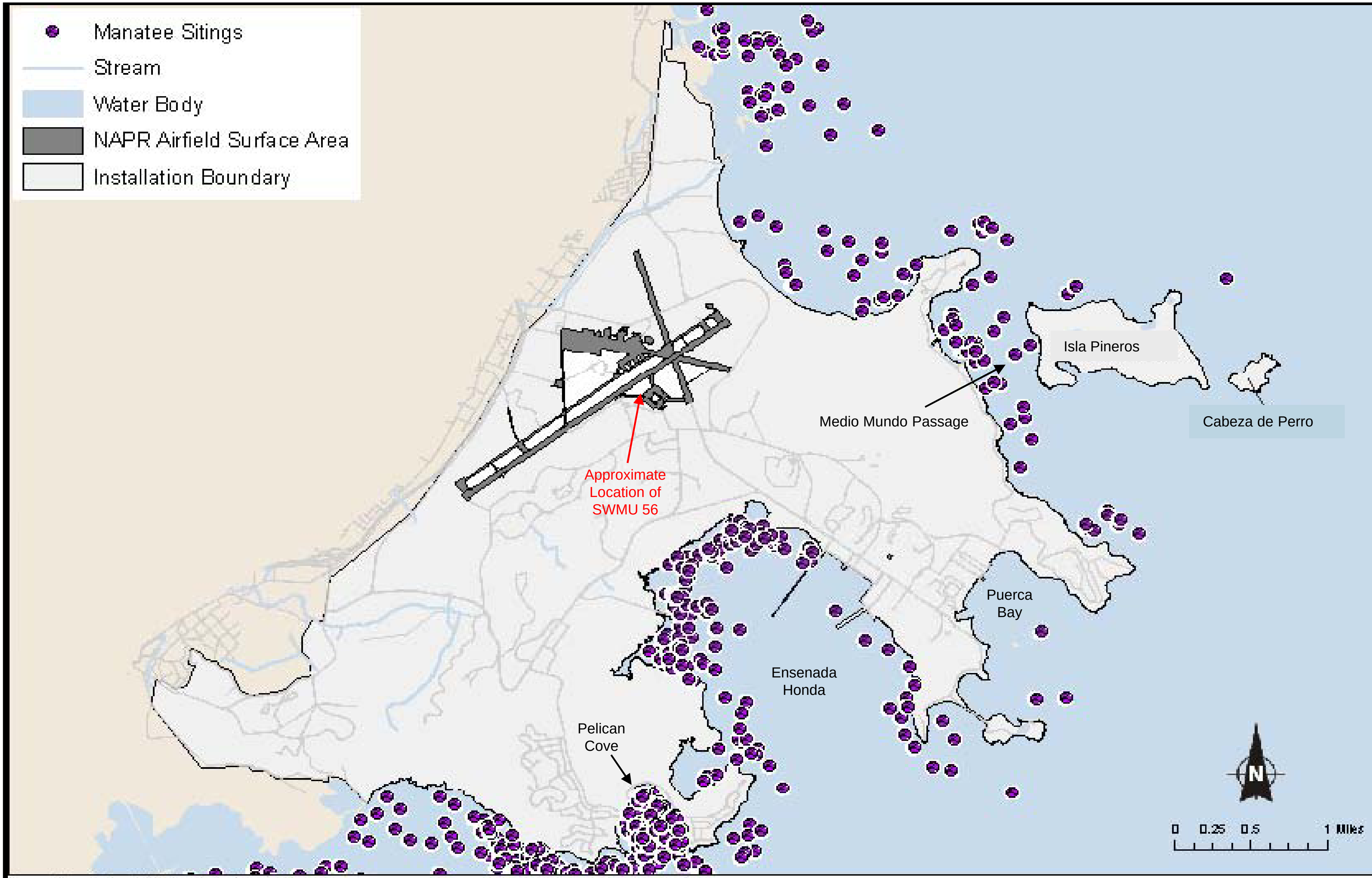


SOURCE: UNITED STATES, FISH AND WILDLIFE SERVICE. CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES, 1985

LEGEND

FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

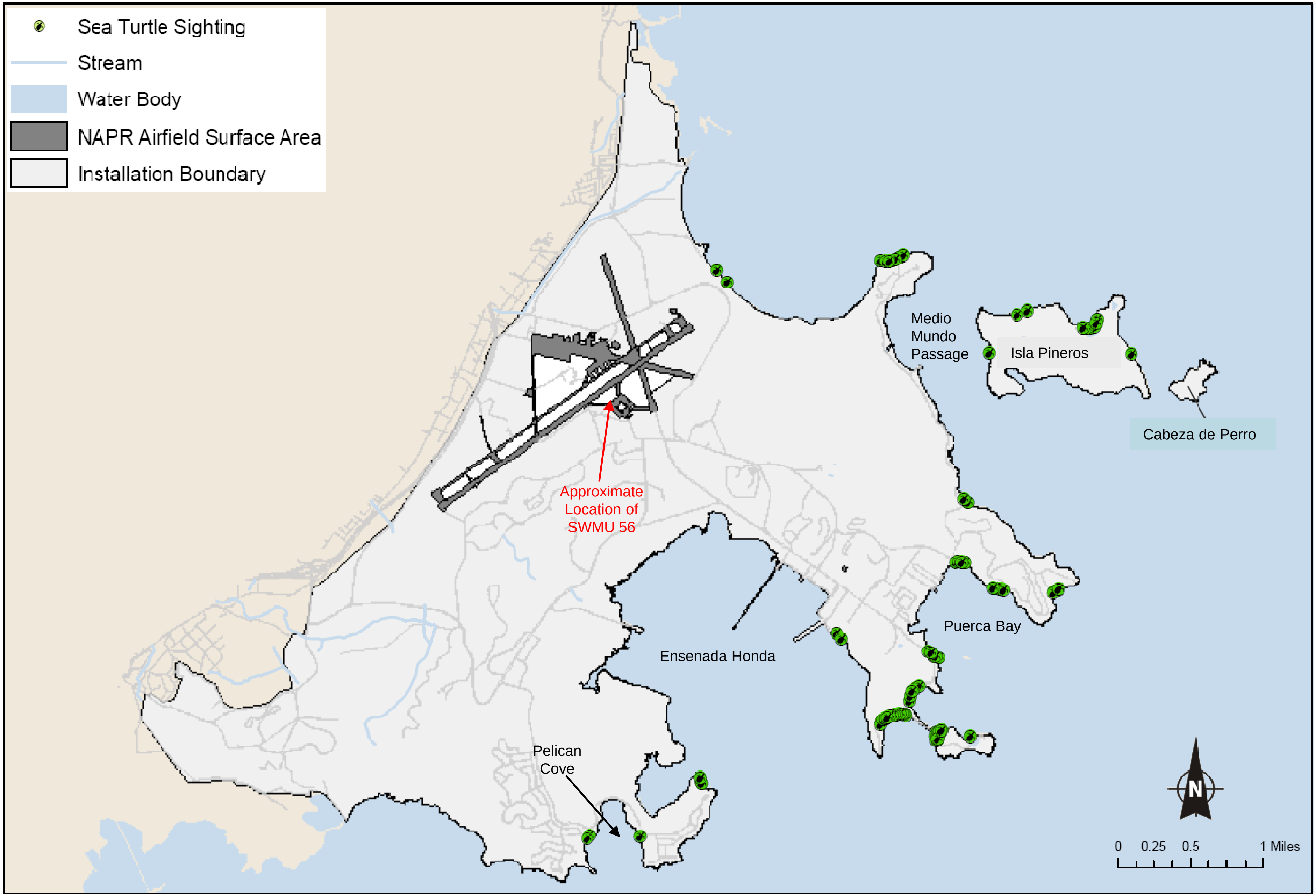
NAVAL ACTIVITY PUERTO RICO



Source: Geo-Marine, 2005; ESRI, 2004; USFWS, 2005;

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 56 – HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

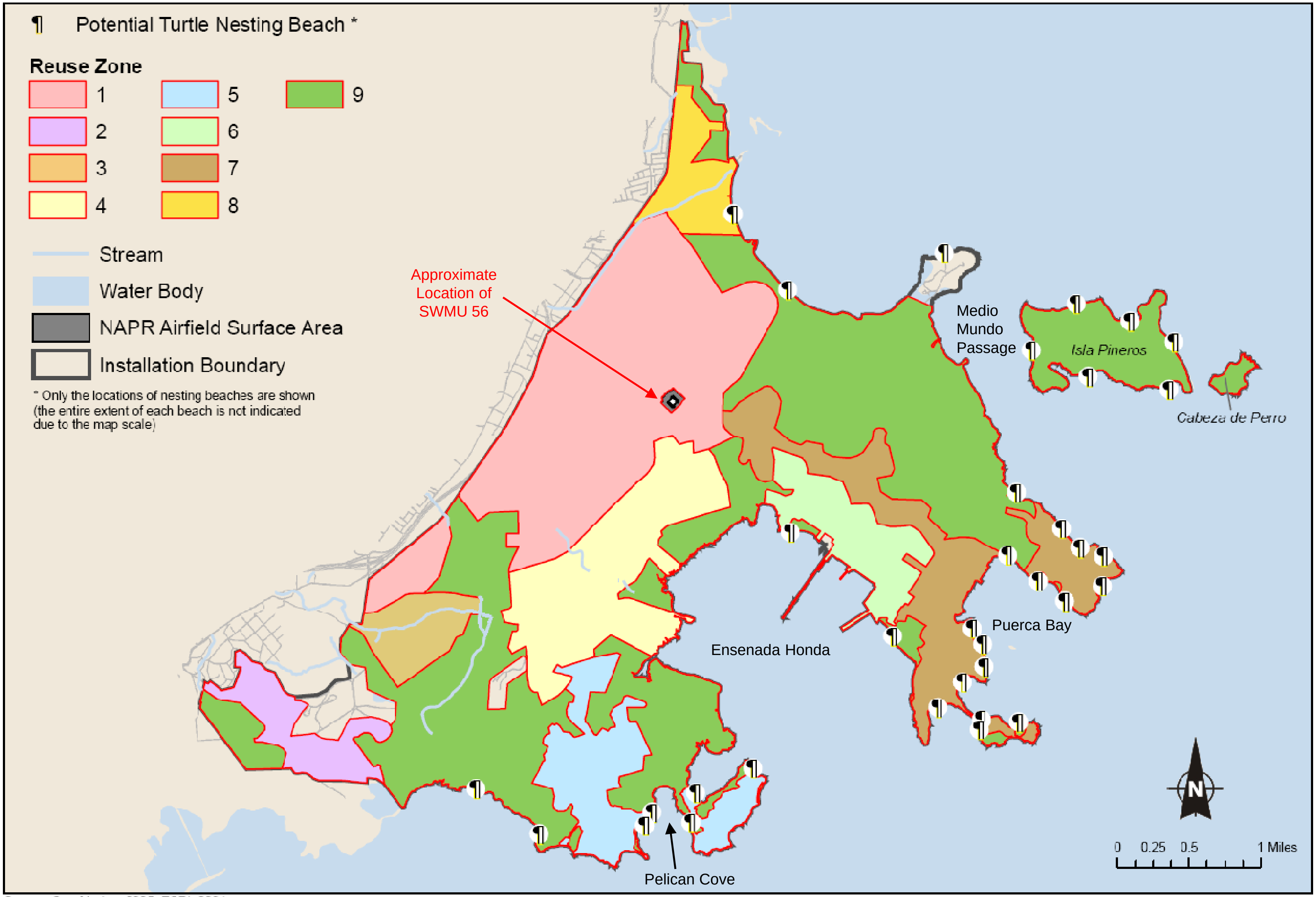


Source: Geo-Marine, 2005; ESRI, 2004; USFWS, 2005;

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.

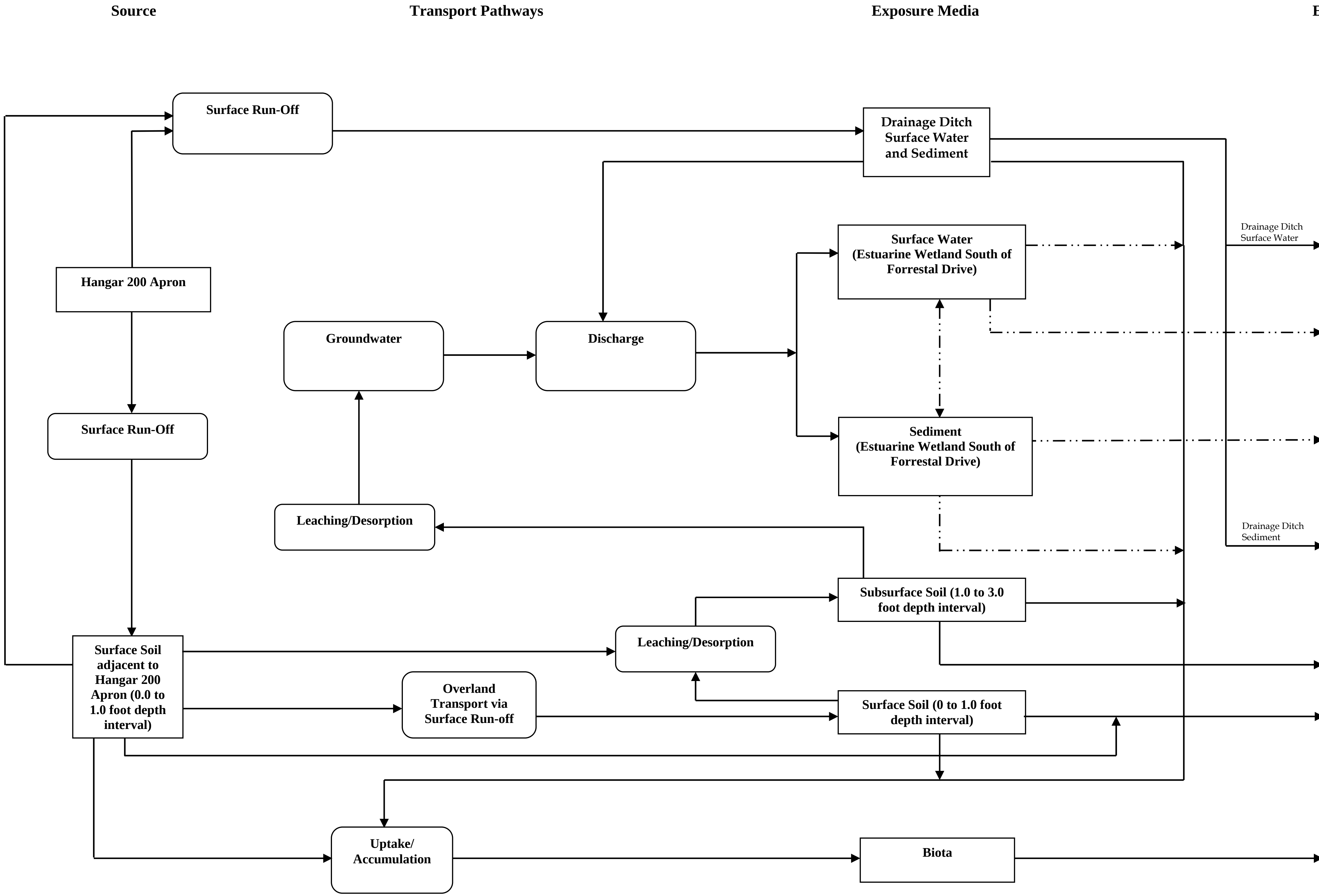
FIGURE 7-6
SEA TURTLE SIGHTINGS AT NAVAL ACTIVITY PUERTO RICO
SWMU 56 – HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



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 56 – HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Receptors

Exposure Medium	Exposure Route	Aquatic Invertebrates	Aquatic Plants	Aquatic Fish	Aquatic Amphibians	Aquatic Reptiles	Aquatic Birds	Aquatic Mammals	Terrestrial Invertebrates	Terrestrial Plants	Terrestrial Amphibians	Terrestrial Reptiles	Terrestrial Birds	Terrestrial Mammals
Drainage Ditch Surface Water	**Ingestion**	•		•	•	x	x				•	•	•	x
	Direct Contact	•	•	•	•	x	x				x	x	x	x
	Ingestion	x		x			x							
	Direct Contact	x	x	x			x							
	Root Uptake													
	Ingestion	x		x			x							
	Direct Contact	x		x			x							
	Root Uptake		x											
Drainage Ditch Sediment	**Ingestion**	•		•	•	x	x				•	•	•	x
	Direct Contact	•		•	•	x	x				x	x	x	x
	Root Uptake		•											
	Ingestion								•		•	•	•	x
	Direct Contact								•		•	•	•	•
	Inhalation										x	x	x	x
	Root Uptake									•				
	Ingestion	x		x	x	x	x		x		•	•	•	x

→ Potentially complete and significant pathway (evaluated)
-·-▶ Potentially complete and significant pathway (not evaluated)

FIGURE 7-8
PRELIMINARY CONCEPTUAL MODEL
SWMU 56 – HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

• - Receptor/pathway evaluated quantitatively or qualitatively
x - Receptor/pathway not evaluated

K:_SOUTHNAVFAC\119197 JM01\SWMU 56\CMS\CADD\Revised 2011-05\119197_56_C05.dwg

Site ID	56SB04
Sample ID	56SB04-00
Date	4/28/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Selenium	1.4
Vanadium	170 J

Site ID	56SB02
Sample ID	56SB02-00
Date	4/28/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Selenium	2.7
Vanadium	250 J

Site ID	56SB01
Sample ID	56SB01-00
Date	4/28/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Copper	81 J
Lead	210
Selenium	1.6
Vanadium	170 J

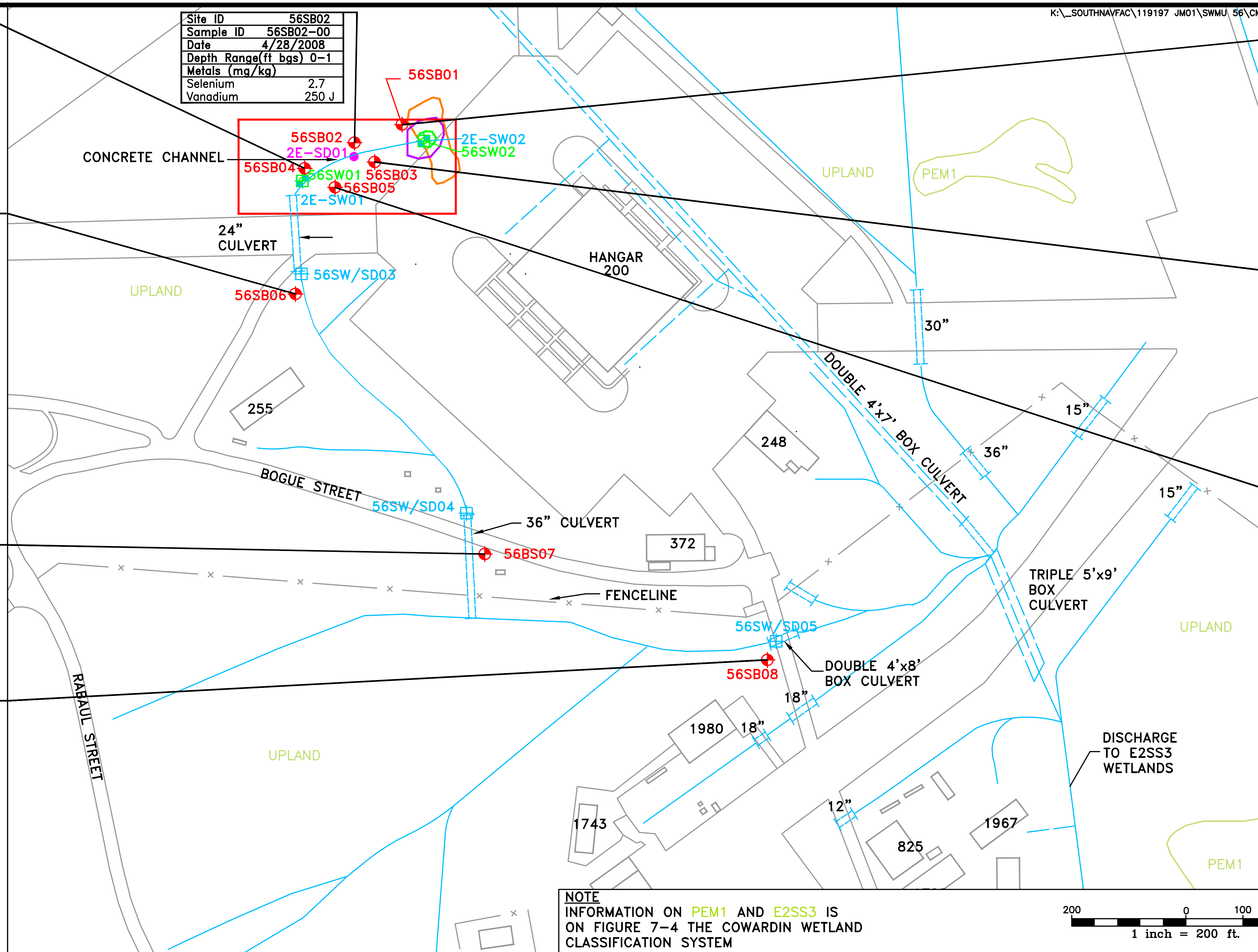
Site ID	56SB06
Sample ID	56SB06-00
Date	4/30/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Selenium	1.7 J
Vanadium	320 J

Site ID	56SB03
Sample ID	56SB03-00
Date	4/29/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Cobalt	29 J
Selenium	0.61 J
Vanadium	200 J

Site ID	56SB05
Sample ID	56SB05-00
Date	4/29/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Cobalt	27 J
Copper	72 J
Selenium	0.88 J
Vanadium	190 J

Site ID	56SB07
Sample ID	56SB07-00
Date	5/1/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Cobalt	50 J
Copper	130 J
Selenium	1.7 J
Vanadium	360 J

Site ID	56SB08
Sample ID	56SB08-00
Date	5/5/2008
Depth Range(ft bgs)	0-1
Metals (mg/kg)	
Cobalt	24 J
Copper	100
Selenium	0.64
Vanadium	180



NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

ECOLOGICAL SOIL SCREENING CRITERIA INORGANICS (mg/kg)	
Cobalt	13.0
Copper	70.0
Lead	120
Selenium	0.52
Vanadium	10.0

J -Estimated value
ft bgs -feet below ground surface
mg/kg -micrograms per kilogram

LEGEND
- -1958 POLYGON FEATURE
- -1961 POLYGON FEATURE
- -1964 POLYGON FEATURE
- -WETLAND DELINEATION
- -DRAINAGE DITCH
- -SWMU BOUNDARY
- -PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- -PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- -CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- -CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- -CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

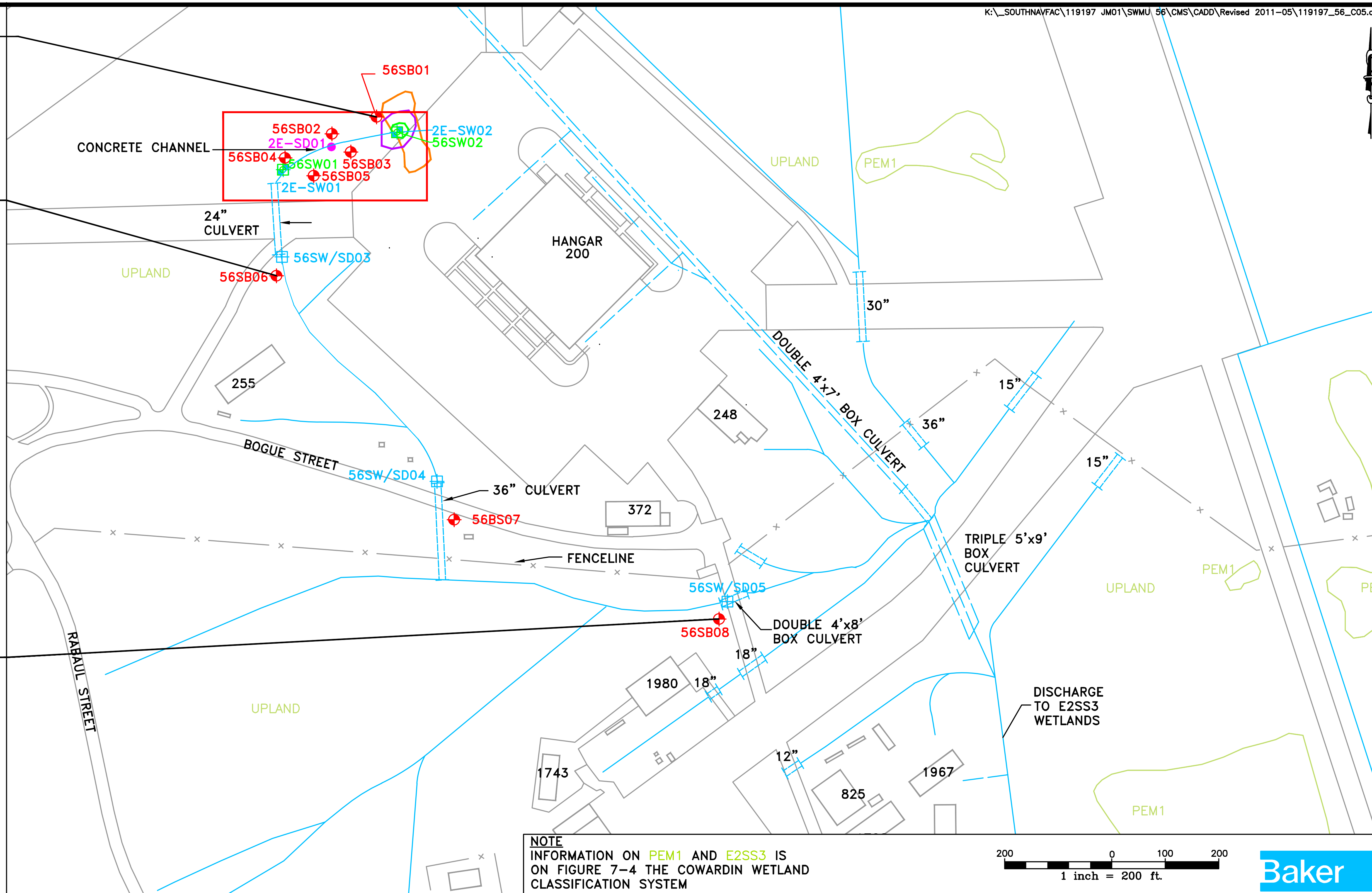
FIGURE 7-9
DETECTED CONCENTRATIONS IN SURFACE SOIL EXCEEDING SOIL SCREENING VALUES
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

Site ID	56SB01
Sample ID	56SB01-01
Date	4/28/2008
Depth Range(ft bgs)	1-3
Metals (mg/kg)	
Selenium	2.9
Vanadium	110 J

Site ID	56SB06
Sample ID	56SB06-01
Date	4/30/2008
Depth Range(ft bgs)	1-3
Metals (mg/kg)	
Copper	75 J
Selenium	2.3 J

Site ID	56SB08
Sample ID	56SB08-01
Date	5/5/2008
Depth Range(ft bgs)	1-3
Metals (mg/kg)	
Selenium	0.72
Vanadium	120

K:_SOUTHNAVFAC\119197 JM01\SWMU 56\CMS\CADD\Revised 2011-05\119197_56_C05.dwg



NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

J -Estimated value
ft bgs -feet below ground surface
mg/kg -micrograms per kilogram

ECOLOGICAL SOIL SCREENING CRITERIA INORGANICS (mg/kg)	
Copper	70.0
Selenium	0.52
Vanadium	10.0

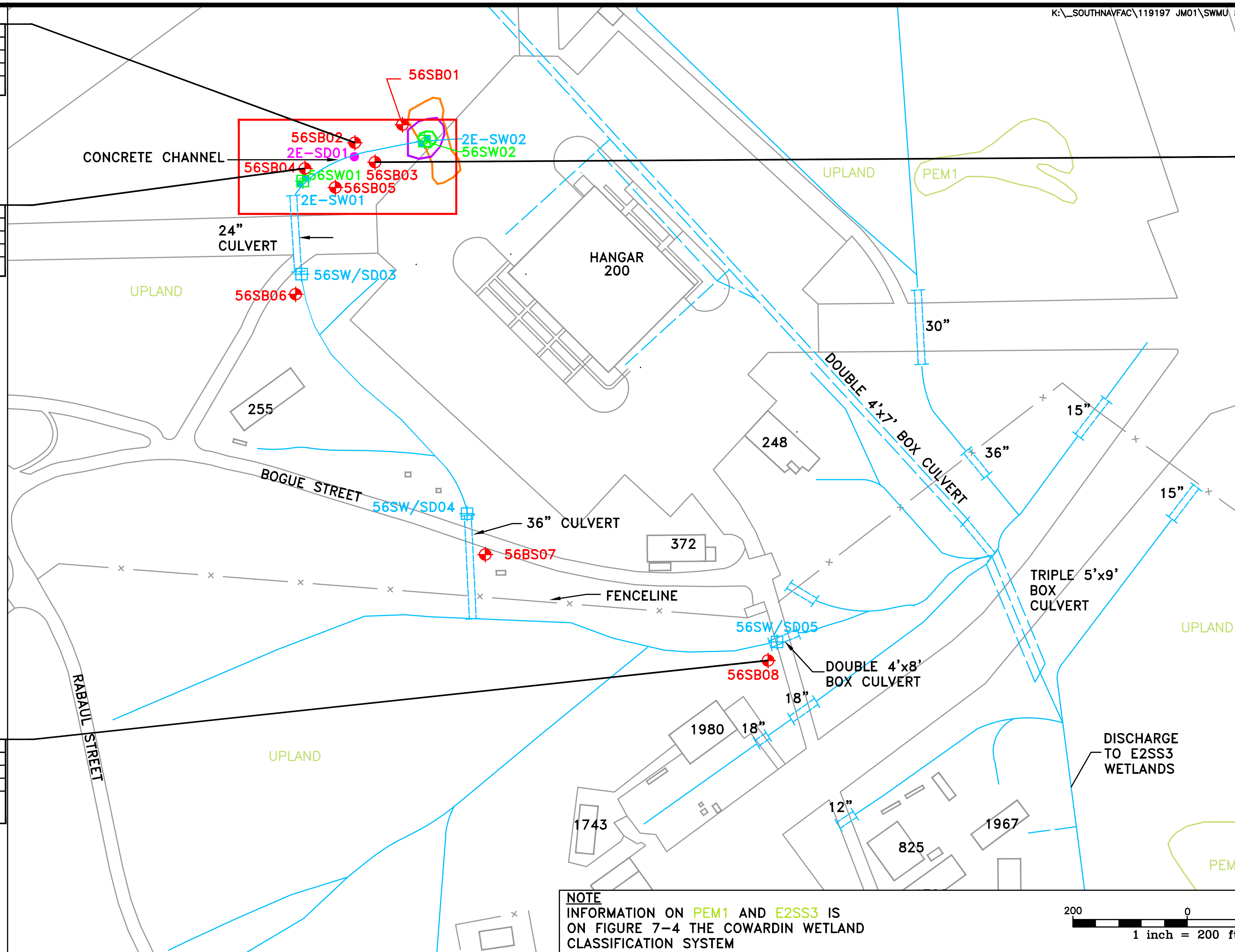
LEGEND
- -1958 POLYGON FEATURE
- -1964 POLYGON FEATURE
- -DRAINAGE DITCH
- -PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- -PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- -CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- -CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- -CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- -1961 POLYGON FEATURE
- -WETLAND DELINEATION
- -SWMU BOUNDARY

FIGURE 7-10
DETECTED CONCENTRATIONS IN SUBSURFACE SOIL EXCEEDING SOIL SCREENING VALUES
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

Site ID	56SB02
Sample ID	56GW02
Date	5/1/2008
Metals (ug/L)	
Vanadium	17

Site ID	56SB03
Sample ID	56GW03
Date	5/1/2008
Metals (ug/L)	
Vanadium	16 J

Site ID	56SB08
Sample ID	56GW08
Date	5/7/2008
Metals (ug/L)	
Copper	8.3
Vanadium	13



Site ID	56SB04
Sample ID	56GW04
Date	5/1/2008
Metals (ug/L)	
Vanadium	20

NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

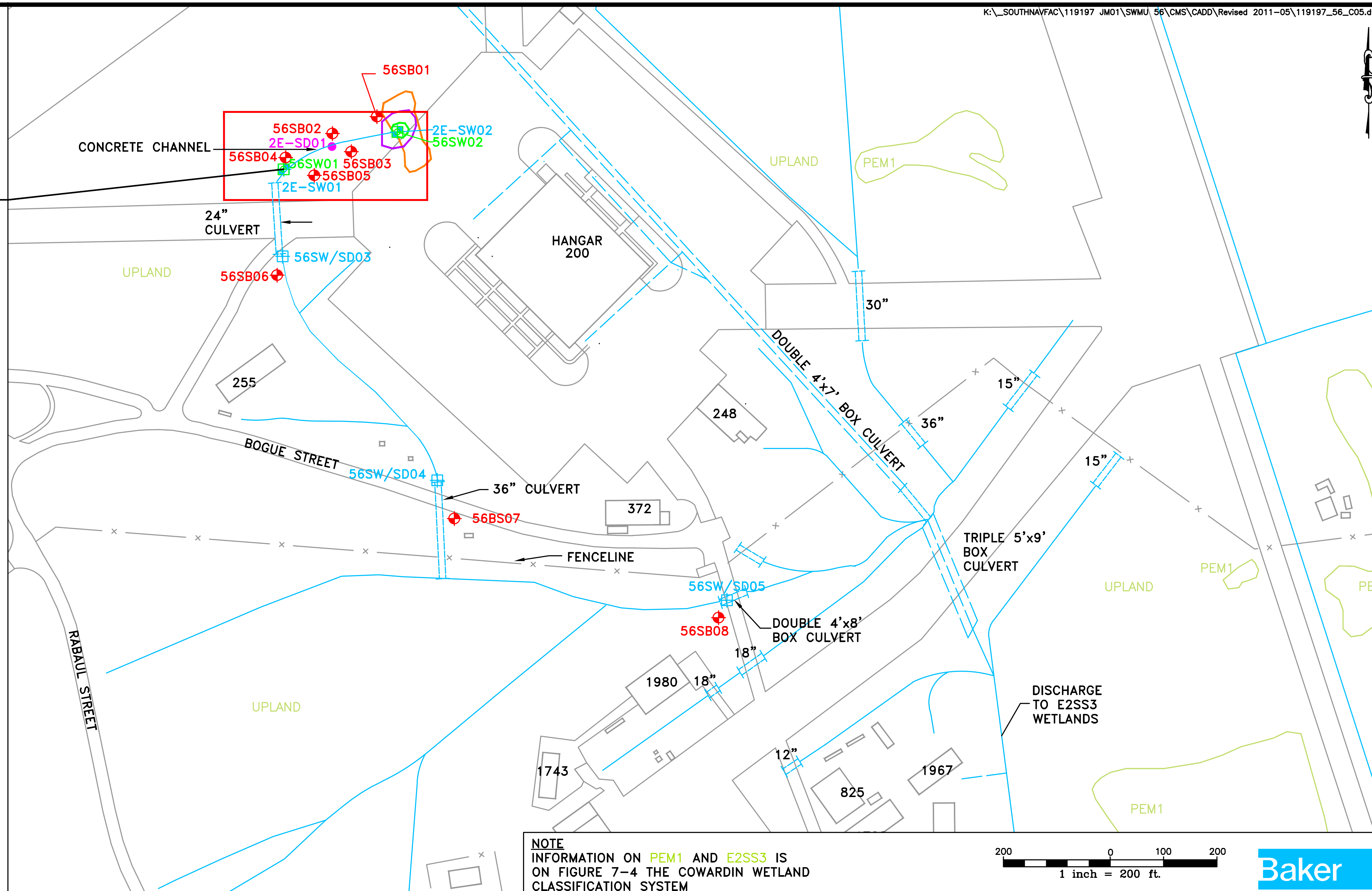
J —Estimated value
ug/L —micrograms per liter

ECOLOGICAL GROUNDWATER SCREENING CRITERIA	
INORGANICS (ug/L)	
Copper	3.73
Vanadium	12.0

LEGEND
- —1958 POLYGON FEATURE
- —1964 POLYGON FEATURE
- —DRAINAGE DITCH
- —PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- —PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- —CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- —CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- —CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- —1961 POLYGON FEATURE
- —WETLAND DELINEATION
- —SWMU BOUNDARY

FIGURE 7-11
DETECTED CONCENTRATIONS IN GROUNDWATER EXCEEDING GROUNDWATER SCREENING VALUES
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

Site ID	56SW01
Sample ID	56SW01
Date	4/29/2008
Metals (ug/L)	
Cadmium	1.1 J
Copper	13
Lead	16
Vanadium	22
Zinc	46



J -Estimated value
ug/L -micrograms per liter

ECOLOGICAL SURFACE WATER SCREENING CRITERIA	
INORGANICS (ug/L)	
Cadmium	0.12
Copper	3.46
Lead	0.73
Vanadium	12.0
Zinc	44.8

NOTE
INFORMATION ON PEM1 AND E2SS3 IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

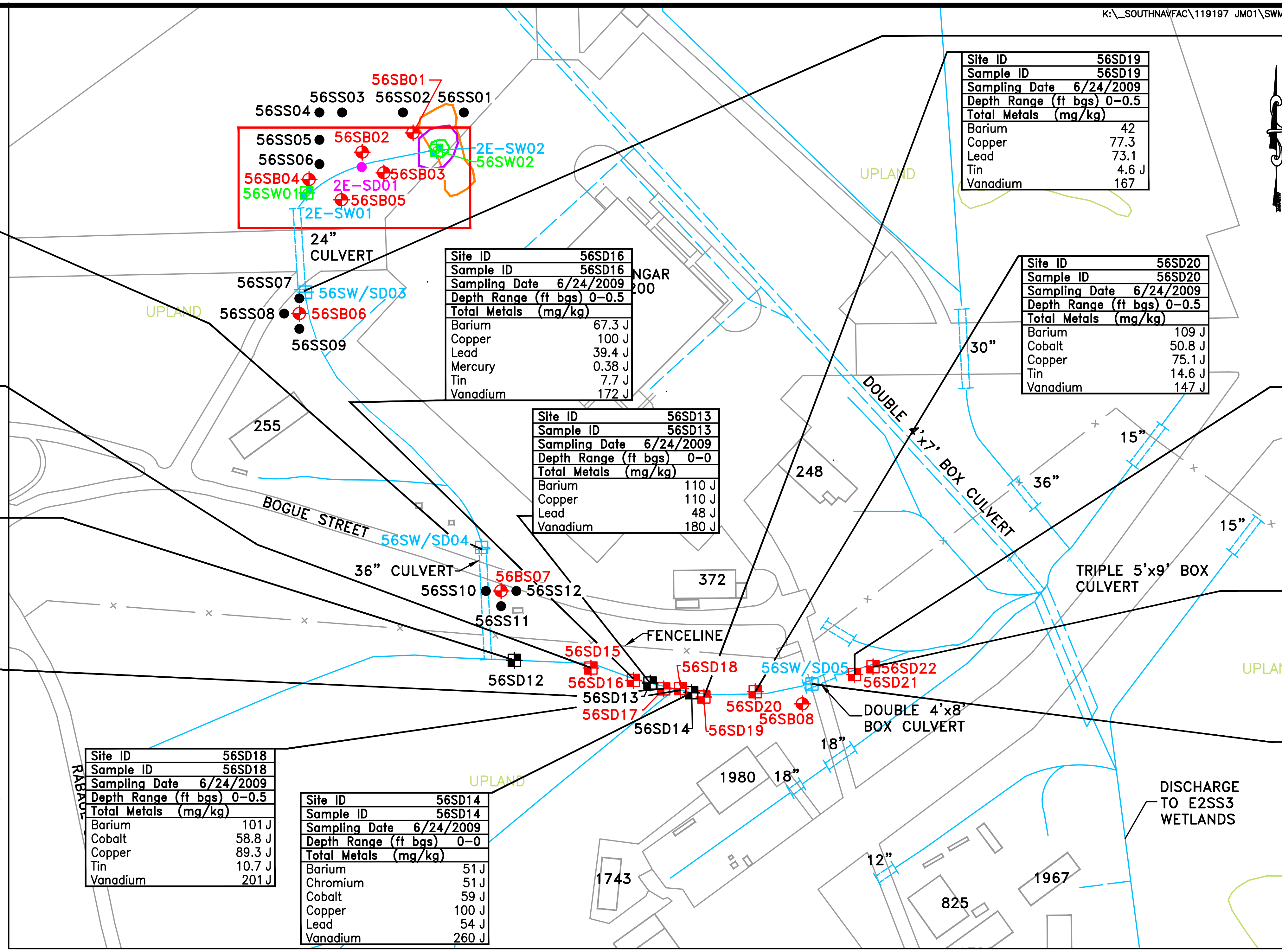
200 0 100 200
1 inch = 200 ft.

Baker

LEGEND
- -1958 POLYGON FEATURE
- -1964 POLYGON FEATURE
- -DRAINAGE DITCH
- -PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- -PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- -CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- -CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- -CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- -1961 POLYGON FEATURE
- -WETLAND DELINEATION
- -SWMU BOUNDARY

FIGURE 7-12
DETECTED CONCENTRATIONS IN SURFACE WATER EXCEEDING SURFACE WATER SCREENING VALUES
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\119197 JM01\SWMU 56\CMS\CADD\Revised 2011-05\119197_56_C06.dwg



Site ID	56SD04
Sample ID	56SD04
Sampling Date	4/29/2008
Depth Range (ft bgs)	
VOC (ug/kg)	
Acetone	250 J
Total Metals (mg/kg)	
Barium	78 J
Cadmium	3.9 J
Chromium	46 J
Copper	130 J
Lead	160 J
Selenium	4.2 J
Vanadium	250 J
Zinc	140 J

Site ID	56SD15
Sample ID	56SD15
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	93 J
Copper	107 J
Silver	4.6 J
Tin	8.2 J
Vanadium	184 J

Site ID	56SD12
Sample ID	56SD12
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0
Total Metals (mg/kg)	
Barium	78 J
Copper	100 J
Vanadium	240 J

Site ID	56SD17
Sample ID	56SD17
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	140 J
Copper	96.6 J
Lead	45.7 J
Tin	13.6 J
Vanadium	189 J

Site ID	56SD16
Sample ID	56SD16
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	67.3 J
Copper	100 J
Lead	39.4 J
Mercury	0.38 J
Tin	7.7 J
Vanadium	172 J

Site ID	56SD13
Sample ID	56SD13
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0
Total Metals (mg/kg)	
Barium	110 J
Copper	110 J
Lead	48 J
Vanadium	180 J

Site ID	56SD19
Sample ID	56SD19
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	42
Copper	77.3
Lead	73.1
Tin	4.6 J
Vanadium	167

Site ID	56SD20
Sample ID	56SD20
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	109 J
Cobalt	50.8 J
Copper	75.1 J
Tin	14.6 J
Vanadium	147 J

Site ID	56SD03
Sample ID	56SD03
Sampling Date	4/29/2008
Depth Range (ft bgs)	
VOC (ug/kg)	
Acetone	200 J
SVOC (ug/kg)	
Benzo[a]anthracene	270 J
Benzo[a]pyrene	300 J
Benzo[k]fluoranthene	630 J
Bis(2-ethylhexyl) phthalate	260 J
Chrysene	410 J
Dibenz(a,h)anthracene	52 J
Pyrene	570 J
Total Metals (mg/kg)	
Barium	54 J
Cadmium	2.6 J
Copper	130 J
Lead	280 J
Vanadium	220 J

Site ID	56SD22
Sample ID	56SD22
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Arsenic	10.4 J
Barium	571 J
Cobalt	91.4 J
Copper	92.8 J
Tin	16 J
Vanadium	171 J

Site ID	56SD21
Sample ID	56SD21
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	105 J
Copper	85.7 J
Tin	10.1 J
Vanadium	176 J

Site ID	56SD05
Sample ID	56SD05
Sampling Date	4/29/2008
Depth Range (ft bgs)	
VOC (ug/kg)	
Acetone	1200 J
Carbon disulfide	800 J
Total Metals (mg/kg)	
Barium	160 J
Copper	110 J
Vanadium	190 J

Site ID	56SD18
Sample ID	56SD18
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0.5
Total Metals (mg/kg)	
Barium	101 J
Cobalt	58.8 J
Copper	89.3 J
Tin	10.7 J
Vanadium	201 J

Site ID	56SD14
Sample ID	56SD14
Sampling Date	6/24/2009
Depth Range (ft bgs)	0–0
Total Metals (mg/kg)	
Barium	51 J
Chromium	51 J
Cobalt	59 J
Copper	100 J
Lead	54 J
Vanadium	260 J

ECOLOGICAL SEDIMENT SCREENING CRITERIA	
VOC (ug/kg)	
Acetone	35.6
Carbon disulfide	50
SVOC (ug/kg)	
Benzo[a]anthracene	108
Benzo[a]pyrene	150
Benzo[k]fluoranthene	240
Bis(2-ethylhexyl) phthalate	180
Chrysene	166
Dibenz(a,h)anthracene	33
Pyrene	195
Total Metals (mg/kg)	
Arsenic	9.8
Barium	20
Cadmium	1
Chromium	43.4
Cobalt	50
Copper	31.6
Lead	35.8
Mercury	0.2
Selenium	2
Silver	1
Tin	3.4
Vanadium	57
Zinc	121

ug/kg –micrograms per kilogram
mg/kg –miligrams per kilogram

NOTE
INFORMATION ON PEM1 IS ON FIGURE 7-4
THE COWARDIN WETLAND CLASSIFICATION SYSTEM

200 0 100 200
1 inch = 200 ft.

Baker

LEGEND
- –WETLAND DELINEATION
- –SWMU BOUNDARY
- –1958 POLYGON FEATURE
- –1961 POLYGON FEATURE
- –1964 POLYGON FEATURE
- –DRAINAGE DITCH
- –SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- –SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- –SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- –PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- –PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- –CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- –CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS
- –CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

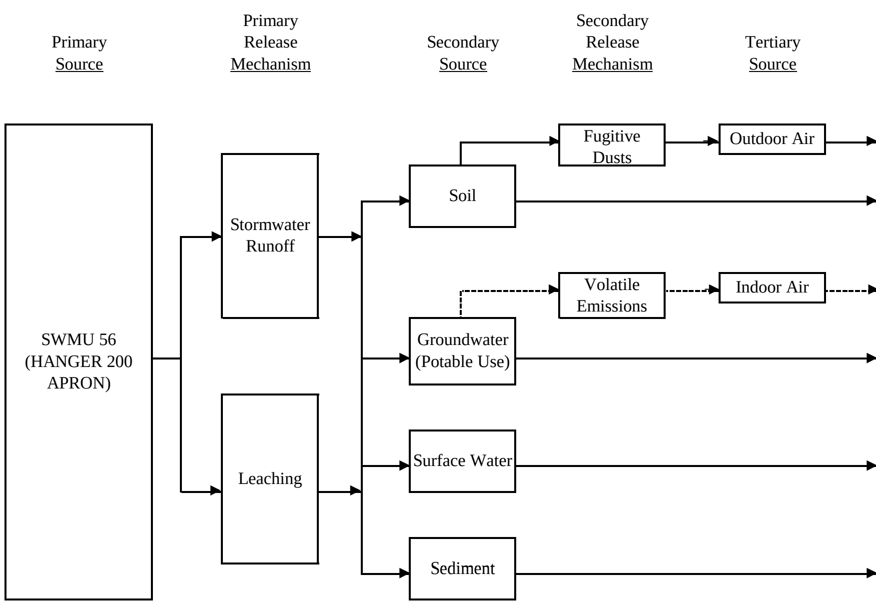
FIGURE 7-13
DETECTED CONCENTRATIONS IN SEDIMENT EXCEEDING SEDIMENT SCREENING VALUES
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

FIGURE 8-1

Revised: September 29, 2011

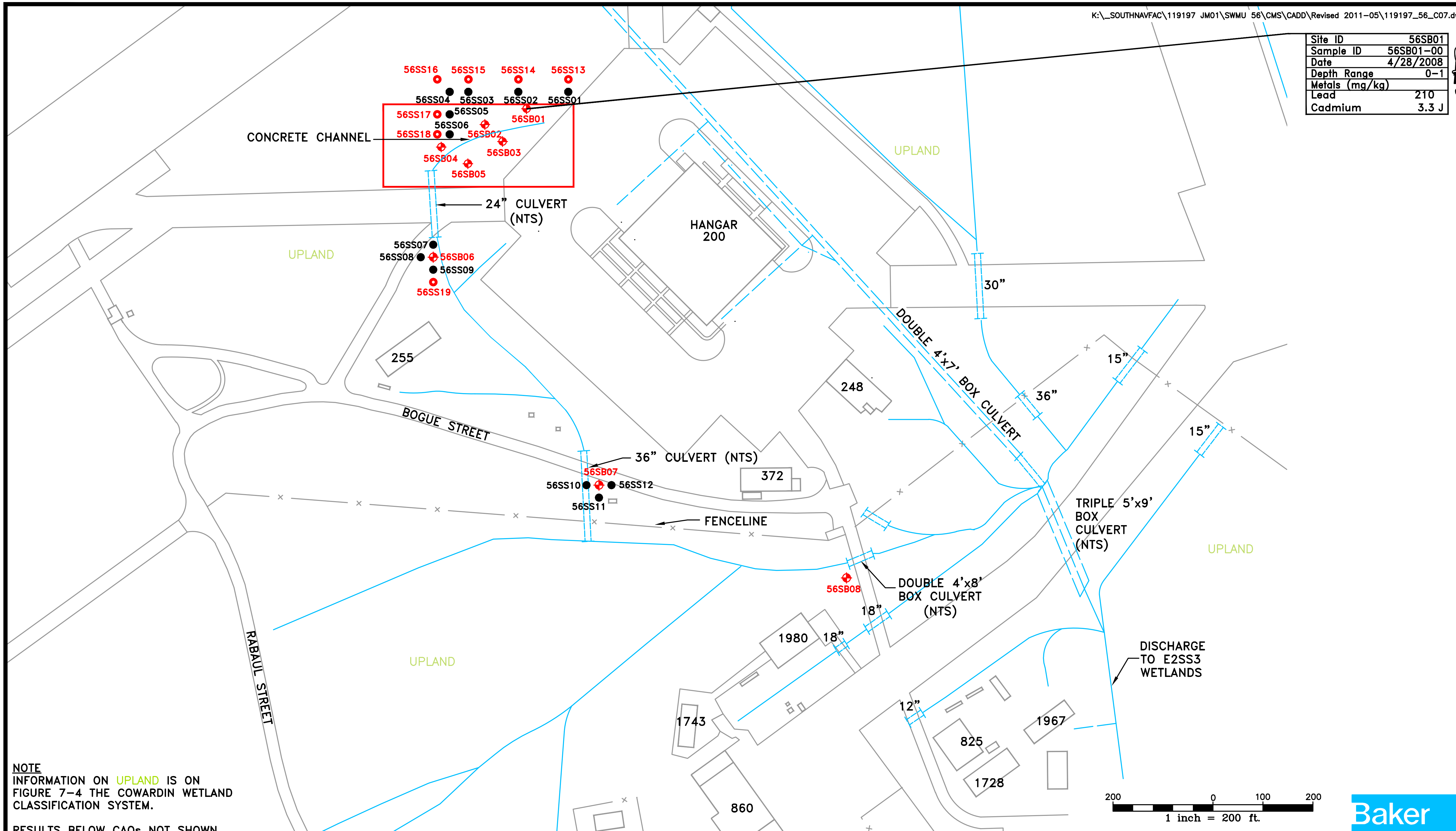
CONCEPTUAL SITE MODEL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



Exposure Route	Current and Future Adult Trespassers	Current and Future Youth Trespassers	Future Adult Residents	Future Young Child Residents	Future Adult Industrial / Commercial Workers	Future Adult Construction Workers	Current and Future Adult On-Site Workers
	Potential Human Receptors						
Inhalation	***CF***	***CF***	**F**	**F**	**F**	**F**	***CF***
Ingestion	***CF***	***CF***	**F**	**F**	**F**	**F**	***CF***
Dermal Contact	***CF***	***CF***	**F**	**F**	**F**	**F**	***CF***
Inhalation							
Ingestion			**F**	**F**	**F**	**F**	
Dermal Contact			**F**	**F**		**F**	
Ingestion	***CF***	***CF***	**F**	**F**	***X***	***X***	***CF***
Dermal Contact	***CF***	***CF***	**F**	**F**	***X***	***X***	***CF***
Ingestion	***CF***	***CF***	**F**	**F**	***X***	***X***	***CF***
Dermal Contact	***CF***	***CF***	**F**	**F**	***X***	***X***	***CF***

Legend

F	Future Exposure Pathway	Complete Exposure Pathway
CF	Current and Future Exposure Pathway	Incomplete Exposure Pathway
X	Potentally complete but insignificant exposure pathway for this receptor.	



CAOs (mg/kg)

LEAD	96
CADMIUM	1.80

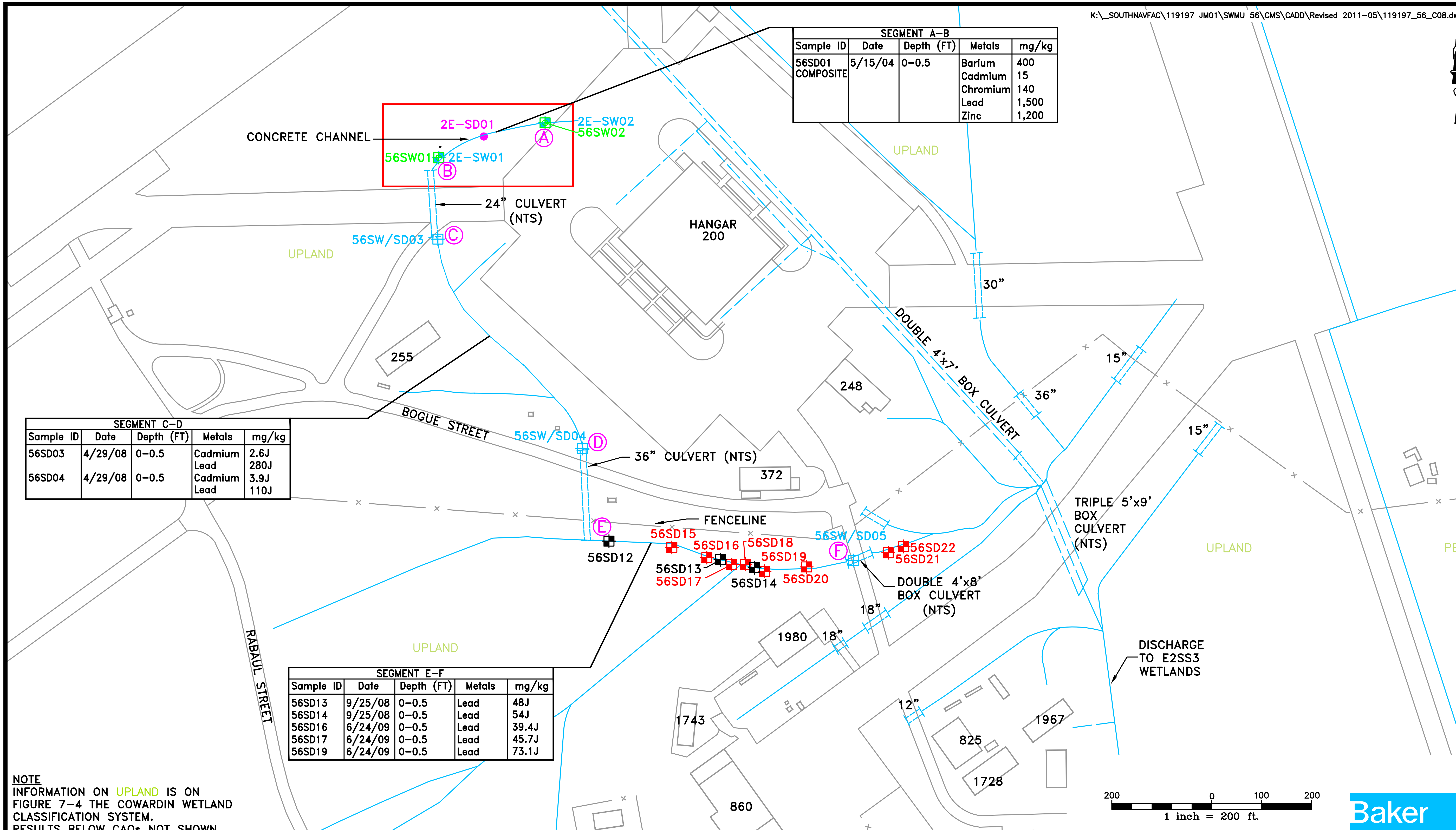
LEGEND

- —DRAINAGE DITCH
- —SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- —CULVERTS
- —CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS (APRIL 2008)
- —SWMU BOUNDARY
- —SURFACE SOIL SAMPLES (SEPTEMBER 2008)

J —ESTIMATED VALUE

Depth Range —FEET BELOW GROUND SURFACE

FIGURE 9-1
DETECTED CONCENTRATIONS OF LEAD AND CADMIUM, IN EXCESS OF SURFACE SOIL CAOs
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO



SEGMENT A-B				
Sample ID	Date	Depth (FT)	Metals	mg/kg
56SD01 COMPOSITE	5/15/04	0–0.5	Barium	400
			Cadmium	15
			Chromium	140
			Lead	1,500
			Zinc	1,200

SEGMENT C-D				
Sample ID	Date	Depth (FT)	Metals	mg/kg
56SD03	4/29/08	0–0.5	Cadmium	2.6J
			Lead	280J
56SD04	4/29/08	0–0.5	Cadmium	3.9J
			Lead	110J

SEGMENT E-F				
Sample ID	Date	Depth (FT)	Metals	mg/kg
56SD13	9/25/08	0–0.5	Lead	48J
56SD14	9/25/08	0–0.5	Lead	54J
56SD16	6/24/09	0–0.5	Lead	39.4J
56SD17	6/24/09	0–0.5	Lead	45.7J
56SD19	6/24/09	0–0.5	Lead	73.1J

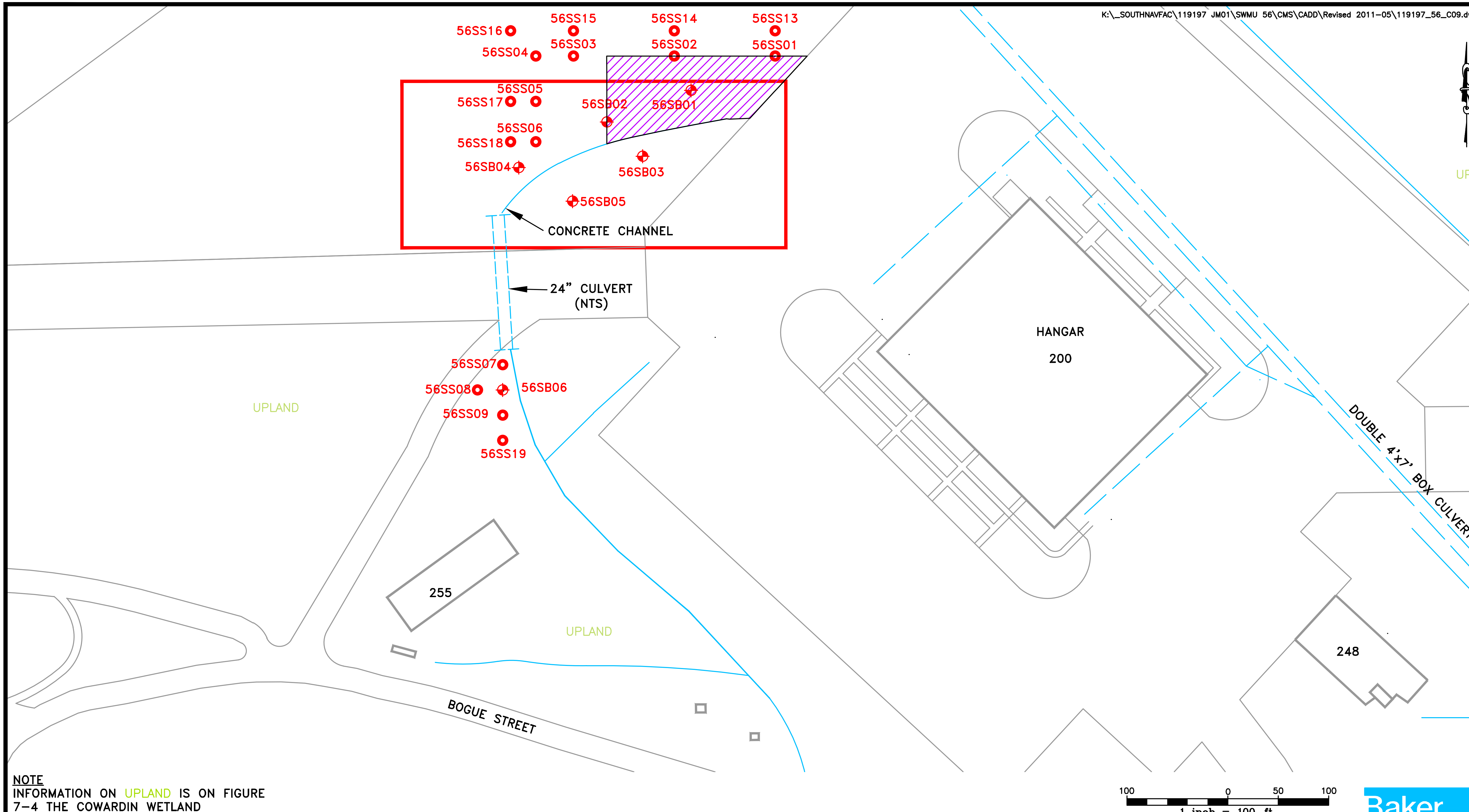
NOTE
INFORMATION ON UPLAND IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM.
RESULTS BELOW CAOs NOT SHOWN

CAOs (mg/kg)		(APPLICABLE DRAINAGE DITCH SEGMENT)
BARIUM	214	(A-B)
CADMIUM	0.99	(A-B AND C-D)
CHROMIUM	65.0	(A-B)
LEAD	35.8	(A-B, C-D AND E-F)
ZINC	152	(A-B)

LEGEND

- –SWMU BOUNDARY
- –DRAINAGE DITCH
- –PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- –PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- –CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION (APRIL 2008)
- –CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS (APRIL 2008)
- –SEDIMENT PRE-EXCAVATION DELINEATION SAMPLES (SEPTEMBER 2008)
- –SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- –CULVERTS
- J –ESTIMATED VALUE

FIGURE 9-2
DETECTED CONCENTRATIONS OF BARIUM, CADMIUM, CHROMIUM, LEAD AND ZINC IN EXCESS OF SEDIMENT CAOs
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO



Baker

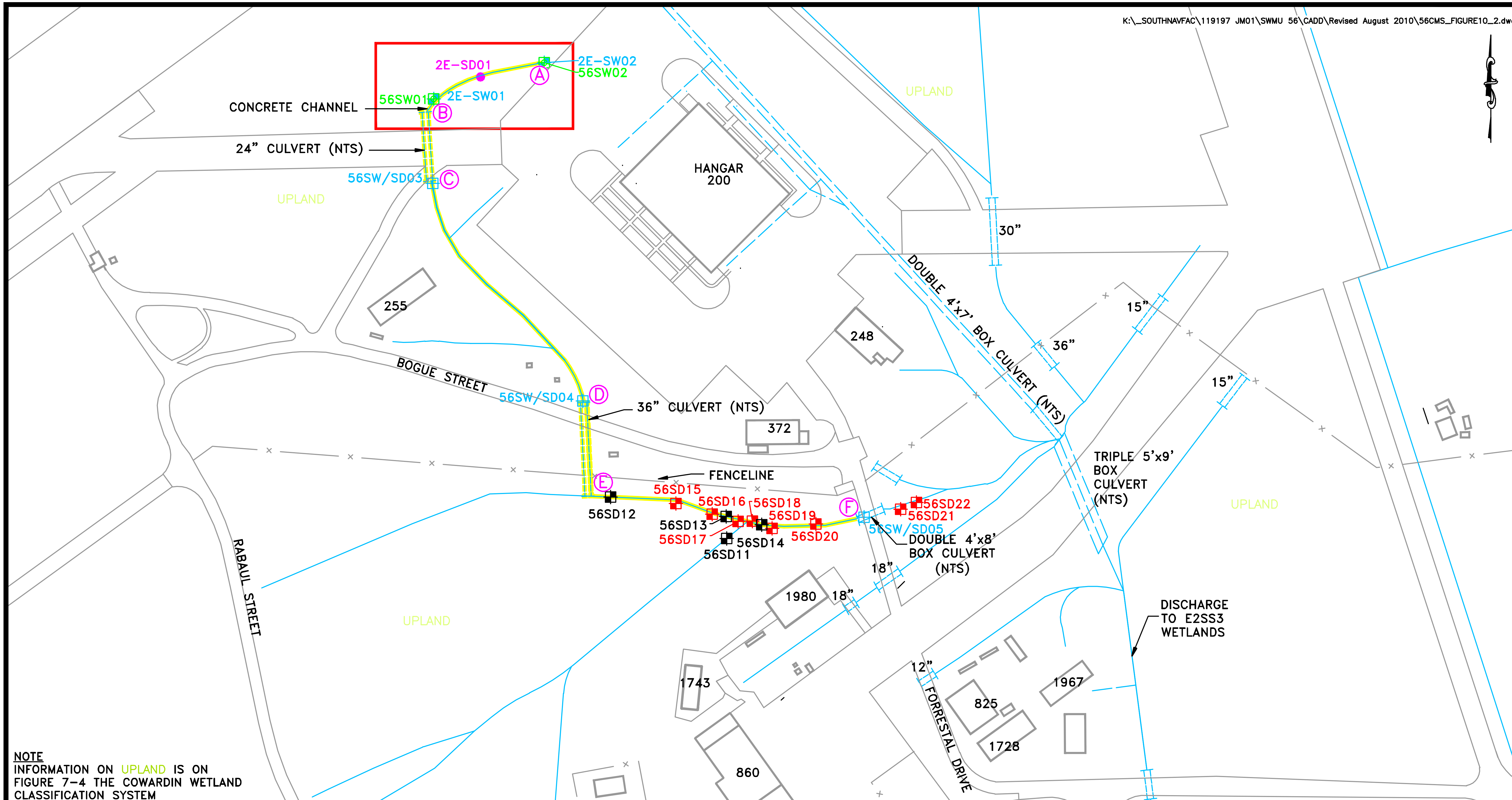
NOTE
INFORMATION ON UPLAND IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

APPROXIMATE SURFACE AREA	APPROXIMATE DEPTH	APPROXIMATE VOLUME	
(SQUARE FEET)	(FEET)	(CUBIC FEET)	(CUBIC YARDS)
11,916	1	11,916	441.3

LEGEND
- DRAINAGE DITCH
- SWMU BOUNDARY
- CULVERTS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS (APRIL 2008)
- SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- AREA OF SURFACE SOIL EXCAVATION (0-1')

FIGURE 10-1
ESTIMATED EXTENT OF SURFACE SOIL CONTAMINATION
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



NOTE
INFORMATION ON UPLAND IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

DITCH SEGMENT	DESCRIPTION	APPROXIMATE LENGTH (FEET)	ESTIMATED WIDTH (FEET)	ESTIMATED DEPTH (FEET)	ESTIMATED VALUE OF CONTAMINATED SEDIMENT (CUBIC FEET)	(CUBIC YARDS)
A – B	CONCRETE LINED	248.14	1.5	0.08	29.8	1.1
B – C	24" DIA CULVERT	133.4	2	0.08	5.3	0.2
C – D	SOIL	532.76	4	1.0	2,132	79
D – E	36"DIA. CULVERT	181.37	3	0.17	30.77	1.1
E – F	SOIL	526.85	4 TO 8	1.0	4,216	156.1
				TOTALS	6,413.9	237.5

DRAINAGE DITCH / SEDIMENT CONTAMINATION

LEGEND

- SWMU BOUNDARY
- DRAINAGE DITCH
- PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION (APRIL 2008)
- CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS (APRIL 2008)
- SEDIMENT SAMPLES (SEPTEMBER 2008)
- SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- CULVERTS

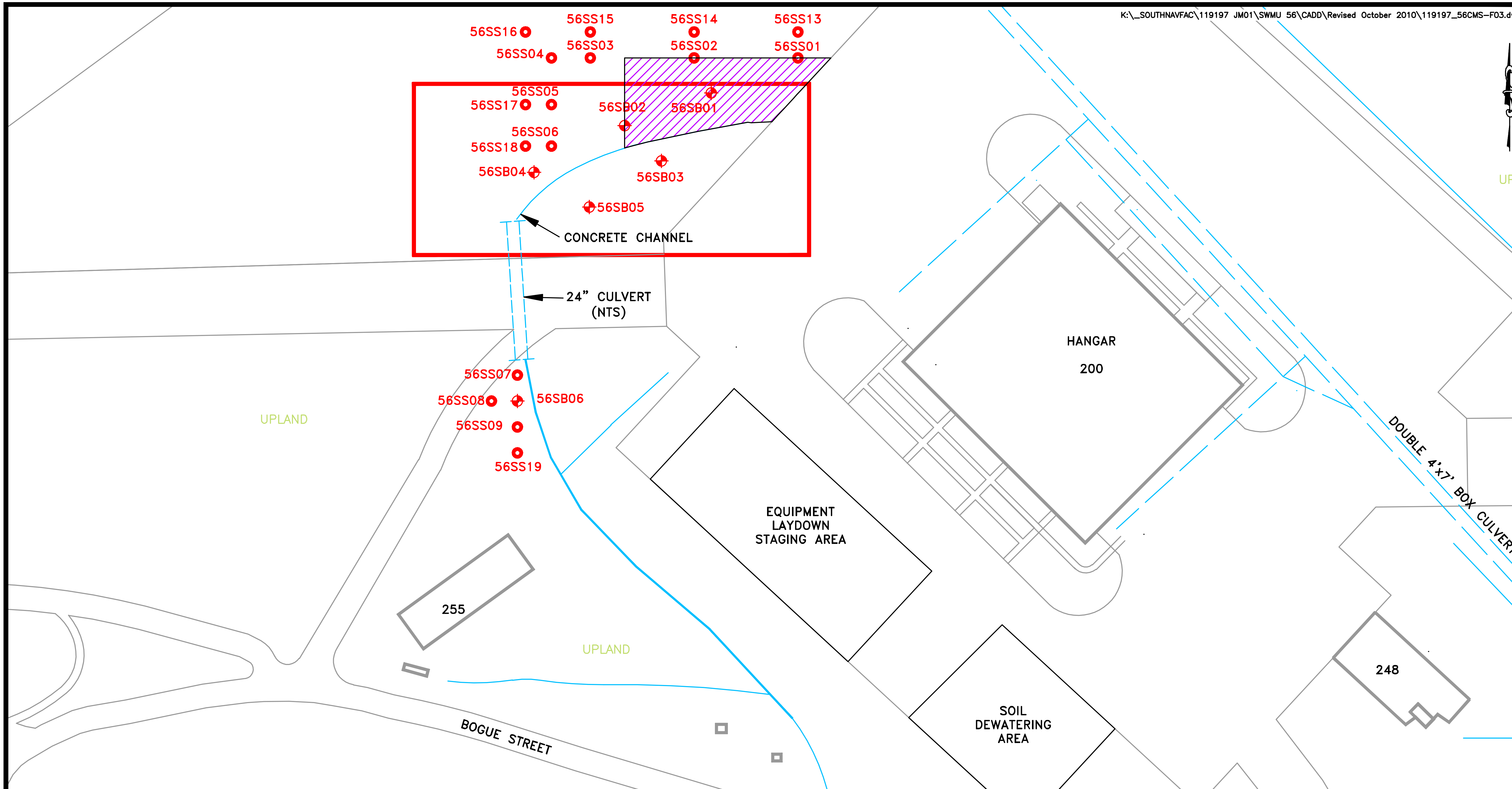
200 0 100 200

1 inch = 200 ft.

Baker

FIGURE 10-2
ESTIMATED EXTENT OF SEDIMENT CONTAMINATION
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



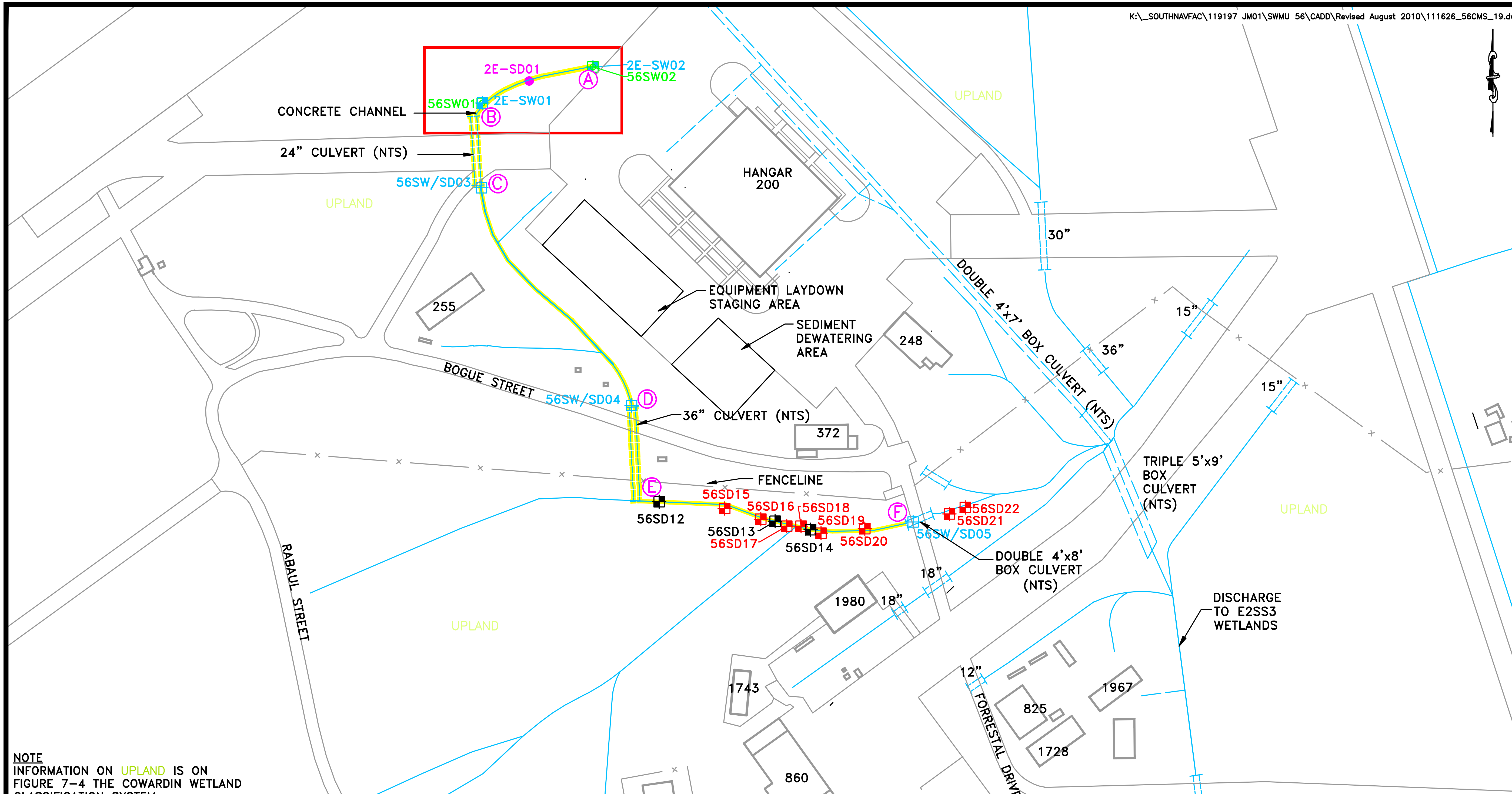
NOTE
INFORMATION ON UPLAND IS ON FIGURE
7-4 THE COWARDIN WETLAND
CLASSIFICATION SYSTEM

LEGEND
- DRAINAGE DITCH
- SWMU BOUNDARY
- CULVERTS
- CMS INVESTIGATION SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS (APRIL 2008)
- SURFACE SOIL SAMPLES (SEPTEMBER 2008)
- AREA OF SURFACE SOIL EXCAVATION (0-1')

APPROXIMATE SURFACE AREA	APPROXIMATE DEPTH	APPROXIMATE VOLUME	
(SQUARE FEET)	(FEET)	(CUBIC FEET)	(CUBIC YARDS)
11,916	1	11,916	441.3

FIGURE 11-1
CONCEPTUAL DESIGN FOR SURFACE SOIL EXCAVATION
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO



NOTE
INFORMATION ON UPLAND IS ON FIGURE 7-4 THE COWARDIN WETLAND CLASSIFICATION SYSTEM

DITCH SEGMENT	DESCRIPTION	APPROXIMATE LENGTH (FEET)	ESTIMATED WIDTH (FEET)	ESTIMATED DEPTH (FEET)	ESTIMATED VALUE OF CONTAMINATED SEDIMENT (CUBIC FEET)	(CUBIC YARDS)
A – B	CONCRETE LINED	248.14	1.5	0.08	29.8	1.1
B – C	24" DIA CULVERT	133.4	2	0.08	5.3	0.2
C – D	SOIL	532.76	4	1.0	2,132	79
D – E	36"DIA. CULVERT	181.37	3	0.17	30.77	1.1
E – F	SOIL	526.85	4 TO 8	1.0	4,216	156.1
				TOTALS	6,413.9	237.5

DRAINAGE DITCH / SEDIMENT EXCAVATION

LEGEND
- –SWMU BOUNDARY
- –DRAINAGE DITCH
- –PREVIOUS SURFACE WATER SAMPLE LOCATION, 2004
- –PREVIOUS COMPOSITE SEDIMENT SAMPLE FROM ENTIRE LENGTH OF DRAINAGE DITCH, 2004
- –CMS INVESTIGATION SURFACE WATER AND SEDIMENT SAMPLE LOCATION (APRIL 2008)
- –CMS INVESTIGATION SURFACE WATER SAMPLE LOCATIONS (APRIL 2008)
- –SEDIMENT SAMPLES (SEPTEMBER 2008)
- –SEDIMENT ADDITIONAL DATA COLLECTION (JUNE 2009)
- –CULVERTS

200 0 100 200
1 inch = 200 ft.

Baker

FIGURE 11-2
CONCEPTUAL DESIGN FOR
SEDIMENT EXCAVATION
SWMU 56-HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT

NAVAL ACTIVITY PUERTO RICO

APPENDIX A
2008 FIELD ACTIVITIES

CHAIN-OF-CUSTODY FORMS

Serial Number 004546

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 56-002

( ) Alternate Laboratory Name/Location
Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)	PAGE	OF
NAPR 7 Site Investigation	111626	PR	1	2

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.

STANDARD REPORT DELIVERY (X) DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE) ( ) DATE DUE ________

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE / REQUIRED ANALYSIS — PRESERVATIVE — 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 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	1125	56SB03-00	G		✓			3	1		1							
	1125	56SB 03-00D	G		✓			3	1		1							
	1140	56SB 03-02	G		✓			3	1		1							
	1145	56SB 03-04	G		✓			3	1		1							
	1010	56SB 05-00	G		✓			3	1		1							
	1020	56SB 05-03	G		✓			3	1		1							
	1020	56SB 05-03MS/MSD	G		✓			3	1		1							
4/29/08	1030	56SB 05-05	G		✓			3	1		1							
4/30/08	1440	56SB 06-00	G		✓			3	1		1							
	1545	56SB 06-01	G		✓			3	1		1							
	~~1505~~ 1545	56SB 06-01D	G		✓			3	1		1							
4/30/08	1500	56SB 06-03	G		✓			3	1		1							

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. K[signature]	5/1/08	1500			

RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
[signature]	4/28/00	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
[signature]	~~4/28/08~~	~~0700~~	YES ( ) NO ( )		680-36360	

MEK 5/1/08

TAL8240-680 (1207)

Serial Number 005101

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

56-002

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)	CONTRACT NO.	CLIENT FAX
NAPR 7 Site Investigation	111626	PR		

TAL (LAB) PROJECT MANAGER	Kathy E. Smith
P.O. NUMBER	
CLIENT (SITE) PM	Mark Kimes
CLIENT PHONE	412.337.7465
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 2

STANDARD REPORT DELIVERY

DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE)

DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS — PRESERVATIVE — 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 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
4/30/08	1500	56SB06-03 MS/MSD	G		✓			3	1		1							
4/29/08	1625	56SW01	G	✓						2	1	1						
4/30/08		56TB02	G	✓				3										
5/1/08	1045	56GW01	G	✓				3	2		1	1						
5/1/08	0930	56GW02	G	✓				3	2		1	1						
5/1/08	1135	56GW04	G	✓				3	2		1	1						
	0845	56SB07-00	G		✓			3	1		1							
	0850	56SB07-02	G		✓			3	1		1							
	0905	56SB07-03	G		✓			3	1		1							

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			[signature]	5/1/08	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
[signature]	5/2/08	0914	YES / NO		680-36360	

Serial Number 005108

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 8005

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

56-003

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 1

STANDARD REPORT DELIVERY: X
DATE DUE 28 Day TAT

EXPEDITED REPORT DELIVERY (SURCHARGE)
DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE / REQUIRED ANALYSIS — PRESERVATIVE — 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 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
5/1/08	1535	56GW03	G	✓				3	2		1	1						
|	1535	56GW03D	G	✓				3	2		1	1						
|	1535	56GW03MS	G	✓				3	2		1	1						
5/1/08	1535	56GW03MSD	G	✓				3	2		1	1						
5/2/08	0825	56GW05	G	✓				3	2		1	1						
5/2/08		56TB03	G	✓				3										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			[signature]	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	8.8/12.8/8.2/10.6/12.8/11.8/6.0/17.6/15.8

TAL8240-680 (1207)

Serial Number 005196

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 7991

☒ TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

56-004

○ 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 1

STANDARD REPORT DELIVERY ☒
DATE DUE 28 Day TAT
EXPEDITED REPORT DELIVERY (SURCHARGE) ○
DATE DUE
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE / REQUIRED ANALYSIS / PRESERVATIVE / 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 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
5/3/08	1140	56GWØ6	G	X				3	2		1	1						
5/3/08	1300	56GWØ7	G	X				3	2		1	1						
5/5/08	0820	56SBØ8-ØØ	G		X			3	1		1							
5/5/08	0835	56SBØ8-Ø1	G		X			3	1		1							
5/5/08	0830	56SBØ8-Ø2	G		X			3	1		1							
5/4/08		56TBØ4	G	X				3										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	5/5/08	1500			
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
KL	5/6/08	0915	YES ○ NO ○		680-36426	

Serial Number 005188

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 7991

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

69-004

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 1

STANDARD REPORT DELIVERY ☒
DATE DUE 28 Day TAT
EXPEDITED REPORT DELIVERY (SURCHARGE)
DATE DUE ______
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE / REQUIRED ANALYSIS / PRESERVATIVE / 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 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
5/3/08	0950	69GW26	G	X				3	2		1	1						
5/3/08	0850	69GW27	G	X				3	2		1	1						
5/4/08		56TB04	G	X				3										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE) [signature]	DATE 5/5/08	TIME 1500	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
RECEIVED BY: (SIGNATURE)	DATE 4/28/08	TIME 0700	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
KL	5/6/08	0915	YES ◯ NO ◯		680-36426	

Serial Number 005167

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8617 8652 7970

TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858 56-005
Fax: (912) 352-0165 ~~74-006~~

Alternate Laboratory Name/Location
Phone:
Fax:

Field	Value
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 1

STANDARD REPORT DELIVERY: X
DATE DUE 28 Day TAT
EXPEDITED REPORT DELIVERY (SURCHARGE)
DATE DUE
NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE / REQUIRED ANALYSIS / PRESERVATIVE / 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 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
5-7-08	0815	56GW08	G	X				3	2		1	1						

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	5/7/08	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	5/8/08	0916	YES / NO		680-36517	

TAL8240-680 (1207)

Serial Number 004540

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

56-001

( ) 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 2

STANDARD REPORT DELIVERY (X) 28 Day TAT
DATE DUE

EXPEDITED REPORT DELIVERY (SURCHARGE) ( )
DATE DUE

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE / 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 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									–		–							
4/28/08	1125	56SB01-00	G		X			3	1		1							
4/28/08	1135	56SB01-01	G		X			3	1		1							
↓	1200	56SB01-04	G		X			3	1		1							
	1420	56SB02-00	G		X			3	1		1							
	1425	56SB02-02	G		X			3	1		1							
	1430	56SB02-04	G		X			3	1		1							
	1500	56SB04-00	G		X			3	1		1							
	1515	56SB04-03	G		X			3	1		1							
↓	1530	56SB04-04	G		X			3	1		1							
4/29/08	1140	56SD03															1	added per client
↓	1110	56SD04															1	KS 5/30/08
↓	1110	56SD04D																

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	4/29/08	1800			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
Mark E. Kimes	4/28/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
Jess Hornsby	4/30/08	0908	YES ( ) NO ( )		680-36289	Temp (°C): 0.4, 1.4, 1.8, 2.2, 3.6, 3.8

TAL8240-680 (1207)

Serial Number 004539

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

FedEx Airbill No.: 8480 2694 7400

☒ TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.testamericainc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

56-001

◯ 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 2

STANDARD REPORT DELIVERY: ☒ 28 Day TAT
DATE DUE ______

EXPEDITED REPORT DELIVERY (SURCHARGE) ◯
DATE DUE ______

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE; AQUEOUS (WATER); SOLID OR SEMISOLID; AIR; NONAQUEOUS LIQUID (OIL, SOLVENT, ...)

REQUIRED ANALYSIS — PRESERVATIVE: App IX VOCs: H_2O HCl; App IX Metals (Total): H_2O HNO_3; App IX Metals (Dissolved): H_2O HNO_3

NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	C/G	AQUEOUS	SOLID	AIR	NONAQUEOUS	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	1110	56SD04MS/MSD	G		X			3	1		1							
4/29/08	1020	56SD05	G		X			3	1		1						1	added per client KS 5/20/08
↓	1200	56SW02	G	X						2	1	1						
↓	1140	56SW03	G	X						2	1	1						
↓	1110	56SW04	G	X						2	1	1						
↓	1110	56SW04D	G	X						2	1	1						
↓	1020	56SW05	G	X						2	1	1						
4/29/08		56TB01	G	X				3										

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
			Mark E. Kimes	4/29/08	1800			
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**
Mark E. Kimes	4/28/08	0700						

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	SAVANNAH LOG NO.	LABORATORY REMARKS
Jess Hornsby	4/30/08	0908	YES ◯ NO ◯		680-36289	Temp (°C): 0.4, 1.4, 1.8, 2.2, 3.6, 3.8

TAL8240-680 (1207)

Serial Number 006317

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: NAPR SWMU 56	PROJECT NO.: 115354 11.4 Island	PROJECT LOCATION (STATE): PR	PAGE 1 OF 1
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER:	CONTRACT NO.:	STANDARD REPORT DELIVERY ● DATE DUE
CLIENT (SITE) PM: MARK KIMES	CLIENT PHONE: 412 269 2009	CLIENT FAX:	
CLIENT NAME: BAKER	CLIENT E-MAIL:		EXPEDITED REPORT DELIVERY (SURCHARGE) DATE DUE
CLIENT ADDRESS:			
COMPANY CONTRACTING THIS WORK (if applicable):			NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE; AQUEOUS (WATER); SOLID OR SEMISOLID; AIR; NONAQUEOUS LIQUID (OIL, SOLVENT, ...)

REQUIRED ANALYSIS: Appendix IX Metals Total

PRESERVATIVE

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	C/G	AQUEOUS	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID	NUMBER OF CONTAINERS SUBMITTED (Appendix IX Metals Total)	REMARKS
9/25/08	1605	56SD06	G		X			1	
↓	1555	56SD07	G		X			1	
↓	1620	56SD08	G		X			1	
↓	1635	56SD09	G		X			1	
↓	1525	56SD11	G		X			1	
↓	1545	56SD12	G		X			1	
↓	1535	56SD13	G		X			1	
↓	1515	56SD14	G		X			1	
↓	1515	56SD14D	G		X			1	Duplicate

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Joe Bimann	9/24/08	1400						
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
KH	9/27/08	0957	YES ○ NO ○		680-40837	2.3°C

Serial Number 004881

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: Baker NAPR 56
PROJECT NO.: 115354-11.2
PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith
P.O. NUMBER:
CONTRACT NO.:
CLIENT (SITE) PM: Mark Ames
CLIENT PHONE: 412 269 2009
CLIENT FAX:
CLIENT NAME: Baker
CLIENT E-MAIL:
CLIENT ADDRESS:
COMPANY CONTRACTING THIS WORK (if applicable):

PAGE 1 OF 2

STANDARD REPORT DELIVERY
DATE DUE

EXPEDITED REPORT DELIVERY (SURCHARGE) ●
DATE DUE 14 Day

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: Lead, Selenium

PRESERVATIVE

MATRIX TYPE: COMPOSITE (C) OR GRAB (G) INDICATE / AQUEOUS (WATER) / SOLID OR SEMISOLID / AIR / NONAQUEOUS LIQUID (OIL, SOLVENT, ...)

NUMBER OF CONTAINERS SUBMITTED

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G)	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID	Lead, Selenium	REMARKS
9/24/08	900	56SS01			X			X	
↓	910	56SS02			X			X	
	920	56SS03			X			X	
	930	56SS04			X			X	
	945	56SS05			X			X	
	950	56SS06			X			X	
	905	56SS13			X			X	Hold
	905	56SS13D			X			X	↓
	905	56SS13 MS/MSD			X			X	
	915	56SS14			X			X	
	925	56SS15			X			X	
	935	56SS16			X			X	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
[signature]	9/24/08	1400						
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
KH	9/25/08	1054 ~~0945~~	YES ○ NO ○		680-40743	0.2/0.9

TAL8240-680 (1207)

Serial Number 013683

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: Baker NAPR 56	PROJECT NO.: 115354 11.2	PROJECT LOCATION (STATE): PR
TAL (LAB) PROJECT MANAGER: Kathy Smith	P.O. NUMBER:	CONTRACT NO.:
CLIENT (SITE) PM: Mark Kimes	CLIENT PHONE: 412 269 2009	CLIENT FAX:
CLIENT NAME: Baker	CLIENT E-MAIL:	
CLIENT ADDRESS:		
COMPANY CONTRACTING THIS WORK (if applicable):		

PAGE 2 OF 2

STANDARD REPORT DELIVERY ○
DATE DUE ________

EXPEDITED REPORT DELIVERY (SURCHARGE) ●
DATE DUE 14 Day

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

REQUIRED ANALYSIS: Lead + Selenium; Selenium + Vanadium

PRESERVATIVE

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, ...)	Lead + Selenium	Selenium + Vanadium	REMARKS
9/24/08	955	56SS17			X			X		Hold
	1000	56SS18			X			X		Hold
	1005	56SS07			X				X	
	1010	56SS08			X				X	
	1015	56SS09			X				X	
	1020	56SS19			X				X	Hold
	1035	56SS10			X				X	
	1040	56SS11			X				X	
	1040	56SS11D			X				X	
	1030	56SS12			X				X	
	1050	56SS20			X				X	Hold
	1045	56SS21			X				X	Hold

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Joe Bumara	9/24/08	1400						
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
KH	9/25/08	1054	YES ○ NO ○		680-40743	

CompuChem
a division of Liberty Analytical Corp.

CHAIN OF CUSTODY

501 Madison Ave.
Cary, NC 27513
Phone: 919-379-4100 Fax 919-379-4040

№ 02615

Page 3 of 4

Courier FED EX
Airbill No. 8611 3412 4163
Sampling Complete? Y or N

Client/Reporting Information

Company Name: Baker Environmental, Inc.
Address: 100 Airside Drive
City / State / Zip: Moon Township, PA 15108
Project Contact: Mark Kimes
Phone #: 412-337-7465
Sampler's Name: John Malinowski/Adam Gailey

Project Information

Project Name: NAPR
Sampling Location: 56 56A BKG Freshwater Ditch
Turnaround time: Standard
Batch QC or Project Specific? If Specific, which Sample ID?
Are aqueous samples field filtered for metals? Y or N
Are high concentrations expected? Y or N? If yes, which ID(s)?

Requested Analysis (include method and bottle type)

Matrices: GW - Ground water; WW - Waste water; SW - Surface water; SO - Soil/Sediment; TB - Trip Blank; RI - Rinsate; WP - Wipe; O - Other

CompuChem Sample No. (Lab Use)	Field ID	Date	Time	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	MEOH	Other	Appendix IX VOC	Appendix IX SVOC	Appendix IX Pest/PCB	Appendix IX Metals	~~AVS/SEM~~ ADG - 6/24/09						pH (Sample Info) (Lab Use)
0906171-10	56A-SD10 MS	6/23/09	0920	SO	4							X	X	X								
↓	56A-SD10 MSD	6/23/09	0920	SO	4							X	X	X								
0906174-01	June09-FB01	6/23/09	1512	O	8							X	X	X	X							<2
-02	June09-ER01	6/23/09	1630	RI	8 (7)							X	X (1)	X	X							<2
-03	June09-FB02	6/24/09	1020	O	1										X							<2
↓	~~June09-ER02~~	~~6/24/09~~	~~1110~~	~~RI~~	~~1~~										~~X~~		ADG 6/24/09					
0906174-04	June09-TB01	6/23/09		TB	3							X										

Residual Chlorine Present?
Yes ____ No ✓

Lab Use Only

Sample Unpacked By: [signature]
Sample Order Entry By: [signature]
Samples Received in Good Condition? Y or (N)
If no, explain: ER01 AL Broken upon receipt
Cyanide samples checked for sulfide & chlorine? Y or (NA)
625 & Phenol samples checked for chlorine? Y or (NA)
608 samples checked for pH between 5.0-9.0? Y or (NA)

Comments

(1) AL Broken upon Receipt ER01
[initials] 6/25/09

Sample Custody

Relinquished by:	Date/Time:	Received by: [signature]	Date/Time: 6/21/09 0630
Relinquished by: [signature]	Date/Time: 6/24/09 1500	Received by: [signature]	Date/Time: 6/25/09 0920
Subcontract? Y or (N) If yes, where?	Custody Seal(s) intact? (Y) or N	On Ice? (Y) or N	Cooler Temp: 2.6, 2.6, 1.8°C 2.3, 1.4°C

Samples stored 60 days after date report mailed at no extra charge.

White & Yellow copy to lab • Pink copy for customer

16048 197 062

CompuChem
a division of Liberty Analytical Corp.

CHAIN OF CUSTODY

501 Madison Ave.
Cary, NC 27513
Phone: 919-379-4100 Fax 919-379-4040

Courier: FED EX
Airbill No. 8611 3412 4163
Sampling Complete? Y or N

Client/Reporting Information

Company Name: Baker Environmental, Inc.
Address: 100 Airside Drive
City / State / Zip: Moon Township, PA 15108
Project Contact: Mark Kimes
Phone #: 412-337-7465
Sampler's Name: John Malinowski/Adam Gailey

Project Information

Project Name: NAPR
Sampling Location: 56 56A BKG Freshwater Ditch
Turnaround time: Standard
Batch QC or Project Specific? If Specific, which Sample ID?
Are aqueous samples field filtered for metals? Y or N
Are high concentrations expected? Y or N? If yes, which ID(s)?

Requested Analysis (include method and bottle type): Appendix IX VOC; Appendix IX SVOC; Appendix IX Pest/PCB; Appendix IX Metals; ~~AVS/SEM~~ ADG 6/24/09

Matrices: GW - Ground water; WW - Waste water; SW - Surface water; SO - Soil/Sediment; TB - Trip Blank; RI - Rinsate; WP - Wipe; O - Other

pH / Sample Info (Lab Use)

CompuChem No (Lab Use)	Field ID	Date	Time	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	MEOH	Other	Appendix IX VOC	Appendix IX SVOC	Appendix IX Pest/PCB	Appendix IX Metals	~~AVS/SEM~~
0906175-01	56 SD 15	6/24/09	0735	SO	1										X	
-02	56 SD 16		0758	SO	1										X	
-03	56 SD 17		0812	SO	1										X	
-04	56 SD 18		0847	SO	1										X	
-05	56 SD 19		0829	SO	1										X	
-06	56 SD 20		0900	SO	1										X	
-07	56 SD 21		0925	SO	1										X	
-08	56 SD 22 (+MS/MSD)		0935	SO	1										X	
-09	56 SD 22 D		0935	SO	1										X	
-10	FWDBKG-SD17	6/24/09	1005	SO	1										X	

Lab Use Only

Sample Unpacked By: [signature]
Sample Order Entry By: [signature]
Samples Received in Good Condition? Y or N
If no, explain:

Cyanide samples checked for sulfide & chlorine? Y or NA
625 & Phenol samples checked for chlorine? Y or NA
608 samples checked for pH between 5.0-9.0? Y or NA

Comments

FWDBKGSD17 top Broken (metals) will transfer sample to new container

Sample Custody

Relinquished by: [signature] Date/Time: Received by: [signature] Date/Time: 6/21/09 0630
Relinquished by: [signature] Date/Time: 6/24/09 1500 Received by: [signature] Date/Time: 6/25/09 0930
Subcontract? Y or N If yes, where? Custody Seal(s) intact? Y or N On Ice? Y or N Cooler Temp: 2.6, 2.6, 1.6°C 2.3, 1.4°C

Samples stored 60 days after date report mailed at no extra charge.

White & Yellow copy to lab • Pink copy for customer

№ 009703

CHAIN OF COUSTODY

CompuChem
a division of Liberty Analytical Corp.

501 Madison Ave.
Cary, NC 27513
Phone: 919-379-4100 Fax 919-379-4040

Page 1 of 1

Courier FED EX
Airbill No. 8611 3412 4174
Sampling Complete? Y or N

Client/Reporting Information

Company Name: Baker Environmental, Inc.
Address: 100 Airside Drive
City: Moon Township State: PA Zip: 15108
Project Contact: Mark Kimes
Phone #: 412-337-7465
Sampler's Name: John Malinowski/Adam Gailey

Project Information

Project Name: NAPR
Sampling Location: (56) 56A BKG Freshwater Ditch
Turnaround time: Standard
Batch QC or Project Specific? If Specific, which Sample ID?
Are aqueous samples field filtered for metals? Y or N
Are high concentrations expected? Y or N? If yes, which ID(s)?

Matrices: GW - Ground water; WW - Waste water; SW - Surface water; SO - Soil/Sediment; TB - Trip Blank; RI - Rinsate; WP - Wipe; O - Other

CompuChem No (Lab Use)	Field ID	Collection Date	Collection Time	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	MEOH	Other	Appendix IX VOC	Appendix IX SVOC	Appendix IX Pest/PCB	Appendix IX Metals	AVS/SEM	pH/Sample Info (Lab Use)
	56 SD 15	6/24/09	0735	SO	1											X	
	56 SD 16		0758	SO	1											X	
	56 SD 17		0812	SO	1											X	
	56 SD 18		0847	SO	1											X	
	56 SD 19		0829	SO	1											X	
	56 SD 20		0900	SO	1											X	
	56 SD 21		0925	SO	1											X	
	56 SD 22 (+MS/MSD)		0935	SO	1											X	
	56 SD 22D	6/24/09	0935	SO	1											X	

R0903519
Compuchem
NAPR

Lab Use Only

Sample Unpacked By:
Sample Order Entry By:
Samples Received in Good Condition? Y or N
If no, explain:

Cyanide samples checked for sulfide & chlorine? Y or NA
625 & Phenol samples checked for chlorine? Y or NA
608 samples checked for pH between 5.0-9.0? Y or NA

Comments: Initiate Analysis upon Receipt due to nature of Requested Analysis.

Sample Custody

Relinquished by:	Date/Time:	Received by:	Date/Time: 6/21/09 0630
Relinquished by:	Date/Time: 6/24/09 1500	Received by: CAS	Date/Time: 6-25-09 9:20

Subcontract? Y or N If yes, where?
Custody Seal(s) intact? Y or N
On Ice? Y or N
Cooler Temp: °C

Samples stored 60 days after date report mailed at no extra charge.
White & Yellow copy to lab • Pink copy for customer

FIELD LOG BOOK NOTES

Environmental Geologist – Robert Roselius

SMWU 56

4/28/08 (SEE PG 2)

— GEOENVIRO TECH, INC.

787.720.5869

ABRAHAM

NASSER

4/28/08

56 SB01 4/28/08

MONDAY

DEPTH	RECOVERY	PID	
0-0.6	TOPSOIL (ORGANICS)		
0.6-4.0	3.8	BKG	Lt GREY TO MAROON MOTTLED CLAY, LITTLE SILT, MED STIFF, MED PLASTICITY.
	* SB01-00 @ 1125 (0-1)		
	* SB01-01 @ 1135 (1-3)		
4.0-8.0	3.6	BKG.	SAA (SAME AS ABOVE) SOME SURFACE WATER RUNNING INTO HOLE FROM RAIN LAST NIGHT
8.0	* SB01-04 @ ~~1135~~ 1200 (7-9)		
8.0-12.0 10.0 ft	2.3	BKG	SAA TO 10' WHITE TO BR w/ MAROON @ 10' - SOME YELLOW @ 11'
12-16	3.2	BKG	SAA, MOIST
16-20	1.0	BKG	SAA
20-24	1.6	BKG	SAA w/ SOME LAMINANT BEDDING

56 SB01 (CONT.)

24-28	1.5	BKG	SAA.	END OF BORING

● INSTALL 56 GW01 ON 4/30/08 (pg 13)

TD 16' bgs (2" PVC)
SCREEN 6' to 16'
SAND TO 4' bgs
BENTONITE TO 2' bgs
YELLOW, SQUARE 4"x4" PRO-TOP
2±' STICKUP

ABRAHAM & NASSER
RR

GEOPROBE ~~DT66~~ 66DT (JOE'S DT6610)

RR

RGR 4/28/08

56SB02 4/28/08

0-4.0 4.0 BKG 0-0.6 TOPSOIL
0.6-4.0 Lt GREY TO MAROON MOTTLED CLAY, SOME SILT, DAMP, MED STIFF, MED PLASTICITY.
* SB02-00 @ 1420

4.0-8.0 3.8 BKG SAA w/ TRACE F. SAND.
* SB02-02 @ 1425 (3-5)
* SB02-04 @ 1430 (7-9)

8.0-12.0 3.9 BKG SAA
@ 9.5' SAA BUT Lt GREY TO DK MAROON w/ SOME SILT INCLUSION, DAMP

12.0-15.0 2.4 BKG ONLY 3' RUN
13-13.5 GREEN CLAY LITTLE SILT
14.8-15.0 " " " "

15.0-19.0 3.5 BKG SAA 13.0 - CLAY SWELLING IN SLEEVE.

END OF BORING MOVE TO SB04.

56 (2" PVC)

● INSTALL GW02 ON 4/30/08 (PG 13)

TD - 16', bgs
SCREEN 6-16'
SAND TO 4' bgs
BENTONITE TO 2' bgs
YELLOW, SQUARE 4'x4' PRO-TOP
2±' STICKUP

RW

56SB04 (04/28/08)

0-4.0 3.9 BKG 0-0.2 TOPSOIL
0.2-4.0 LT GREY W/
LITTLE MAROON CLAY
W/ LITTLE SILT, DAMP. MED.
STIFF, MED, PLAST.

* SB04-00 @ 1500

4.0-8.0 3.9 BKG SAA TO 5.0
5.0-6.5 MAROON CLAY W/
WEATHERED SILT "PIECES"
6.5-8.0 SAA 5.0 W/ LESS
LT GREY, DAMP

* SB04-03 (5-7) @ 1515

8-12 3.7 BKG 8-9.5 LT GREY, LITTLE
MAROON, DAMP
9.5-12 MAROON SILTY CLAY
W/ LITTLE LIGHT GREY.

* SB04-04 (7-9) @ 1530

12-16 1.3 — SAA MOIST TO WET.

END OF DAY

4/29/08 (TUES)

@ 56SB04 (CONTINUE SAMPLING) 0745

DEPTH	RECOVER	PID	
16-19	2.6	—	ONLY 3' RAN MED GREY TO MAROON SILTY CLAY, W/ SMALL (∴) BLACK INCLUSIONS, DAMP

GW MS @ APPROX 4' bgs BEFORE START.

BUILD WELL + WILL OBSERVE SWL; AND CONTINUE SOIL SAMPLING @ SB03 AND SB05 AND DETERMINE WELL SPECS ~~FOR~~ AS BASED ON SB04 SWL.

~~TD 1 RGR~~
~~SCREEN 3 - 18'~~
~~BENTONITE 2' ABOVE (4.0 bgs)~~ RGR SAND.
~~SAND TO 6' bgs~~

• INSTALL 56GW04 (2" PVC)

TD 16' bgs
SCREEN 6' - 16'
SAND TO 4' bgs
BENTONITE TO 2' bgs
YELLOW SQUARE 4"x4" PRO-TOP
2±' STICKUP

56SB05 START @ 1000

0-4 4.0 BKG 1.4 TOPSOIL BR. SILT & CLAY.
1.4-4.0 LT GREY & YELLOW W/ LITTLE MAROON. SILTY CLAY, DAMP, MED STIFF

* SB05-00 @ 1010

4-8 3.2 BKG SAND BLOCKY/FRIABLE W/ F. SAND 6.0-7.5 - SAND AFTER 7.5 COARSE SAND GRAIN @ 8.0.

* SB05-03 + ~~DUP~~ MS/MSD @ 1020

8-12 3.4 BKG. SAND W/ INCREASE IN GRAINSIZE (LITTLE FINE TO MED SAND) MOIST

* SB05-05 @ 1030 (COLLECTED FROM 9-10' INTERVAL)

12-16 2.4 — SAND (WET), SOFT.
16-20 3.2 — SAND (WET) 19.4-20 GREEN GREY CLAY.

SWL @ MW04 - 2.45' (WILL ~~NOTIFY~~ MONITOR AND EXPECT TO DROP. @ 1040.

1310 2/29/08 MOVE TO SB05
AUGER 16' IN PREP FOR WELL
CONSTRUCTION TOMORROW:
56GW05 (2" PVC)
● COMPLETE MW CONSTRUCTION 4/30/04A
(SEE 16/13)

TD 16' bgs
SCREEN 6-16'
SAND TO 4' bgs
BENTONITE TO 2' bgs
YELLOW SQUARE 4"x4" PRO-TOP
2±' STICKUP

RGR

56SB03 (SET UP @ 1110) 4/29/08
REFUSAL @ 1.5 x 2/MOVE 6' SE REFUSAL @ 3' MOVE
3' NW OF ORIGINAL OK

0-4 — 0-1.7 TOPSOIL (BOTTOM 1.0 BLACK SILT/SAND
1.7-4.0 LT GREY & ~~LT~~ ORANGE SILTY (CLAY)
DAMP.
→4.0 BKG

* SB03-00 + DUP @ ~~1120~~ 1125
* SB03-02 @ 1140 (3-5)

4-8 3.8 BKG SAA GRADING TO GREENISH W/ ORANGE/MAROON DAMP

* SB03-04 @ 1145

8-12 3.5 BKG DK MAROON W/ BLACK ~~INCLUSIONS~~ INCLUSIONS, DAMP.

12-16 3.8 BKG 12-14 - GREENISH GREY AND YELLOW ORANGE SILTY CLAY
14-16 SAME AS 8-12
DAMP.

1150 ABRAHAM OFFSITE TO GET SAND AND LUNCH.

• INSTALL ~~56~~ GW03 (2" PVC)

TD 16'

SCREEN 6-16'

SAND TO 4' bgs

BENTONITE TO 2' bgs

YELLOW, SQUARE 4"x4" PRO-TOP

DRILLERS ADVANCE AUGERS TO 16' bgs @ SB05, INSTALL BOLLARDS @ ~~ABA~~ MW SB03

1620 DEPART (ABRAHAM)

1750 BAKER DEPARTS BASE.

★ SEE PG 17 FOR NEW GW-2 TD (ie. PRO-TOP DROPPED, NEED TO CUT PVC)

4/30/08 (WED.)

0730 @ GATE #1 (FROM PUBLIC WORKS BLDG)

COMPLETE MW CONSTRUCTION @ GW05

– SEE PAGE 10 FOR SPECS.

MOVE TO ~~56~~ SB02 FOR MW CONSTRUCTION

	56		SWL	TD
~~4~~	0750	GW04	2.37' TOC	17.90 TOC
~~5~~	0800	GW05	EQUILIBRATING(1)	18.25'
~~3~~	0805	GW03	"	18.22

(1) WELL CAPS TIGHT – DID NOT ALLOW SWL TO EQUILIBRATE, ALLOW EQUILIBRATE.

0930 COMPLETE GW02 WELL SEE PAGE 6 FOR DETAILS (NOT COMPLETED @ SURFACE)

		SWL	TD
1030	GW02	17.13'	~~17.13~~ ~~18.3~~ VOID
	LOW/SLOW YIELD.		

1030 COMPLETE GW01 (NOT AT SURFACE (SEE PG 3)

1035 GW01 3.41' 18.3'

1040 ABRAHAM HEADS TO DECON NSA.

1435 ABRAHAM RETURNS FROM GETTING EQUIP. START @ SB06, HELPER COMPLETING GW01 & GW02 AT SURFACE.

14

56 SB06

0-4 4.0 BKG 0-0.5 TOPSOIL
0.5-4 Lt GREY TO MAROON MOTTLED SILTY CLAY, SOME COARSE SAND SIZED SILTSTONE PIECES @3.5. STIFF, DAMP

SB06-00 @ 1440
SB06-01 + DUP @ 1445

4-8' 3.9 BKG SAA GRADING TO Lt GREY + ORANGE @ 6.5', DAMP, STIFF

SB06-03 + MS/MSD @ 1505

8-12' 3.8 BKG SAA GRADING TO INCREASED GRAIN SIZE (SILT, V.F SAND) AND TO Lt GREY/MAROON AT 11.5' (MOIST TO WET @ 11±')

12-16 2.4 — ~~16~~ 12.6-14.6 SAA VERY SOFT SILTY CLAY,
14.6-16 SAA STIFF WET

15

56

PREP TO ~~18~~ INSTALL GW06
AUGER 16' 56
• INSTALL GW06 (2" PVC)
TD 16' bgs
SCREEN 6'-16'
SAND to 4' bgs
BENTONITE TO 2' bgs
BELOW, SQUARE 4"x4" PRO-TOP.
STICKUP 2±'

1615 ~~1645~~ CREW NEEDS TO DECON W/ COMPLETE WELL @ SURFACE (PRO-TOP + PAD) TOMORROW.

1645 NEED TO ~~PA~~ PWB
1750 DEPART RNS

RGR

16

5/1/08 (THURS)

0810 COMPLETE GW06 (PRO-TOP/GROUT), CLEANUP MOVE TO SB07

56SB07

0-4' 2.8' BLG 0-0.7 TOPSOIL (ONE GRAVEL)
2.8. BROWN SILT & CLAY, DAMP, MED SOFT. SOME SAND (FILL)

~~0848~~ SB0700 @ 0845
SB0702 @ 0850 (3-5)

4-8' 3.3 BLG - FILL CLAY TO COARSE SAND (GRAVEL ~~4-4.4~~) 4.0-4.4)
MOIST-to WET., SOFT (CLAY MATRIX)
SB0703 @ 0905 (5-7)

8-12' 3.1 — SAA, GRADING TO Lt GREY & ORANGE CLAY w/ LITTLE SILT (SILTY CLAY).
@ 11.5' MED STIFF.
* SATURATED (W/ GRAVEL ~~SLIGHT~~ SLUFF)

12-16' 1.5 — SAA (Lt GREY/ORANGE SILTY CLAY, STIFF, MOIST.

17

PREP TO DRILL/CONSTRUCT GW07 @ 0915.

THE PRO-TOP @ GW02 DRAPED SO THE LID WOULD NOT CLOSE, CUT APPROX 2" OF PVC - NEW WELL SPECS:

		TD	SWL
1055	GW02	18.11	11.35
1105	GW06	18.41	2.88 (SOME SILT ON BOTTOM 0.2'±)
1110	GW07	18.44	6.44' ↳ NOT EQUILIBRATED

56

• COMPLETE GW07 INSTALL @ 1110 (2" PVC)
TD - 16' bgs
SCREEN 6' to 16
SAND TO 4' bgs
BENTONITE TO 2' bgs
YELLOW, SQUARE 4"x4" PRO-TOP.

— ABRAHAM & NASSER WILL COMPLETE ALL WELLS AT SURFACE (PADS/BOLLARDS) TODAY — WORKING @ GW07 NOW.

COMPLETE PADS/BOLLARDS @ GW07, GW05 GW04, GW02 & GW01

1645 HEAD TO PWB
— JOE STAYS TO MONITOR MY CREW FINISHING GW01

1810 DEPART NAPR

5/2/08 FRI

0615 ONSITE GATE #3 PKR
0710 @ AIR FIELD, ABRAHAM/NASSER
ARBP TO COMPLETE WELLS @
SURFACE GW3 AND GW6

- COMPLETE WELLS AT SURFACE
- LOCATE VALVE PITS (VP) 1 & 2
- MARK CLEARS FOR VP BORING

1020 BEGIN SB VP2A — VP2A

	BLK	
0-4	3.8	0-1.5 CLAY W/ SILT TO F. SAND, T. COARSE SAND BROWN, DAMP 1.5-4.0 CLAY, SOME SILT. LT. GREY AND MAROON, FRIABLE/BLOCKY. DRY TO DAMP
4-8	2.0	F. SAND TO GRAVEL. BROWN, WET @ 7.5.
8-11	1.9	← 3' RUN - REFUSAL @ 11'; SAA - F. SAND TO GRAVEL, SATURATED.

DRIVE 2 5/8" ID (10.3') CASING TO
10.6' bgs - REFUSAL.

1100 ABRAHAM/NASSER DEPART TO GET
PREPACK RISER AT EQUIP STAGING
@ NEAR PWB.

1325 BUILD GWVP2A WITH 1 1/2
PREPACKED SCREEN & RISER (GEOPROBE)
LIGHT RAIN
■ GWVP2A (1 1/2 PRE-PACK)
74 TD 10.5± bgs.
SCREEN 10.5 - 5.5
SAND TO 4.5' bgs
BENTONITE TO SURFACE
PUSH PRO-TOP, 1+' DIAMETER ROD.

1800 STILL RAINING. DIRECT CREW TO
LOAD RIG (PER SECURITY; THEY WANT
THE EQUIPMENT BY THE ENTRANCE
GATE ~~#5~~ OVER THE WEEK END SO
THEY CAN WATCH IT.) DRILLERS HEAD
TO HANGAR TO UNLOAD TRAILER SO
THEY CAN LOAD THE RIG.

ASSIST JOB W/ SLUG TEST

1520 DRILL CREW DEPARTS AIRFIELD
RGR DEPARTS AIRFIELD TO PWB.

1635 DEPART NAVAL STATION.

RGR

5/3/08 SAT.

0615 ARRIVE @ NAVAL STATION. PREP/MEETING.
0735 ARRIVE AIRFIELD RR
0815 VP2A 12.65 (TD) 8.50' (SWL) 8.50'

— VP2B START @ 0820

0-4 3.4 BKG 0-0.5 TOPSOIL
0.5-~~4.0~~ 1.1 CLAY, LITTLE SILT, LT GREY & MAROON, HARD, BLOCKY. DRY TO DAMP. 4.0
1.1'-~~4.0~~ ~~3.8~~ SILT TO GRAVEL GREY & BROWN, DRY, ~~3.8~~ ~~4.0~~ RR

4.0-8.0 2.4. BKG SAA. (SILT TO GRAVEL) WET @ 7.7'

VP2B-01 @ 0830 (1-3)

VP2B-03 @ 0840 (5-7) ABOVE WATER

8.-12 0.8 — SAA SATURATED
12-16 2.8 — 12-14 SAA (SILT to COARSE SAND, T. GRAVEL i.e. COMPLEX) SATURATED
14-16 CLAY LT GREY & MAROON MOTTLED, DAMP

 74

[redacted] GWVP2B (1½ PRE-PACK)

15' TD

SCREEN 5-15'

SAND 4' bgs

BENTONITE TO SURFACE

FLUSH PRO-TOP, 1+' DIAMETER PAD

0940 LEFT REAR STABILIZER STUCK IN DOWN POSITION (WORKING ON IT).

1050 GWVP2B 17.20 (TD) 8.13 (SWL)
STILL WORKING ON STABILIZER.

1055 STABILIZER REPAIRED (SWITCH)
MOVE TO VP1B

— VP1B (SW OF PIT)

0-4 2.4 BKG 0-0.4 TOPSOIL (? FILL OR FILL?)
0.4-4.0 SILT TO GRAVEL?

4-8 4.0 BKG CLAY TO COARSE SAND ORANGE BROWN. FILL, DAMP.

VP1B-03 @ 1130 (5-7 ~~3-5~~ NR)

BEND SP SAMPLER — OFF SET.

8-11 0.3 BKG SAME AS ABOVE, MED SOFT, MOIST.
ONLY 3' RUN, ~~LINER~~ FULL LINER FULL.

— VP1B-04 @ 1145 (7-8)

REFUSAL @ 12'

11-12 1.0 SAA WET

MOVE TO VP1A — WILL SOIL SAMPLES AND EVALUATE FOR WELL

— VP1A (NORTH EAST OF PIT)

0-0.3' TOPSOIL

0-4' 4.0 BKG 0.3-1.4' DR. CLAY TO GRAVEL, MOSTLEY CLAY, BROWN DAMP.

1.4-3.0 MAROON SILTY CLAY, BLOCKEY, DRY TO DAMP

3.0-4.0 SILT TO GRAVEL, LT GREY & BROWN, DAMP.

SAMPLE ~~4-8~~

4-8 0.4 BKG SAA (3.0-4.0) LITTLE RECOVERY

8-12 0.9 BKG SAND TO GRAVEL, SATURATED.
VERY HARD TO PUSH NEAR 12' — ATTEMPT 12'-16' REFUSAL @ 12'

74

GWVP1A (1½" PRE-PACK)

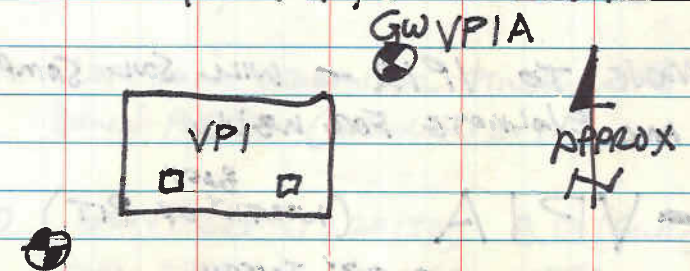
12' TD

7-12' SCREEN

SAND TO 5' bgs

BENTONITE TO ~~SURFACE~~ RUN 3' bgs, CEMENT TO SURFACE ✓

PUSH PRO-TOP, 1+' DIAMETER PAD



ALSO FOR VP2 (i.e. A TO NORTH, B @ SOUTH)

MOVE TO GWVP1B TO BUILD WELL

- GWVP1A 13.49 TD / 10.49 SWL. @ 1415

GWVP1B

- PUSH CASING TO 12' ALTHOUGH SCREEN RISER OR 1" RODS CANNOT GET TO BOTTOM — WATER LEVEL METER CAN'T - DEFLECTED OFF OF SOMETHING. PULL CASING, LOST 1 SECTION IN HOLE, BENT FEMALE END. - TOP OF BOTTOM SECTION @ 3' bgs.

~~UNDAMAGED~~ RUN

- ATTEMPT TO USE DUAL TUBE SAMPLER BROKE IT ALSO AROUND 8' bgs. ✓

CONSULT W/ MARK WILL ABANDON THIS LOCATION DUE TO DIFFICULTIES AND THAT VP1A IS INSTALLED.

- ODOR (ACETONE/SOLVENT LIKE) COMING FROM DUAL TUBE SAMPLER. PID - 500±

- 18-24 FROM BOREHOLE OFFSET APPROX 4' SE FROM ORIGINAL.

1615 COLLECT VP1B-04X (≈7-8' bgs)

HEAD TO PWB, SAMPLE MANAGEMENT

1910 DEPART NAVAL STATION

5/4/08 SUN.

0620 ONSITE, PREP, DISCUSS REMAINING 74 ACTIVITIES (WELL LOCATIONS)
0715 @ AIR FIELD, PREP TO AUGER @ VP1B
0805 BEGIN. @ VP1B, SCREEN CUTTINGS W/ PID — NO PID HITS OR ODOR
0825 SWL @ GW VP1A 10.53' (TOC)
0835 AUGERED TO 12' @ VP1B, AUGERS NOT STRAIGHT, DEFLECTED WHILE AUGERING GRAVELS, BUILD WELL
— COUPLE OF COBBLES TO SURFACE WHILE AUGERING

74GW ■ VP1B (PREPACK THROUGH AUGERS) 3¼"
12' TD bgs 1½"
7-12' SCREEN
SAND TO 5' bgs
BENTONITE 3' bgs
CEMENT TO SURFACE
PUSH YELLOW PRO-TOP (NOT EQUILIBRATED) (LEANING DUE TO GRAVEL & AUGER KICK-OFF)
0940 VP1B 13.74 (TD) 8.62 (SWL
PREP TO MOVE TO 74SB57 TO INSTALL MW (~~12'~~ 11' W/ 5' SCREEN, CONSULTED W/ CHRIS

12.70
4.50

RE: SB57 SPECS. (11' TD DUE TO POTENTIAL SHALLOWER WATER TABLE & LNAPL; ALTHOUGH NO EVIDENCE OF PETROLEUM/JP-5 DURING BOREHOLE ADVANCEMENT BY CHRIS K.)

1015 BEGIN @ 74GW57

■ 74GW57 (1½" PREPACK)
11' TD bgs
SCREEN 6-11'
SAND TO 4' bgs
BENTONITE TO 2' bgs
PUSH PRO-TOP.

—1125 74GW57 12.7 (TD TOC) ~~4.8~~
NO EQUILIBRATED — 4.50 (SWL TOC)
1145 @ 74GW ~~35~~ 34 X PREP TO SAMPLE & BUILD WELL (PER MARK DO NOT COLLECT SAMPLES UNLESS IMPACTS ARE OBSERVED). OFFSET FROM ORIGINAL SB34 (CLOSER TO PIPELINE) — USE DUEL TUBE SAMPLER.

BEGIN @ 1205.

← 74SB34

0-5 5.0 BKG. 0-0.4 TOPSOIL
0.4-4.0 CLAY w/ SOME SILT, LT GREY & MAROON MOTTLED, DAMP, STIFF LOW PLASTICITY.

~~4-8~~ 5-10', 5.0 BKG SAA BUT MED ~~SOFT~~ STIFF MED PLASTICITY ~~APPR~~ @ 8±' & DAMP TO MOIST.

10-13' 3.0 BKG ONLY 3' RUN, OVERPACKED THE SLEEVE, MAROONS AND LITTLE GREY MOTTLED W/ BLACK INCLUSIONS, SOFT, MED PLASTICITY, (CLAY, LITTLE SILT, DECREASE IN GRAIN SIZE) MOIST.

13-15.5' BKG SAA, MOIST +

PREP TO BUILD WELL W/ DESIGNATION OF 74GW34 (PER MARK)
NO IMPACTS OBSERVED ∴ NO SOIL SAMPLES COLLECTED

~~17.57~~ RR.

74GW34 (1½" PRE PACK)
TO 15±' bgs
SCREEN 5-15'
SAND TO 3' bgs
BENTONITE TO 1' (~~CEMENT~~ CONCRETE TO SURFACE) & PAD.
PUSH PROTOP

1350 17.57 (TD TOC) NO WATER YET.
≈ 3' STICKUP ∴ 14.5 TD (CHECK SURVEY DATA) WHEN AVAILABLE.
— LOAD EQUIP TO MOVE TO NAVAL STATION PROPERTY

1445 DEPART AIRFIELD, DID NOT GET EVERYTHING, TRUCK FULL, THEY GET THE BALANCE TOMORROW MORNING.

1540 DEPART N.S.

RR

30

5/5/08 MONDAY

0620 ONSITE, ABRANOMI/NOBSER GETS/BRINGS BALANCE OF EQUIP FROM AIR FIELD (ONSITE @ 0720, SAID TOBY STARTED @ 0620).

PREP, HEAD TO 54SB08

0750 @ 54SB08, PREP TO DRILL

56 SB08

0-4.0 3.9 BKG 0-0.4 TOPSOIL
0.4-~~4~~ 1.5 SILT TO GRAVEL, GREY & BROWN, & F
1.5-4.0 CLAY LITTLE SILT-SAND MAROON, YELLOW, MED HARD GRADING TO MED SOFT @ 3.0 (FILL)

56SB08-00 0820
01 0830
02 0835

4-8 4.0 BKG STILL FILL CLAY W/ SOME SILT TO SAND, OLIVE, BROWN & BLACK. WET @ 5.0

31

SATURATED @ 6.0±

8-12 4.0 — 8-9.4 SAA (SATURATED VERY SOFT
9.4-12 - CLAY W/ SILT, SOFT. GREY AND YELLOW ORANGE W/ BLACK INCLUSIONS

12-14 2.0 — SAA

AUGER FOR WELL TO 14'

56 ~~B~~ GW08 (SEE PG 15 & 16 FOR LAST SMWU 56 ENTRY)

TD 14' bgs (2" PVC)
SCREEN 4-14'
SAND TO 3' bgs
BENTONITE TO 1' bgs
PUSH PRO-TOP - CONCRETE TO SURFACE & PAD

1050 56GW08 16.70 (TD TOC) 5.47 (SWL TOC)

1125 COMPLETE 56GW08 PAD. ETC MOVE TO VP3 FOR SOIL SAMPLING AND TEMP WELL INSTALLATION.

LABELED ~~BY~~ PIT.12

VP-3 — √ 74SB63 IS ADJACENT TO VP-3 ∴ NO SAMPLES WILL BE COLLECTED. CONSULT CHRIS K. RE: SB63 STRATIGRAPHY & WATER PRESENCE. (WATER ≈ 9-10'±)

BEGIN SOIL SAMPLING @ VP3B (SOUTH)
* WILL JUST INSTALL WELL @ VP3A (ADJACENT TO 74SB63)

VP3B

0-4' 3.1 BKG 0-0.6 TOPSOIL
0.6-4.0 CLAY TO FINE GRAVEL (FILL) LT GREY, TAN & BROWN. DRY TO DAMP.

4-8 3.7 BKG 4-4.4 SAA. DRY TO DAMP
PID 4-16 200± 4.4-8.0 SILT to C. SAND, GREY W/ PETRO ODOR.
1-4± VP3B-03 @ 1155
16-200 VP3B-04 @ 1200 + PAH.

8-12 4.0 200±-BKG 8-10 SAA. DAMP TO MOIST SOME CLAY
10-12 SILT & F. SAND, BROWN
PID 2-4 10-11 GRADE TO 1±-BKG @ 12.

12-14 2.0 1±-BKG SAA
PREP FOR WELL.

■ 74GW VP3B (1½" PET PVC)

14' TD bgs,
SCREEN 4-14'
SAND TO 3'
BENTONITE TO 0.4', CONCRETE PAD

1350 74GW VP3B ~~17.10~~ 16.10 (TD TOC) DRY (ALLOW TO RECHARGE)

1355 BEGIN 74 GW VP3A INSTALL, APPROX 3' W OF 74SB63, WILL INSTALL TO 16' SINCE GWVP3B APPEARS TO BE A LOW YIELD WELL.

■ 74GWVP3A (1½" PVC)

TD 16' bgs
SCREEN 6-16'
SAND 4'
BENTONITE 2'
FLUSH PRO-TOPS (@ VP3B ALSO) CONCRETE TO SURFACE

1510 74GWVP3A 18.43 (TD TOC) DRY.
(ALLOW TO SET OVERNIGHT

VP11 (DESIGNATION CHANGE)

1525 HEAD TO ~~VP4~~ (LABELED PIT. 11)
WILL USE 5' SAMPLER (OUT OF 4' LINERS)
LINER STUCK IN SAMPLER, FIGHT TO GET IT OUT.

1555 BEGIN @ VP11A (SOUTHERN SIDE OF PIT B on NORTH)

0-5 5.0 BKG 0-0.6 TOPSOIL
0.6-5.0 CLAY SOME SILT, Lt GREY & MAROON MOTTLED. SOFT, MED PLASTICITY, DAMP

5-10 4.6 BKG INCREASE IN GRAINSIZE. @ 6.0', CLAY, SOME SILT,
6.0-8.5 LITTLE F. SAND, SOFT, MED PLASTICITY, DAMP
8.5-10.0 SAA BUT ORANGE TAN & Lt GREY, MED ~~STIFF~~ STIFF, MED PLASTICITY, DAMP

10-15 4.7 BKG to 13 SAA TO 13.0' 12.4-12.5 BLACK SILT AND CLAY ~~RR~~ LENSE DAMP
4-12 @ 13-15' 13.0-15.0 ~~CLAY S. SLT~~
SAA BUT Lt YELLOW/TAN & Lt GREY, MOTTLED w/ BLACK INCLUSIONS, DAMP

SLIGHT PETRO ODOR w/ 4-12 PID READINGS

15-19 4.0 BKG ONLY 4' RUN, LINER FULL.
- SILT AND CLAY, ~~LIGHT~~ Lt TAN w/ LITTLE ORANGE AND BLACK (BLACK INCLUSIONS) RR LAMINAE, ~~SLIGHT PETRO ODOR~~ BUT NO PID HITS (CHECK @ PWB). Damp +

NO PID HITS OR ODOR BY OTHERS DETECTED

ALLOW TO SET OVERNIGHT TO MONITOR GW.

1645 DEPART VP11 to PWB.

1740 DEPART NS.

RR

34

5/6/08 TUES

0620 ONSITE (GATE #3) PREP.

0700. 74GWVP3B 15.58 SWL TOC
16.10 TD TOC

0703 74GWVP3A 18.15 SWL TOC
18.43 TD TOC

- NASSER PAINTING BOLLARDS @ 56GW08 (MAYBE A ~~FALSE~~ FALSE POSITIVE)

0715 WATER AROUND 12± bgs IN 74VP11A - MEASURE THROUGH BOREHOLE. WILL BUILD WELL W/ 18' TD bgs TO ACCOUNT FOR SEASONAL FLUCTUATIONS.

~~74 VP~~ RL

74GWVP11A (1½" PVC)
TD 18' bgs
SCREEN 8-18'
SAND TO 6' bgs RCR
BENTONITE TO ~~4' bgs~~ SURFACE

35

0800 MOVE TO VP11B (NORTH OF PITS)

— 74VP11B

0-5 2.6 BKG 0-0.2 TOPSOIL
0.2-1.0 SILTY CLAY, MAROON
@ 1.0 GRAVEL (ROCK DID NOT ALLOW FOR RECOVERY)
⇒ 4.4 to 5.0 - CLAY W/ SAME SILT, MAROON W/ LITTLE LT GREY, DRY TO DAMP.

5-10' 4.6 BKG 5-8 ~~SILTY CLAY~~ CLAY AND SILT, BLOCKY LT GREY & MAROON MOTTLED, DRY TO DAMP, LOW PLASTICITY, MOD STIFF, DRY TO DAMP.
8-10 SAA BUT LESS SILT, STIFF, MED PLASTICITY.

10-15' 5.0 BKG SAA MED STIFF GRADING TO SOFT ~~STIFF~~ AROUND 13±, DAMP TO MOIST+, MED PLASTICITY.

74VP11A-03 @ 0830
74VP11A-04 @ 0835

PID

15-20 5.0 BKG:15-18.9 SAA. (MOTTLED)
4-30: 18.9-20.0 SAA (CLAY w/ SILT)
BUT DK GREY & LT GREY
LAMINAE & MOTTLED.
PETRO ODOR (STAINED?)

0930 RAINING
0955 RAIN STOPS.

PID

20-25 5.0 5-90 SAA

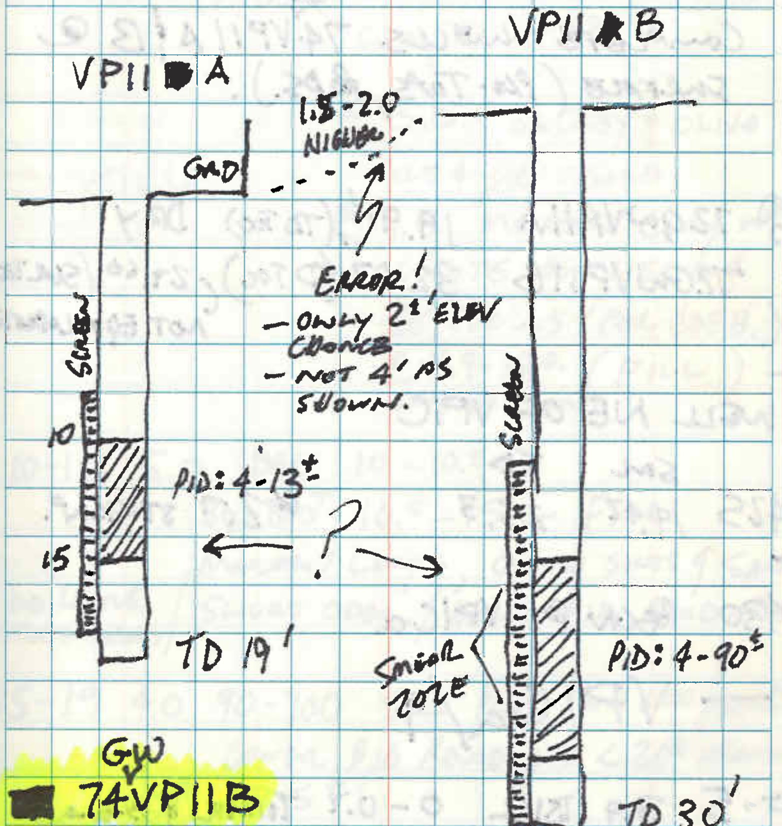
RW ±
25-30 5.0 ~~4-30~~ SAA.
↳ 25-27 SAA (PID 4-30±)
BKG <1.0 27-30, CLAY & SILT, LT GREY
TAN, LT YELLOW,
LAMINAE, MED STIFF
MED, PLASTICITY.

CONSULT w/ KUPFER, WILL BUILD WELL
w/ 30' TD TOC & 15' SCREEN.

ABRAHAMS ORDERS MORE SAND & GRAVEL
WILL STAGE IT AT PARKING EAST OF
DEFENSE LOGISTICS AGENCY DRMO
BLDG. (ACROSS FROM VP11)

VP11 TOP 3.5 S
1.5 N
TD 8.7
PIPE BOTTOM 6.0'

— VP11 BORING SAME



GW
74VP11B
30' TD
SCREEN 15'-30'
SAND TO 13'
BENTONITE TO ~~11~~ SURFACE RW.

1145 DRILLERS TO LUNCH, RECON NEXT AREA
w/ MULTIPLE VPs. DRILLERS RETURN
1240 — MEETING w/ JUAN / UNLOAD EQUIP

1300 RAINING — STOPS 1315.

COMPLETE WELLS 74 GW VP11 A & B @ SURFACE (FLO-TOPS, PADS).

1350 72GWVP11A 19.91' (TD TOC) DRY
72GWVP11B 32.07 (TD TOC), 27.60 (SWL TOC)
NOT EQUILIBRATED

WELL NE OF VP1C

	SWL	TD	
1425	14.42	25.3	≈2.7 STICKUP.

1430 BEGIN @ VP1Ca

— VP1Ca/9

0-5 3.9 BKG 0-0.7 TOPSOIL & BROWN SILT, F SAND & CLAY.
FILL 0.7-5.0. - SILT, F SAND LITTLE CLAY, LT GREY, TAN & BROWN
DRY TO DAMP. (FILL)

5-10 5.0 BKG. FILL - SAND W/ LT GREY
LENSES < CLAY 5-5.5 & MAROON CLAY 7.5-7.9
@ 8.5.- DK GREY & OLIVE SILT & ~~GR~~ F. SAND,
FILL
@ 9.5 MAROON CLAY W/ WHITE BEACH SAND & SC SHELLS (PER JOE B.)
@ 9.9-10.0. (FILL) DRY TO DAMP.

10-15 5.0 BKG 10.-10.5
30-800± 10.5-15 - FILL
MAROON CLAYS, OLIVE SILTS & SANDS
AND LITTLE WHITE SHELLS / SLIGHT ODOR / LARGE PID READINGS

15-19 4.0 90-900 SAA PLUS TAN SILTS & SAND
LOWER PID READINGS <20± AROUND
50± 17.5±

19-24 5.0 19-21.2 SAA SATURATED
* BKG 21.2 - 24 NATIVE — SILT & CLAY
YELLOW ORANGE & TAN MOTTLED.

WILL BUILD WELL W/ 22' TD 10' SCREEN

74 GW
[redacted] VPICa/9
TD 22' bgs
SCREEN 12-22'
SAND to 9'
BENTONITE to ~~7' bgs~~ SURFACE
WILL COMPLETE @ SURFACE TOMORROW
TD 23.75 (TOC.) SEE PG 44

1625 DEPART FOR PWB

DEPART NS

RLR

5/7/08 WED.

0620 ONSITE
0650 @ SMMU 9 VPs - PREP/LABEL BOTTLES
DRILLER GETTING SAND/GRAVEL FROM THE AIR FIELD
0735 DRILLERS ARRIVE

-74 VPICb/9

0-5 4.2 BKG 0-0.3 TOPSOIL
FILL → 0.3-4.0 FILL YELLOW & TAN CLAY TO MED SAND, DAMP / DRY TO
74VPICb/9-02 @ 0805 (3-5)

RLR
~~4.8~~ 5.0 BKG 4.0-9.6 SAA
5-10' FILL → 9.6-10.0 GREEN/DK. GREY w/ LITTLE WHITE SHELLS/SAND, DAMP
74VPICb/9-04 (7-9) @ 0815

10-15 3.4 (*) 10-13 LT GREY/WHITE F. SAND TO FINE GRAVEL
FILL → 13-15 CLAY/SILT OLIVE, WHITE MOTTLED, HARD
15-20 5.0 (*) 15-17.4 SATURATED, SAME AS 10-13
FILL → 17.4-20 SAME AS 13-15 PETRO ODOR

(*) PID MALFUNCTION/PETRO ODOR

- WILL BUILD WELL W/ 22' TD / 10' SCREEN

0835 DRILLER OFF TO STAGING AREA FOR SAND DELIVERY.

■ GWVP1Cb/9
22' TD
SCREEN 12-22'
SAND TO 10'
BENTONITE to ~~8'~~ & 1' bgs / SURFACE PER
PROTOP/PAD LATER SEE PG 44

WILL CONTINUE SAMPLING @ VPs AND LIKELY COMPLETE WELLS @ SURFACE NEXT TUES.

0950 MOVE TO VP1Aa/9

- VP1Aa/9

0-5 4.4 BKG 0-0.4 TOPSOIL
0.4-2 WHITE SILT/F. SAND & SHELLS.
FILL → 2-5 FILL ORANGE/BROWN CLAY & SILT, HARD, DRY TO DAMP.

5-10 5.0 BKG FILL ORANGE/TAN SILT AND F. SAND.
FILL → 5-5.5 WHITE SAND/SHELL
6.2-6.6 COARSE SAND & GRAVEL.
7.5-10.0 SILT & CLAY, GREY/OLIVE W/ WHITE MOTTLING (CALICHE? PER DRILLER/MINGO) DAMP.

74VP1Aa/9-03 @ 1015 (5-7)
74VP1Aa/9-04 @ 1025 (7-9)

10-15 ~~5.0~~ 4.1 60± * - SLIGHT ODOR, SAA (9.5-10) DAMP TO MOIST @ 14±

15-20 5.0 60-560± - 15-16' SAA, MOIST
16-20' SILT & CLAY, TAN ORANGE W/ RUST & WHITE MOTTLING (LIKE NATIVE @ VP1Ca) BUT OLIVE GREY @ 16.8-17'; 17.6-17.8 ~~AND~~ 18.5-18.6; 19.0-19.1 AND 19.6-20.0.
560± ≈ 17±'

20-25 END 0.2 1/2± - SLEEVE STUCK IN SAMPLER
24.8-25.0 - OLIVE, CLAY & SILT W/ WHITE MOTTLING, SLIGHT ODOR.

* PID ACTING UP

[redacted] 74GWVP1Aa/9

TD 24' bgs
SCREEN 14-24'
SAND TO 12'
BENTONITE TO SURFACE 1" bgs.
PUSH PROTOP, PAD.

COMPLETE GW/P1Ca & b @ SURFACE

	TD (TOC)	* SWL (TOC) *	
74GWVP1Aa/9	26.25	DRY (JUST INSTALLED)	1240
74GWVP1Cb/9	24.11	16.52	1237
74GWVP1Ca/9	23.75	23.65	1235

* NOT EQUILIBRATED. *

74GWVP1Bb/9	26.35	DRY (JUST INSTALLED)	1245

JOE'S CREW/MINGO INSTALLED

DRILL CREWS CLEANUP/PACK
1305 DEPART VP/9 AREA, HEAD TO PWB.

RLR

Environmental Technician – Adam Gailey

56GW04

Static Water Level: 2.30
Total Depth: 18.20

1st gallon	pH	Temp	Cond	DO	Turb	ORP
	6.99	29.53	0.651	4.08	543	21.8

Reddish/clay color. No odor. Clearing

2nd gallon	pH	Tmp	Cond	DO	Turb	ORP
	6.65	27.52	0.661	3.62	409	7.8

cloudy. No odor.

3rd gallon	pH	Tmp	Cond	DO	Turb	ORP
	6.64	27.49	0.659	3.80	81.8	8.4

Cloudy. No odor.

4th gallon	pH	Tmp	Cond	DO	Turb	ORP
	6.69	27.45	0.646	3.88	46.0	7.3

Clear. No odor.

5th gallon	pH	Tmp	Cond	DO	Turb	ORP
	6.67	27.37	0.625	3.37	28.9	6.6

Clear. No odor.

6th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.59	27.35	0.656	3.44	22.1	6.1

Clear. No odor. → Cont'd

7th gallon	pH	Tmp	Cond	DO	Turb	ORP
	6.61	27.38	0.658	3.21	18.9	5.4

Clear. No odor.

8th gallon	pH	Tmp	Cond	DO	Turb	ORP
	6.61	27.42	0.658	3.21	20.5	1.8

Start Pumping: 1425
Stop Pumping: 1510

Units for YSI Multi Parameter Meter used for Well Development:

Temp - °C
Spec. Conductance - mS/cm
Dissolved O_2 - mg/L
pH - NA
ORP - NA

Start pumping: 1500

56GW02 Stop Pumping: 1535

Static Water Level: 14.75 Total Depth: 18.20

1st gallon	pH	Temp	Cond	DO	Turb	ORP
	7.10	29.12	1.197	5.73	—	40.1

Cloudy. No odor.

2nd gallon	pH	Temp	Cond	DO	Turb	ORP
	6.98	27.95	1.372	4.90	214	21.3

Well Pumped Dry - Full 2nd gallon Not obtained.

Start pumping: 15..

56GW01 Stop Pumping: 1620

Static Water Level: 2.80

Total Depth: 18.30

1st gallon	pH	Temp	Cond	DO	Turb	ORP
	7.06	29.18	1.255	1.73	/	50.3

Very Turbid. Not Clearing. No odor.

2nd gallon	pH	Temp	Cond	DO	Turb	ORP
	6.94	27.68	1.319	2.52	/	21.4

Very Turbid. Not clearing. No odor.

3rd gallon	pH	Temp	Cond	DO	Turb	ORP
	6.92	27.45	1.311	2.71	/	11.1

Turbid. Clearing slowly. No odor.

4th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.87	27.42	1.308	2.52	/	1.9

Turbid. Clearing slowly. No odor.

5th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.86	27.42	1.307	2.47	/	1.7

Cloudy. No odor.

6th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.87	27.39	1.304	2.35	/	-2.5

Cloudy. No odor.

7th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.84	27.37	1.300	2.35	/	-9.4

Clearing. No odor. →

8th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.87	27.35	1.290	2.40	893	-9.0

9th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.88	27.33	1.291	2.78	796	-9.7

10th gallon	pH	Temp	Cond	DO	Turb	ORP
	6.85	27.28	1.291	2.58	702	-8.9

Depart NAPR @ 1800 hrs.

ADG

May 1, 2008

Field Team arrives at NAPR at 0700 hrs.

Prep for days sampling events.

Groundwater Sampling

56GW02

SWL => 10.35

Sample time : 0930

56GW01

Static Water Level => 2.77

1 well volume = 2.5 gallons.

	pH	Temp	DO	Cond	Turb
1st Volume	6.91	28.40	2.92	1.327	7.98
2nd Volume	7.05	28.23	2.84	1.312	6.42
3rd Volume	6.85	27.91	2.80	1.299	5.50

56GW04

1 well Volume => 2.55 gal.

Static Water level -> 2.45

	pH	Temp	Cond	DO	Turb
1 Volume	6.54	27.92	0.619	2.62	23.0
2nd Volume	6.58	27.90	0.584	2.55	27.0
3rd Volume	6.59	27.99	0.648	2.74	29.2

Sample time : 1135

APh

56GW03

Static Water level -> 3.35

1 well Volume = 2.4 gallons

	pH	Temp	Cond	DO	Turb
1st Volume	6.99	27.28	1.487	4.14	38.7
2nd Volume	6.81	27.06	1.497	3.39	12.0
3rd Volume	6.80	26.90	1.459	3.51	11.1
4th Volume	6.84	27.02	1.469	3.54	10.8

Sample time: 1335

Collected ER04 at 1500 from Ground H_2O Tubing for VOC's, SVOC's + Metals.

Depart MAPR at 1800.

5/3/08

S6GW07

TD= 18.44

SWL= 6.42

1 Well Vol. = 2.0

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1223	.5	26.63	1.857	1.21	7.14	51	79
1229	1	26.22	1.866	1.07	7.12	32	21
SWL= 6.89							
1234	1.5	26.00	1.872	0.82	7.08	16	9.6
1240	2	25.96	1.875	0.77	7.08	3	5.5
SWL= 6.9							
1246	2.5	25.92	1.876	0.79	7.09	4	3.0
1250	3	25.93	1.877	0.86	7.09	3	2.3
SWL= 6.9							
1255	3.5	25.93	1.877	0.89	7.10	2	2.1

1300- Sample Taken.
Pump Speed = 3/4

5/3/08

SWMU74 [Well Development]

74GW05

TD= 16.59

SWL= 8.51

Time= 1357

Time	Vol. gal.	Temp.	Cond.	D.O.	pH	ORP	Turb.
1403. Start							
1410	1	29.31	1.021	1.87	7.05	-21	>1K
Dry.							

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
2 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
4 SWL = 6.16							

0815 - Sample Taken
Pump Speed = 2/3

5/7/08

Water Level Readings

	Level	Time
69GW25	9.17	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

April 30, 2008

WEATHER: Sunny, mid 80's
ARRIVE at NAPR Public works 0645.
Prepare for days field event and depart to SWMU's 56, 69 + 74 at 0730.

SWMU 56 Groundwater Development

Start Pumping - 0941 Stop Pumping - 1008

56GW03
Static Water level - 4.50
TOTAL Depth - 18.20
ORP - -59.0

	pH	Temp °C	Cond ms/cm	DO mg/L	Turbidity	ORP
1st gallon	8.62	27.85	1.518	3.24	259	

cloudy - Reddish

	pH	Temp	Cond	DO	Turb	ORP
2nd gallon	4.97	27.74	1.524	3.51	144	-74.3

Clearing - Somewhat cloudy. No odor.

	pH	Temp	Cond	DO	Turb	ORP
3rd gallon	8.95	27.42	1.562	4.40	84.1	-62.9

Somewhat cloudy. No odor

	pH	Temp	Cond	DO	Turb	ORP
4th gallon	8.95	27.36	1.589	4.44	88.9	-63.1

Somewhat cloudy. No odor

	pH	Temp	Cond	DO	Turb	ORP
5th gallon (Same as previous)	9.03	27.60	1.575	4.42	91.6	-64.9

Start Pumping: 1335
Stop Pumping: 1415

56GW05

Static Water Level - 5.50[redacted]
Total - 18.21
ORP - 98

	pH	Temp	Cond	DO	Turb
1st gallon	6.79	28.43	0.724	4.27	208

Very Turbid - Reddish / clay color. becoming clear as pumping progresed.

	pH	Temp	Cond	DO	Turb	ORP
2nd gallon	6.51	27.28	0.712	3.92	173	-3.9

Becoming clear. no odor.

	pH	Temp	Cond	DO	Turb	ORP
3rd gallon	6.58	27.25	0.707	3.44	54.3	-3.1

Clear. No odor.

	pH	Temp	Cond	DO	Turb	ORP
4th gallon	6.64	27.38	0.705	3.57	24.9	-2.9

Clear. No odor.

	pH	Temp	Cond	DO	Turb	ORP
5th gallon	6.64	27.36	0.708	3.39	23.5	-3.2

Clear. No odor.

	pH	Temp	Cond	DO	Turb	ORP
6th gallon	6.60	27.29	0.705	3.28	25.8	-2.9

Clear. No odor.

5/2/08

SWMU 56 [Well Sampling]

56GW05

TD= 18.20

SWL= 5.57

1 Well Vol. 2.1 gal.

Time	Vol.	Temp.	Cond.	D.O.	pH	ORP	Turb.
0748	Start						
0758	1	27.19	0.707	1.50	6.82	146	15
0807	2	26.93	0.707	1.26	6.80	141	6
0819	3	26.94	0.706	1.16	6.79	137	2.6

0825 - Sample Taken

5/2/08

SWMU 56 [Well Development]

~~Weather: Overcast, breezy, ~80°F~~

56GW07

TD= 18.44 (Hard Bottom)

SWL= 6.49

Time= 11.31

Time	Vol. (gal)	Temp	Cond	D.O.	pH	ORP	Turb
1136	Start						
1145	2	27.20	1.769	3.25	7.22	88	>1K
1153	4	26.20	1.838	1.44	7.12	70	"
1201	6	26.14	1.845	1.24	7.09	52	"
1209	8	25.98	1.847	1.21	7.09	43	981
1218	10	26.03	1.850	1.15	7.08	35	691
1226	12	25.92	1.852	1.30	7.12	15	293
1234	14	25.88	1.853	1.12	7.09	7	119

Ending SWL - 7.17

Pump Speed = Full

Time	Vol.	Temp	Cond	D.O.	pH	ORP	Turb
1243	16	25.84	1.855	1.07	7.11	-2	44

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]

~~69GW02~~
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

69GW26

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

Technical Manager – John Malinowski

John Malinowski

56A, SWMU 56, and
Background drainge ditch
sampling event

June 22, 2009 – June 26, 2009

Sampling Event Extended to
June 27, 2009

JJM 6/27/09

The paper in this book is
made of 100% high grade rag stock
with a WATER RESISTING surface sizing.

JRM
6/24/09

21

Wednesday June 24, 2009
weather - warm/humid low 80's
(raining)

0615: Arrive at NAPR Security Building and begin prep for sediment sampling at SWMU 56 (metals, PVS/SEM)

0635: Could not gain access to SWMU 56 drainage ditch due to training activity. Returned to Security Building to inquire about access

0643: Arrive at Security Building and discussed access with watch commander. Training contact informed of need to access drainage ditch - access granted.

0652: Left Security office for SWMU 56 drainage ditch

0705: Arrive at SWMU 56 drainage ditch and begin prep. for sampling.

JRM 6/24/09

JBM
6/24/09

0735: 56SD15 sediment sample collected using stainless steel spoon. Depth of water approximately 4 inches. High organic content.

0758: 56SD16 sediment sample collected using dedicated stainless steel spoon. Depth of water approximately 6 inches. High organic content

0812: 56SD17 sediment sample collected using dedicated stainless steel spoon. Depth of water approximately 5 inches. High organic content

0829: 56SD19
~~0847: 56SD18~~ sediment sample collected using dedicated stainless steel spoon. Depth of water approximately 8 inches. High organic content
JBM 6/24/09

0847: 56SD18 sediment sample collected using dedicated stainless steel spoon. Depth of water approximately 5 inches. High organic content.

JBM 6/24/09

J.J.M.
6/24/09

0900 : 56SD20. sediment sample collected using dedicated stainless steel spoon. Depth of water approximated 3 inches. High organic content.

0925 : 56SD21 sediment sample collected downgradient of culvert (historical sample SD05) using a dedicated stainless steel spoon. Depth of water approximately 4 inches. High organic content.

0935 : 56SD22 sediment sample collected using a dedicated stainless steel spoon. Depth of water approximately 4 inches. High organic content

QA/QC collected at this sample location: Field duplicate, MS, and MSD

J.J.M.
6/24/09

JJM 6/24/09

~~1020: JUN09-FB02 field blank~~

1005: FWD BKG-SD17 background drainage ditch sample collected using a dedicated stainless steel spoon. Depth of water approximately 6 inches. High organic content.

1020: JUN09-FB02 field blank collected in the field using ~~dedicated~~ JJM 6/24/09 laboratory grade deionized water. Field blank consisted of a single 250-mL poly bottle (with HNO_3 as preservative). The JUN09-FB02 field blank applies to sediment samples for SWMU 56 and Background Drainage Ditches

Rational for Placement of the SWMU 56 sediment samples is provided on the following page

JJM 6/24/09

JJM 6/24/09

24

JJM
6/24/09

56SD15 was established midway historical sample 56SD12 and 56SD13

56SD16 was established ~20 feet upgradient from 56SD13 were Lead was detected at a concentration greater than sediment screening value

56SD17 was established ~20 feet downgradient of historical sample location 56SD13, but upgradient of the 56A drainage ditch confluence with the SWMU 56 drainge ditch

56SD18 and 56SD19 were established approximately 20 feet upgradient and downgradient of historical sample location 56SD14. 56SD18 is located downgradient from the 56A drainge ditch confluence with the SWMU 56 drainge ditch.

JJM 6/24/09

JPM 6/24/09

56SD20 was established at the midpoint between historical sample location 56SD14 and historical location 56 SW/SD 05.

56SD 21 and 56SD22 were established approximately 20 feet and 40 feet downgradient from a double box culvert. This segment of of the SWMU 56 drainage ditch was not sampled during previous investigations.

It is noted that no fish were observed at the SWM 56 sample locations, nor were fish observed at the background location

1025: Arrive Back at Security Building to process 56A, SWMU 56, Background, and QA/QC samples collected on June 23 and June 24 for shipment to the analytical laboratory

JPM 6/24/09

jfm
6/24/09

1110: collected JUN09-ER02 Equipment rinsate blank by passing laboratory grade water over a clean stainless steel spoon. The following bottles were filled:

4 one-liter glass ambers for SVOC, PCB, and pesticide analyses

3 40-mL glass vials (HCl as preservative) for VOC analyses

1 250mL poly bottle (HNO3 preservative) for metals

The blank applies to sediment samples collected at 56A, SWMU56, and Background

0514 Fed Ex arrived for sample

0525 Leave Security Building for Palmas Del Mar

jfm
6/24/09

2009 Drainage Ditch Vegetation Assessment

INCH

"Rite in the Rain"®

ALL-WEATHER WRITING PAPER

Name

Address

Phone

Project

CONTENTS

PAGE	REFERENCE	DATE
	SWMU 56	
	DRAINAGE Ditch	
	Vegetation	
	ASSESSMENT	
	June 27, 2009	
	Adam D. Gailey	

APG
6/27/09

Saturday - June 27, 2009
Weather - Hot / Humid, upper 80's (sunny)

1240: Depart Security Building to conduct SWMU 56 Drainage Ditch Vegetation Assessment.

1247: Arrive at SWMU 56 Drainage Ditch.

After Walking the Length of the Ditch, the following species were noted as Dominant:

- Typha domingensis (southern cattail)
- Acrostichum Aureum (golden leather fern)
- Leucaena Leucocephala (white lead tree)

Additional species within the ditch and along the immediate Riparian banks were also Noted as dominant. However,

APG
6/27/09

those species were unable to be identified in the field. A vegetation sample was collected, placed in a plastic bag, and kept cold in a cooler with ice. Samples were taken back to the Security building for I.D.

1315: Depart SWMU 56 Ditch

1322: Arrive at Security Building. Identify Remaining Vegetation Samples from SWMU 56 Ditch.

- Eleocharis interstincta (Knotted spikerush)
- Ipomoea indica (Ocean blue morning-glory)
- Paspalum distichum (Knot grass)
- Delonix regina (Royal Poinciana)
- Roystonea borinquena (Puerto Rico Royal Palm)
- Erythroxylum sp.

1355: Depart NAPR

APG
6/26/09

SOIL BORING LOGS AND WELL CONSTRUCTION RECORDS

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56			
PROJ. NO.:	111626		BORING NO.:	56SB01
COORDINATES:	EAST:	931927.9	NORTH:	806925.7
ELEVATION:	SURFACE:	115.5	TOP OF PVC CASING:	117.87

Rig:	Geoprobe 66DT				**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
	MC Sampler	**Casing**	**Augers**	**Core Barrel**				
Size (ID)	1-5/8"	--	3 1/4"	--	4/28/2008	0.0 - 28.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Well installed on 4/30/08

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)
					56SB01-00		TOPSOIL (organics) 0.6		
1					(0-1')		CLAY, little silt; light grey to	2" PVC	
			3.8		56SB01-01		maroon, mottled; med. stiff, medium	Riser	
2		D-1	95%		(1-3')	BKG	plasticity, damp		113.5
3								Bentonite	
								2.0' - 4.0'	
4	4.0								111.5
								Sand	
5								4.0' - 16.0'	
			3.6						
6		D-2	90%			BKG		Top of 2"	109.5
								PVC Screen	
7								at 6.0'	
					56SB01-04				
8	8.0				(7-9')				
			2.3						
9		D-3	58%			BKG	White to Brown w/maroon		
10							10' - some yellow 10.0		
							CLAY, little silt; white to brown		

DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius
DRILLER:	Abraham Nunez	BORING NO.:	56SB01 SHEET 1 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56
SO NO.: 111626 BORING NO.: 56SB01

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample	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)
11–12	12.0	D-3					*Continued from Sheet 1*		
12–16	16.0	D-4	3.2 80%			BKG	moist at 12'	Bottom of well at 16'	99.5
16–20	20.0	D-5	1.0 25%			BKG		Backfill	
20–24	24.0	D-6	1.6 40%			BKG	Some laminant bedding at 20'		
24–28	28.0	D-7	1.5 38%			BKG			87.5
28–30							END OF BORING at 28.0		

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius
DRILLER: Abraham Nunez BORING NO.: 56SB01 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56				
PROJ. NO.:	111626		BORING NO.:	56SB02	
COORDINATES:	EAST:	931844.5	NORTH:	806894.3	
ELEVATION:	SURFACE:	116.3	TOP OF PVC CASING:	118.62	

Rig:	Geoprobe 66DT				**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
	MC Sampler	**Casing**	**Augers**	**Core Barrel**				
Size (ID)	2.5"	--	4 1/2"	--	4/28/2008	0.0 - 19.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Well installed on 4/30/08

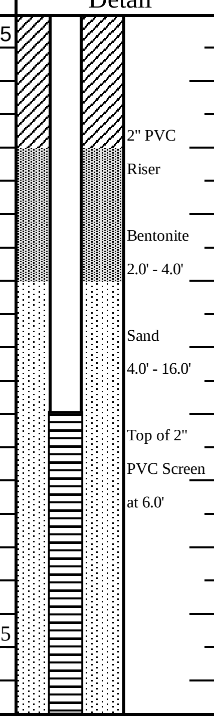
SAMPLE TYPE

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	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)
							TOPSOIL 0.5		
1					56SB02-00 (0-1')		CLAY, some silt; lt grey to maroon mottled , med. stiff, med. plasticity, damp		
2		D-1	4.0 100%			BKG			114.3
3					56SB02-02 (3-5')				
4	4.0								112.3
5							Increase in grain size; trace fine sand		
6		D-2	3.8 95%			BKG			110.3
7									
8	8.0				56SB02-04 (7-9')				
9		D-3	3.9 98%			BKG	9.5		
10							CLAY; lt grey to dark maroon with some siltstone, inclusions, damp		



DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius	
DRILLER:	Abraham Nunez	BORING NO.:	56SB02	SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56

SO NO.: 111626 BORING NO.: 56SB02

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					*Continued from Sheet 1*		
12	12.0								
13		D-4	2.4 80%			BKG	13.0' - 13.5' green clay, little silt		
14									
15	15.0						14.8' - 15.0' green clay, little silt		
16		D-5	3.5 88%			BKG	Clay, some silt w/ siltstone inclusions; Lt. grey to Dk maroon; damp	Bottom of well at 16.0'	100.3
17							clay swelling in sleeve		
18								Backfill	
19	19.0						END OF BORING at 19.0		97.3
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius

DRILLER: Abraham Nunez BORING NO.: 56SB02 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56			
PROJ. NO.:	111626		BORING NO.:	56SB03
COORDINATES:	EAST:	931879.1	NORTH:	806859.6
ELEVATION:	SURFACE:	115.4	TOP OF PVC CASING:	117.63

Rig:	Geoprobe 66DT							
	MC Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"	--	4 1/2"	--	4/29/2008	0.0 - 16.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Well installed on 4/30/08

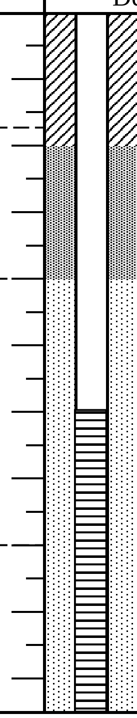
SAMPLE TYPE

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"	-	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					56SB03-00		0-1.7 TOPSOIL w/black silt, sand	2" PVC	
			4.0		(0-1')			Riser	
2		D-1	100%			BKG			113.4
							SILTY CLAY; Lt grey and orange;		
3							damp	Bentonite	
					56SB03-02			2.0' - 4.0'	
4	4.0				(3-5')				111.4
							SILTY CLAY; Lt grey & orange	Sand	
5							grading to greener w/orange/maroon	4.0' - 16.0'	
			3.8				damp		
6		D-2	95%			BKG		Top of 2"	109.4
								PVC Screen	
7								at 6.0'	
					56SB03-04				
8	8.0				(7-9')				
							SILTY CLAY; dk maroon w/black		
9			3.5				inclusions, damp		
		D-3	88%			BKG			
10									



DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius	
DRILLER:	Abraham Nunez	BORING NO.:	56SB03	SHEET 1 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56
SO NO.: 111626 BORING NO.: 56SB03

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)
11–12	12.0	D-3					*Continued from Sheet 1*		
13–16	16.0	D-4	3.8 95%			BKG	SILTY CLAY; greenish grey and yellow/orange SILTY CLAY; dark maroon w/black inclusions, damp	Bottom of well at 16.0'	99.4
17–30							END OF BORING at 16.0		

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius
DRILLER: Abraham Nunez BORING NO.: 56SB03 SHEET 2 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56		
PROJ. NO.:	111626	BORING NO.:	56SB04
COORDINATES:	EAST: 931757.1	NORTH:	806849.2
ELEVATION:	SURFACE: 116.2	TOP OF PVC CASING:	118.25

Rig:	Geoprobe 66DT							
	MC Sampler	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	2.5"	--	4 1/2"	--	4/28/2008	0.0 - 16.0	Sunny, Hot	
Length	4'	--	5'	--	4/29/2008	16.0 - 19.0	Sunny, Hot	
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Well installed on 4/30/08

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"	+2	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					56SB04-00 (0-1')		TOPSOIL	2" PVC Riser	
2		D-1	3.9 98%			BKG	CLAY, little silt; light grey w/little maroon, medium stiff, medium plasticity; damp		114.2
3								Bentonite 2.0' - 4.0'	
4	4.0								112.2
5								Sand 4.0' - 16.0'	
6		D-2	3.9 98%		56SB04-03 (5-7')	BKG	CLAY; maroon with weathered siltstone inclusions	Top of 2" PVC Screen at 6.0'	110.2
7							CLAY; with less light grey; damp		
8	8.0				56SB04-04 (7-9')				
9		D-3	3.7 94%			BKG	CLAY; Lt grey, little maroon; damp		
10							SILTY CLAY; maroon with little light grey		

DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius
DRILLER:	Abraham Nunez	BORING NO.:	56SB04

SHEET 1 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56
SO NO.: 111626 BORING NO.: 56SB04

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample	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					*Continued from Sheet 1*		
12	12.0								
12–16		D-4	1.3 33%			BKG	moist to wet at 12'	Sand 2" PVC Screen Bottom of well at 16.0'	
16	16.0								100.2
16–19		D-5	2.6 65%			BKG	SILTY CLAY; med grey to maroon w/small black inclusions, damp	Backfill	
19	19.0								97.2
20–30							END OF BORING at 19.0		

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius
DRILLER: Abraham Nunez BORING NO.: 56SB04 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56			
PROJ. NO.:	111626		BORING NO.:	56SB05
COORDINATES:	EAST:	931810.4	NORTH:	806815.8
ELEVATION:	SURFACE:	117.8	TOP OF PVC CASING:	120.11

Rig:	Geoprobe 66DT				Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	MC Sampler	Casing	Augers	Core Barrel				
Size (ID)	1-5/8"	--	3 1/4"	--	4/29/2008	0.0 - 20.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Well installed on 4/30/08

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					56SB05-00 (0-1')		0 - 1.4' TOPSOIL; brown silt & clay	2" PVC Riser	
2		D-1	4.0 100%			BKG	1.4 SILTY CLAY; Lt grey & yellow w/little maroon; med stiff; damp		115.8
3								Bentonite 2.0' - 4.0'	
4	4.0								113.8
5								Sand 4.0' - 16.0'	
6		D-2	3.2 80%		56SB05-03 (5-7')	BKG	6.0 SILTY CLAY w/ litte fine sand, blocky/friable	Top of 2" PVC Screen at 6.0'	111.8
7							7.5		
8	8.0						SILTY CLAY; Lt grey & yellow w/little maroon; med stiff; damp		
9		D-3	3.4 85%				Coarse SAND, grain at 8.0. Increase		
10					56SB05-05 (9-10)	BKG	in grain size little fine to med. SAND; moist		

DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius
DRILLER:	Abraham Nunez	BORING NO.:	56SB05

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56

SO NO.: 111626 BORING NO.: 56SB05

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					*Continued from Sheet 1*		
12	12.0							Sand	
13							Wet at 12'	2" PVC Screen	
14		D-4	2.4 60%			BKG			
15									
16	16.0							Bottom of well at 16.0'	101.8
17									
18		D-5	3.2 80%			BKG		Backfill	
19							19.4		
20	20.0						CLAY; green grey; wet		97.8
21							END OF BORING 20.0		
22									
23									
24									
25									
26									
27									
28									
29									
30									

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius

DRILLER: Abraham Nunez BORING NO.: 56SB05 SHEET 2 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56
PROJ. NO.: 111626 BORING NO.: 56SB06
COORDINATES: EAST: 931741.1 NORTH: 806628.8
ELEVATION: SURFACE: 114.8 TOP OF PVC CASING: 117.06

Rig:	Geoprobe 66DT				**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
	MC Sampler	**Casing**	**Augers**	**Core Barrel**				
Size (ID)	2.5"	--	4 1/2"	--	4/30/2008	0.0 - 16.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Well installed on 4/30/08

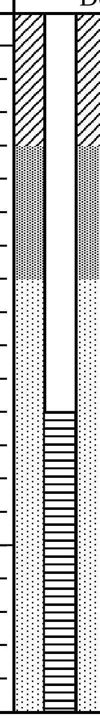
SAMPLE TYPE

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"	-	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					56SB06-00 (0-1')		TOPSOIL	2" PVC Riser	
2		D-1	4.0 100%		56SB06-01 56SB06-01D (1-3')	BKG	SILTY CLAY; Lt grey to maroon mottled, some coarse sand sized siltstone pieces		112.8
3							stiff, damp at 3.5	Bentonite 2.0' - 4.0'	
4	4.0								110.8
5								Sand 4.0' - 16.0'	
6		D-2	3.9 98%		56SB06-03 56SB06-03D 56SB06-03MS/MSD (5-7')	BKG		Top of 2" PVC Screen at 6.0'	108.8
7							6.5' grading to lt grey & orange; stiff; damp		
8	8.0								
9		D-3	3.8 95%			BKG	SILTY CLAY; Lt grey & orange grading to increased grain size		
10									



DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius
DRILLER: Abraham Nunez BORING NO.: 56SB06 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56

SO NO.: 111626 BORING NO.: 56SB06

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					*Continued from Sheet 1* Grading to light grey and maroon; moist to wet at 11.5'	Sand	
12	12.0								
13		D-4	2.4 60%					2" PVC Screen	
14						BKG	SILTY CLAY; very soft; wet		
15							SILTY CLAY; stiff, wet		
16	16.0							Bottom of well at 16.0'	98.8
17							END OF BORING at 16.0		
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius

DRILLER: Abraham Nunez BORING NO.: 56SB06 SHEET 2 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56		
PROJ. NO.:	111626	BORING NO.:	56SB07
COORDINATES:	EAST: 932072.7	NORTH:	806172.7
ELEVATION:	SURFACE: 114.0	TOP OF PVC CASING:	116.63

Rig:	Geoprobe 66DT				**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
	MC Sampler	**Casing**	**Augers**	**Core Barrel**				
Size (ID)	1-5/8"	--	3 1/4"	--	5/1/2008	0.0 - 16.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

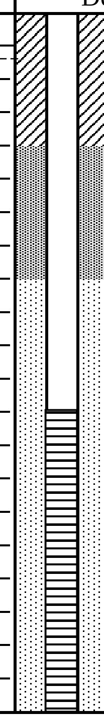
Remarks:

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)
					56SB07-00 (0-1')		TOPSOIL (some gravel)		
1								2" PVC Riser	
2		D-1	2.8 70%			BKG			112.0
3							SILT & CLAY, some sand; brown; med soft FILL; damp	Bentonite 2.0' - 4.0'	
4	4.0				56SB07-02 (3-5')				110.0
5							FILL clay to coarse sand (gravel 4.0-4.4) moist to wet, soft (clay matrix)		
6		D-2	3.3 83%		56SB07-03 (5-7')	BKG		Top of 2" PVC Screen at 6.0'	108.0
7									
8	8.0								
9		D-3	3.1 78%			BKG	SILTY CLAY; lt grey & orange		
10									

DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius
DRILLER:	Abraham Nunez	BORING NO.:	56SB07

SHEET 1 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56
SO NO.: 111626 BORING NO.: 56SB07

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample	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					*Continued from Sheet 1* Medium stiff and saturated at 11.5'		
12	12.0							Sand	
13		D-4	1.5 38%					2" PVC Screen	
14									
15									
16	16.0							Bottom of well at 16.0'	98.0
17							END OF BORING at 16.0		
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius
DRILLER: Abraham Nunez BORING NO.: 56SB07 SHEET 2 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Naval Activity Puerto Rico SWMU 56		
PROJ. NO.:	111626	BORING NO.:	56SB08
COORDINATES:	EAST: 932567.0	NORTH:	805986.3
ELEVATION:	SURFACE: 112.3	TOP OF PVC CASING:	114.69

Rig: Geoprobe 66DT								
	MC Sampler	**Casing**	**Augers**	**Core Barrel**	**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
Size (ID)	1-5/8"	--	3 1/4"	--	5/5/2008	0.0 - 14.0	Sunny, Hot	
Length	4'	--	5'	--				
Type	--	--	HSA	--				
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	4.0
Schedule 40 PVC Screen	2"	4.0	14.0

Depth (Ft.)		Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm)	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
					56SB08-00		TOPSOIL	2" PVC	
1					(0-1')		SILT to Gravel; grey and brown	Riser	111.3
			3.9		56SB08-01				
2		D-1	98%		(1-3')	BKG	CLAY, little silt and fine sand;	Bentonite	
					56SB08-02		maroon, yellow; med. hard grading to	1.0' - 3.0'	
3					(3-5')		med. soft at 3.0 (FILL)		109.3
4	4.0							Top of 2"	108.3
							Olive, brown & black (FILL) at 4.0'	PVC Screen	
5								at 4.0'	
			4.0				Wet at 5.0		
6		D-2	100%			BKG			
							Saturated at 6.0	Sand	
7								3.0' - 14.0'	
8	8.0								
							Saturated, very soft at 8.0		
9			4.0						
		D-3	100%			BKG			
10							SILTY CLAY; grey and yellow		
							orange with black inclusions; soft		

DRILLING CO.:	GeoEnviroTech, Inc.	BAKER REP.:	Robert Roselius
DRILLER:	Abraham Nunez	BORING NO.:	56SB08

SHEET 1 OF 2

Baker
Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Naval Activity Puerto Rico SWMU 56
SO NO.: 111626 BORING NO.: 56SB08

SAMPLE TYPE	DEFINITIONS
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample	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)
11–12	12.0	D-3					*Continued from Sheet 1*	Sand	
12–14	14.0	D-4	2.0 50%				END OF BORING at 14.0	2" PVC Screen Bottom of well at 14.0'	98.3
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

DRILLING CO.: GeoEnviroTech, Inc. BAKER REP.: Robert Roselius
DRILLER: Abraham Nunez BORING NO.: 56SB08 SHEET 2 OF 2

SURFACE WATER AND SEDIMENT SAMPLE COLLECTION NOTES

WEATHER -
Sun/Partly Cloudy
80's

April 29, 2008

- Arrive at NAPR 0745
- Prepare for Surface Water and Sediment Sampling at SWMU 56.

- Surface Water / Sed Sample 56SD05 at 1020.
Aquatic Vegetation abundant in ditch.

- Sample Location for 56SD04 was moved to the opposite side of the Road. The effluent from this Culvert flows underneath Road to Ditch that flows to Sample Point for 56SD04.
- Sample time: 1110
Aquatic vegetation abundant in channel

Surface Water / Sed Sample 56SD03
- Sample Time: 1140
Minnows seen in channel.
Aquatic veg. abundant.

Surface Water Sample 56SW02
- Sample time: 1200
Aquatic Vegetation abundant within and on adjacent Banks. Shell fragments (snails) visible on ditch bottom. Also, small fish near Culvert. Fish or small minnows Not seen at Sample Point 56SW02

Surface Water Sample 56SW01
Sample time: 1625
aquatic veg. abundant.

Depart NAPR - 1740

AJW

SITE PHOTOGRAPHS

Photo A-1. Concrete ditch entrance near the eastern-most side of SWMU 56 at the apron edge, view looking north from the ECP investigation 2004.

Photo A-2. Concrete lined drainage ditch and associated culvert near the western-most side of SWMU 56, view looking west from the ECP investigation 2004.

Photo A-3. View of drainage pathways delineated by change in vegetation from the ECP investigation 2004

Photo A-4. Site drilling activities for 56SB02 looking southeast from the CMS Investigation 2008

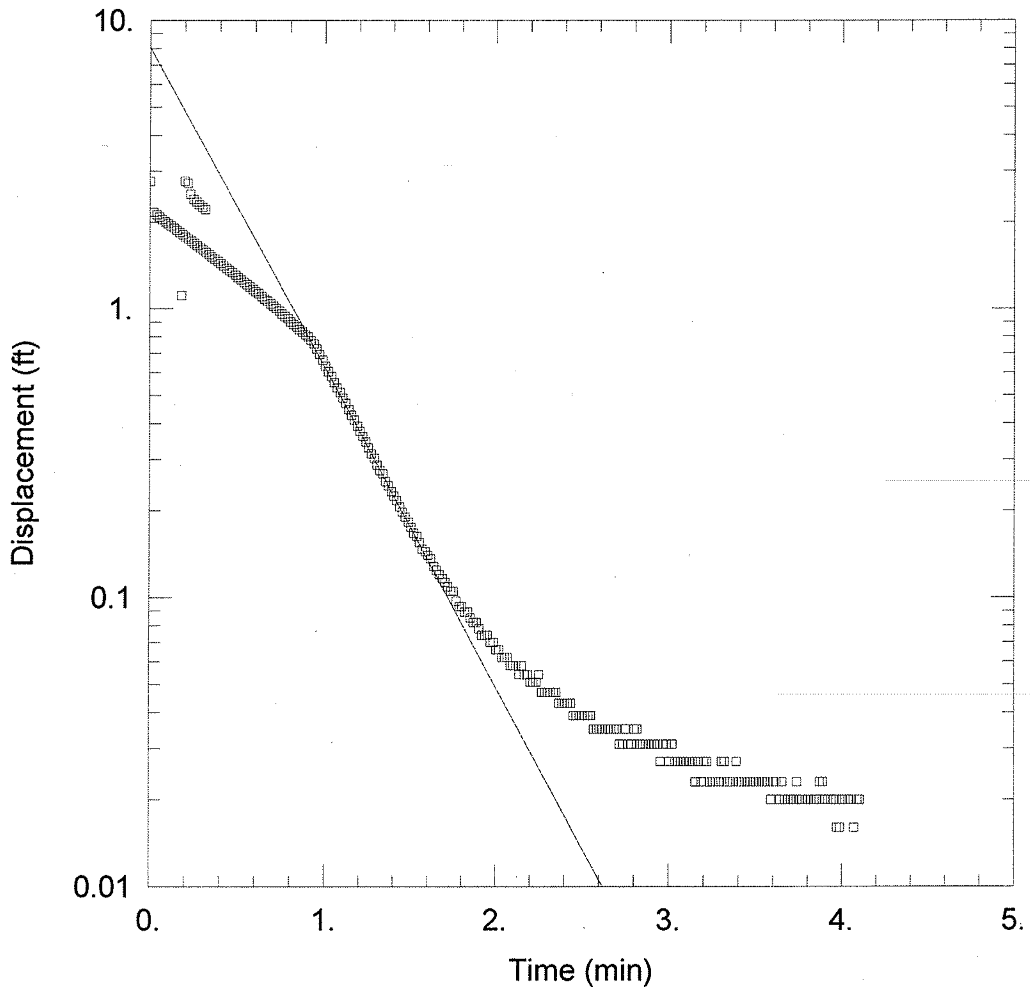
Photo A-5. Groundwater monitoring wells (56SB01 – 56SB05) and drainage pathway (in center) northwest of Hangar 200 apron, view looking west from the CMS Investigation 2008

Photo A-6. 24-inch culvert outlet, south of SWMU 56 and west of Hangar 200 apron from the CMS Investigation 2008

Photo A-7. Groundwater monitoring well 56SB08 adjacent to earthen drainage ditch, view looking north from the CMS Investigation 2008

Photo A-8. Clayey soil encountered in subsurface soil (gray color visible in the middle two MacroCores) from the CMS Investigation 2008

SLUG TEST RESULTS



WELL TEST ANALYSIS

Data Set: K:\...\56gw01f.aqt
Date: 07/15/08 | Time: 11:14:37

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW01f

AQUIFER DATA

Saturated Thickness: 30. ft | Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW01F)

Initial Displacement: 2.765 ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.083 ft

Static Water Column Height: 15.6 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined | Solution Method: Bouwer-Rice

K = 0.002174 ft/min | y0 = 8.049 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:37:31

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW01f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW01F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.765 ft
Static Water Column Height: 15.6 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.6 ft

No. of Observations: 265

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.004	1.922	0.074
0.022	2.16	1.939	0.074
0.033	0.	1.955	0.074
0.039	2.121	1.972	0.07
0.05	0.	1.989	0.07
0.055	2.082	2.005	0.066
0.067	0.	2.022	0.066
0.072	2.04	2.039	0.062
0.083	0.	2.055	0.062
0.089	2.005	2.072	0.062
0.1	0.	2.089	0.058
0.105	1.97	2.105	0.058
0.117	0.	2.122	0.058
0.122	1.939	2.139	0.054
0.133	0.	2.155	0.058
0.139	1.904	2.172	0.054
0.15	0.	2.189	0.054
0.155	1.869	2.205	0.051
0.167	0.004	2.222	0.051
0.172	1.834	2.239	0.051
0.183	1.109	2.255	0.054
0.189	1.803	2.272	0.047
0.2	2.765	2.289	0.047
0.205	1.772	2.305	0.047
0.217	2.722	2.322	0.047
0.222	1.745	2.339	0.047
0.233	2.494	2.355	0.047
0.239	1.714	2.372	0.043

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	2.397	2.389	0.043
0.255	1.683	2.405	0.043
0.267	2.346	2.422	0.043
0.272	1.652	2.439	0.043
0.283	2.296	2.455	0.039
0.289	1.625	2.472	0.039
0.3	2.249	2.489	0.039
0.305	1.598	2.505	0.039
0.317	2.207	2.522	0.039
0.322	1.567	2.539	0.039
0.339	1.54	2.555	0.039
0.355	1.512	2.572	0.035
0.372	1.485	2.589	0.035
0.389	1.458	2.605	0.035
0.405	1.431	2.622	0.035
0.422	1.408	2.639	0.035
0.439	1.377	2.655	0.035
0.455	1.353	2.672	0.035
0.472	1.334	2.689	0.035
0.489	1.307	2.705	0.035
0.505	1.28	2.722	0.031
0.522	1.257	2.739	0.031
0.539	1.233	2.755	0.035
0.555	1.21	2.772	0.031
0.572	1.187	2.789	0.031
0.589	1.163	2.805	0.035
0.605	1.144	2.822	0.035
0.622	1.125	2.839	0.031
0.639	1.101	2.855	0.031
0.655	1.078	2.872	0.031
0.672	1.063	2.889	0.031
0.689	1.039	2.905	0.031
0.705	1.02	2.922	0.031
0.722	1.001	2.939	0.031
0.739	0.981	2.955	0.027
0.755	0.958	2.972	0.031
0.772	0.939	2.989	0.031
0.789	0.923	3.005	0.027
0.805	0.9	3.022	0.031
0.822	0.88	3.039	0.027
0.839	0.865	3.055	0.027
0.855	0.845	3.072	0.027
0.872	0.83	3.089	0.027
0.889	0.811	3.105	0.027
0.905	0.799	3.122	0.027
0.922	0.776	3.139	0.027
0.939	0.756	3.155	0.023
0.955	0.725	3.172	0.027
0.972	0.694	3.189	0.023
0.989	0.663	3.205	0.027
1.005	0.632	3.222	0.027
1.022	0.605	3.239	0.023
1.039	0.582	3.255	0.023
1.055	0.555	3.272	0.023
1.072	0.531	3.289	0.023
1.089	0.512	3.305	0.027
1.105	0.489	3.322	0.027
1.122	0.469	3.339	0.023
1.139	0.446	3.355	0.023
1.155	0.427	3.372	0.023
1.172	0.411	3.389	0.027
1.189	0.392	3.405	0.023
1.205	0.376	3.422	0.023

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	0.361	3.439	0.023
1.239	0.345	3.455	0.023
1.255	0.33	3.472	0.023
1.272	0.314	3.489	0.023
1.289	0.303	3.505	0.023
1.305	0.287	3.522	0.023
1.322	0.275	3.539	0.023
1.339	0.268	3.555	0.023
1.355	0.252	3.572	0.023
1.372	0.244	3.589	0.02
1.389	0.233	3.605	0.023
1.405	0.225	3.622	0.023
1.422	0.217	3.639	0.02
1.439	0.206	3.655	0.023
1.455	0.198	3.672	0.02
1.472	0.19	3.689	0.02
1.489	0.182	3.705	0.02
1.505	0.175	3.722	0.02
1.522	0.167	3.739	0.023
1.539	0.163	3.755	0.02
1.555	0.155	3.772	0.02
1.572	0.147	3.789	0.02
1.589	0.144	3.805	0.02
1.605	0.14	3.822	0.02
1.622	0.136	3.839	0.02
1.639	0.128	3.855	0.02
1.655	0.124	3.872	0.023
1.672	0.12	3.889	0.023
1.689	0.116	3.905	0.02
1.705	0.113	3.922	0.02
1.722	0.109	3.939	0.02
1.739	0.105	3.955	0.02
1.755	0.105	3.972	0.016
1.772	0.097	3.989	0.016
1.789	0.093	4.005	0.02
1.805	0.093	4.022	0.02
1.822	0.089	4.039	0.02
1.839	0.089	4.055	0.02
1.855	0.085	4.072	0.016
1.872	0.082	4.089	0.02
1.889	0.082	4.105	0.02
1.905	0.078		

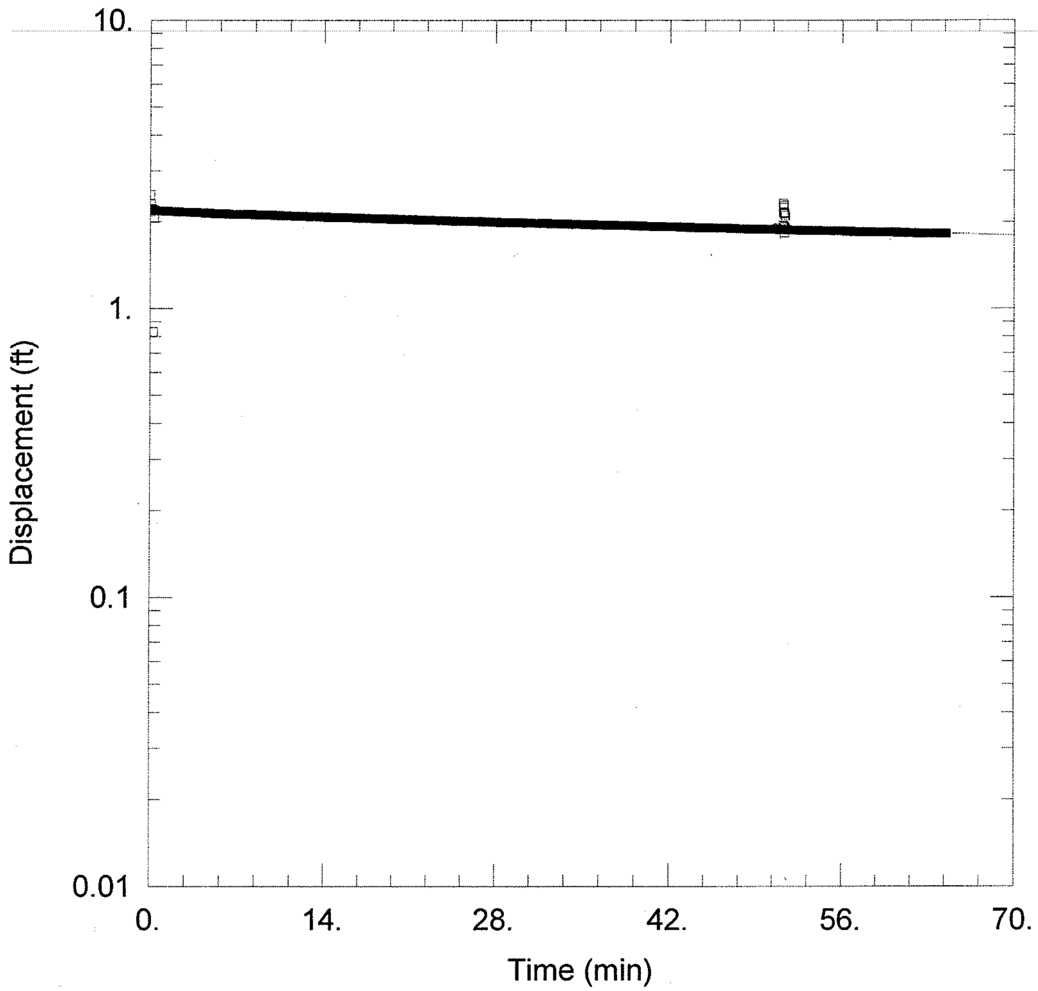
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.476

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.002174	ft/min
y0	8.049	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw02f.aqt
Date: 07/15/08 Time: 11:14:31

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW02f
Test Date: 4/28/08

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW02F)

Initial Displacement: 2.483 ft
Total Well Penetration Depth: 12.94 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.94 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.468E-06 ft/min
y0 = 2.208 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:37:19

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Date: 4/28/08
Test Well: 56GW02f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW02F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.483 ft
Static Water Column Height: 12.94 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 12.94 ft

No. of Observations: 3889

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.	32.12	1.971
0.022	2.483	32.14	1.975
0.033	0.	32.16	1.975
0.039	2.169	32.17	1.971
0.05	0.	32.19	1.971
0.055	2.304	32.2	1.975
0.067	0.	32.22	1.971
0.072	2.227	32.24	1.971
0.083	0.	32.26	1.971
0.089	2.219	32.27	1.971
0.1	0.	32.29	1.971
0.105	2.227	32.31	1.971
0.117	0.	32.32	1.971
0.122	2.207	32.34	1.971
0.133	0.	32.35	1.971
0.139	2.211	32.37	1.971
0.15	-0.003	32.39	1.971
0.155	2.203	32.41	1.971
0.167	-0.003	32.42	1.971
0.172	2.207	32.44	1.971
0.183	-0.003	32.45	1.971
0.189	2.207	32.47	1.967
0.2	-0.003	32.49	1.971
0.205	2.203	32.51	1.971
0.217	0.	32.52	1.967
0.222	2.203	32.54	1.971
0.233	0.	32.56	1.971

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.239	2.203	32.57	1.967
0.25	0.004	32.59	1.971
0.255	2.2	32.6	1.971
0.267	0.004	32.62	1.971
0.272	2.2	32.64	1.971
0.283	0.83	32.66	1.967
0.289	2.2	32.67	1.971
0.3	2.219	32.69	1.971
0.305	2.196	32.7	1.967
0.317	2.06	32.72	1.967
0.322	2.2	32.74	1.967
0.339	2.196	32.76	1.967
0.355	2.196	32.77	1.967
0.372	2.196	32.79	1.967
0.389	2.192	32.81	1.967
0.405	2.192	32.82	1.967
0.422	2.192	32.84	1.971
0.439	2.192	32.85	1.967
0.455	2.192	32.87	1.967
0.472	2.192	32.89	1.971
0.489	2.192	32.91	1.967
0.505	2.192	32.92	1.971
0.522	2.192	32.94	1.967
0.539	2.188	32.95	1.967
0.555	2.188	32.97	1.971
0.572	2.188	32.99	1.971
0.589	2.188	33.01	1.971
0.605	2.188	33.02	1.971
0.622	2.188	33.04	1.967
0.639	2.184	33.06	1.971
0.655	2.188	33.07	1.971
0.672	2.188	33.09	1.967
0.689	2.184	33.1	1.967
0.705	2.184	33.12	1.967
0.722	2.188	33.14	1.967
0.739	2.184	33.16	1.967
0.755	2.184	33.17	1.967
0.772	2.184	33.19	1.967
0.789	2.184	33.2	1.967
0.805	2.184	33.22	1.967
0.822	2.184	33.24	1.967
0.839	2.184	33.26	1.967
0.855	2.184	33.27	1.967
0.872	2.184	33.29	1.967
0.889	2.18	33.31	1.967
0.905	2.18	33.32	1.967
0.922	2.18	33.34	1.963
0.939	2.184	33.35	1.967
0.955	2.18	33.37	1.967
0.972	2.184	33.39	1.967
0.989	2.18	33.41	1.967
1.005	2.18	33.42	1.967
1.022	2.184	33.44	1.967
1.039	2.18	33.45	1.967
1.055	2.18	33.47	1.967
1.072	2.18	33.49	1.967
1.089	2.18	33.51	1.963
1.105	2.184	33.52	1.967
1.122	2.18	33.54	1.963
1.139	2.18	33.56	1.963
1.155	2.184	33.57	1.967
1.172	2.18	33.59	1.967
1.189	2.18	33.6	1.967

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.205	2.18	33.62	1.967
1.222	2.18	33.64	1.967
1.239	2.18	33.66	1.967
1.255	2.18	33.67	1.963
1.272	2.18	33.69	1.963
1.289	2.18	33.7	1.967
1.305	2.18	33.72	1.967
1.322	2.18	33.74	1.963
1.339	2.18	33.76	1.963
1.355	2.18	33.77	1.963
1.372	2.18	33.79	1.963
1.389	2.176	33.81	1.963
1.405	2.176	33.82	1.967
1.422	2.18	33.84	1.963
1.439	2.176	33.85	1.963
1.455	2.176	33.87	1.963
1.472	2.176	33.89	1.963
1.489	2.176	33.91	1.963
1.505	2.176	33.92	1.963
1.522	2.176	33.94	1.963
1.539	2.173	33.95	1.963
1.555	2.176	33.97	1.963
1.572	2.173	33.99	1.963
1.589	2.173	34.01	1.963
1.605	2.173	34.02	1.963
1.622	2.176	34.04	1.963
1.639	2.173	34.06	1.963
1.655	2.176	34.07	1.959
1.672	2.176	34.09	1.959
1.689	2.176	34.1	1.963
1.705	2.176	34.12	1.963
1.722	2.173	34.14	1.963
1.739	2.173	34.16	1.963
1.755	2.176	34.17	1.963
1.772	2.173	34.19	1.963
1.789	2.173	34.2	1.963
1.805	2.173	34.22	1.959
1.822	2.173	34.24	1.963
1.839	2.173	34.26	1.959
1.855	2.173	34.27	1.959
1.872	2.173	34.29	1.963
1.889	2.173	34.31	1.959
1.905	2.173	34.32	1.959
1.922	2.173	34.34	1.959
1.939	2.173	34.35	1.959
1.955	2.173	34.37	1.963
1.972	2.169	34.39	1.959
1.989	2.169	34.41	1.959
2.005	2.169	34.42	1.959
2.022	2.169	34.44	1.959
2.039	2.169	34.45	1.959
2.055	2.169	34.47	1.959
2.072	2.169	34.49	1.959
2.089	2.169	34.51	1.959
2.105	2.169	34.52	1.959
2.122	2.169	34.54	1.963
2.139	2.169	34.56	1.959
2.155	2.169	34.57	1.963
2.172	2.169	34.59	1.959
2.189	2.169	34.6	1.959
2.205	2.169	34.62	1.963
2.222	2.169	34.64	1.959
2.239	2.169	34.66	1.959

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.255	2.165	34.67	1.959
2.272	2.169	34.69	1.959
2.289	2.169	34.7	1.959
2.305	2.165	34.72	1.959
2.322	2.169	34.74	1.959
2.339	2.169	34.76	1.959
2.355	2.165	34.77	1.959
2.372	2.165	34.79	1.959
2.389	2.165	34.81	1.956
2.405	2.165	34.82	1.959
2.422	2.165	34.84	1.959
2.439	2.165	34.85	1.956
2.455	2.165	34.87	1.959
2.472	2.165	34.89	1.956
2.489	2.161	34.91	1.959
2.505	2.165	34.92	1.959
2.522	2.165	34.94	1.959
2.539	2.165	34.95	1.959
2.555	2.161	34.97	1.959
2.572	2.165	34.99	1.956
2.589	2.161	35.01	1.956
2.605	2.165	35.02	1.955
2.622	2.165	35.04	1.956
2.639	2.165	35.06	1.959
2.655	2.165	35.07	1.959
2.672	2.165	35.09	1.959
2.689	2.165	35.1	1.959
2.705	2.165	35.12	1.956
2.722	2.165	35.14	1.956
2.739	2.161	35.16	1.956
2.755	2.161	35.17	1.956
2.772	2.161	35.19	1.955
2.789	2.165	35.2	1.955
2.805	2.165	35.22	1.956
2.822	2.161	35.24	1.955
2.839	2.161	35.26	1.955
2.855	2.161	35.27	1.956
2.872	2.161	35.29	1.956
2.889	2.161	35.31	1.956
2.905	2.161	35.32	1.956
2.922	2.161	35.34	1.955
2.939	2.161	35.35	1.952
2.955	2.161	35.37	1.955
2.972	2.161	35.39	1.956
2.989	2.161	35.41	1.955
3.005	2.161	35.42	1.952
3.022	2.161	35.44	1.955
3.039	2.161	35.45	1.952
3.055	2.161	35.47	1.955
3.072	2.161	35.49	1.955
3.089	2.161	35.51	1.955
3.105	2.161	35.52	1.956
3.122	2.161	35.54	1.956
3.139	2.161	35.56	1.956
3.155	2.161	35.57	1.956
3.172	2.161	35.59	1.956
3.189	2.161	35.6	1.955
3.205	2.161	35.62	1.955
3.222	2.161	35.64	1.952
3.239	2.161	35.66	1.956
3.255	2.157	35.67	1.956
3.272	2.157	35.69	1.956
3.289	2.157	35.7	1.955

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.305	2.157	35.72	1.955
3.322	2.161	35.74	1.955
3.339	2.157	35.76	1.955
3.355	2.157	35.77	1.952
3.372	2.161	35.79	1.952
3.389	2.157	35.81	1.952
3.405	2.157	35.82	1.952
3.422	2.157	35.84	1.955
3.439	2.157	35.85	1.952
3.455	2.157	35.87	1.956
3.472	2.157	35.89	1.956
3.489	2.157	35.91	1.952
3.505	2.161	35.92	1.955
3.522	2.157	35.94	1.952
3.539	2.157	35.95	1.952
3.555	2.157	35.97	1.952
3.572	2.157	35.99	1.948
3.589	2.157	36.01	1.952
3.605	2.157	36.02	1.952
3.622	2.153	36.04	1.952
3.639	2.157	36.06	1.952
3.655	2.157	36.07	1.952
3.672	2.153	36.09	1.952
3.689	2.157	36.1	1.952
3.705	2.157	36.12	1.952
3.722	2.157	36.14	1.952
3.739	2.157	36.16	1.952
3.755	2.153	36.17	1.952
3.772	2.153	36.19	1.952
3.789	2.153	36.2	1.948
3.805	2.153	36.22	1.952
3.822	2.153	36.24	1.952
3.839	2.153	36.26	1.952
3.855	2.153	36.27	1.952
3.872	2.153	36.29	1.948
3.889	2.153	36.31	1.952
3.905	2.153	36.32	1.952
3.922	2.153	36.34	1.952
3.939	2.153	36.35	1.952
3.955	2.153	36.37	1.948
3.972	2.153	36.39	1.952
3.989	2.153	36.41	1.952
4.005	2.153	36.42	1.952
4.022	2.153	36.44	1.948
4.039	2.153	36.45	1.948
4.055	2.149	36.47	1.948
4.072	2.149	36.49	1.952
4.089	2.149	36.51	1.952
4.105	2.149	36.52	1.952
4.122	2.149	36.54	1.948
4.139	2.153	36.56	1.948
4.155	2.149	36.57	1.948
4.172	2.149	36.59	1.948
4.189	2.149	36.6	1.948
4.205	2.149	36.62	1.948
4.222	2.149	36.64	1.948
4.239	2.149	36.66	1.948
4.255	2.149	36.67	1.948
4.272	2.149	36.69	1.948
4.289	2.149	36.7	1.948
4.305	2.146	36.72	1.948
4.322	2.149	36.74	1.948
4.339	2.146	36.76	1.948

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
4.355	2.146	36.77	1.948
4.372	2.146	36.79	1.948
4.389	2.146	36.81	1.948
4.405	2.146	36.82	1.948
4.422	2.146	36.84	1.948
4.439	2.146	36.85	1.948
4.455	2.142	36.87	1.948
4.472	2.146	36.89	1.948
4.489	2.142	36.91	1.948
4.505	2.146	36.92	1.948
4.522	2.146	36.94	1.948
4.539	2.142	36.95	1.948
4.555	2.142	36.97	1.948
4.572	2.146	36.99	1.948
4.589	2.142	37.01	1.948
4.605	2.146	37.02	1.948
4.622	2.142	37.04	1.948
4.639	2.146	37.06	1.948
4.655	2.146	37.07	1.948
4.672	2.146	37.09	1.948
4.689	2.142	37.1	1.948
4.705	2.146	37.12	1.944
4.722	2.142	37.14	1.944
4.739	2.146	37.16	1.948
4.755	2.142	37.17	1.948
4.772	2.142	37.19	1.948
4.789	2.146	37.2	1.948
4.805	2.142	37.22	1.944
4.822	2.142	37.24	1.948
4.839	2.142	37.26	1.948
4.855	2.142	37.27	1.948
4.872	2.142	37.29	1.948
4.889	2.142	37.31	1.948
4.905	2.142	37.32	1.948
4.922	2.142	37.34	1.948
4.939	2.142	37.35	1.948
4.955	2.142	37.37	1.944
4.972	2.138	37.39	1.948
4.989	2.138	37.41	1.948
5.005	2.142	37.42	1.944
5.022	2.138	37.44	1.948
5.039	2.142	37.45	1.948
5.055	2.138	37.47	1.944
5.072	2.138	37.49	1.944
5.089	2.138	37.51	1.944
5.105	2.138	37.52	1.944
5.122	2.138	37.54	1.944
5.139	2.138	37.56	1.944
5.155	2.134	37.57	1.944
5.172	2.138	37.59	1.948
5.189	2.134	37.6	1.944
5.205	2.138	37.62	1.944
5.222	2.138	37.64	1.944
5.239	2.138	37.66	1.944
5.255	2.138	37.67	1.94
5.272	2.138	37.69	1.944
5.289	2.134	37.7	1.944
5.305	2.138	37.72	1.944
5.322	2.138	37.74	1.944
5.339	2.134	37.76	1.944
5.355	2.134	37.77	1.944
5.372	2.134	37.79	1.944
5.389	2.134	37.81	1.944

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
5.405	2.134	37.82	1.944
5.422	2.138	37.84	1.944
5.439	2.134	37.85	1.944
5.455	2.134	37.87	1.94
5.472	2.13	37.89	1.944
5.489	2.134	37.91	1.944
5.505	2.134	37.92	1.944
5.522	2.134	37.94	1.94
5.539	2.134	37.95	1.944
5.555	2.134	37.97	1.94
5.572	2.134	37.99	1.944
5.589	2.13	38.01	1.94
5.605	2.13	38.02	1.94
5.622	2.134	38.04	1.944
5.639	2.134	38.06	1.94
5.655	2.134	38.07	1.94
5.672	2.134	38.09	1.944
5.689	2.134	38.1	1.944
5.705	2.134	38.12	1.944
5.722	2.13	38.14	1.94
5.739	2.134	38.16	1.94
5.755	2.134	38.17	1.94
5.772	2.134	38.19	1.94
5.789	2.134	38.2	1.94
5.805	2.134	38.22	1.94
5.822	2.134	38.24	1.944
5.839	2.134	38.26	1.94
5.855	2.138	38.27	1.94
5.872	2.138	38.29	1.94
5.889	2.134	38.31	1.94
5.905	2.134	38.32	1.94
5.922	2.134	38.34	1.94
5.939	2.134	38.35	1.94
5.955	2.134	38.37	1.94
5.972	2.134	38.39	1.94
5.989	2.134	38.41	1.94
6.005	2.13	38.42	1.94
6.022	2.13	38.44	1.94
6.039	2.134	38.45	1.94
6.055	2.13	38.47	1.94
6.072	2.134	38.49	1.94
6.089	2.134	38.51	1.94
6.105	2.13	38.52	1.94
6.122	2.13	38.54	1.94
6.139	2.13	38.56	1.94
6.155	2.126	38.57	1.936
6.172	2.13	38.59	1.94
6.189	2.13	38.6	1.936
6.205	2.126	38.62	1.94
6.222	2.126	38.64	1.94
6.239	2.13	38.66	1.936
6.255	2.126	38.67	1.94
6.272	2.13	38.69	1.936
6.289	2.126	38.7	1.936
6.305	2.13	38.72	1.936
6.322	2.13	38.74	1.936
6.339	2.126	38.76	1.94
6.355	2.126	38.77	1.936
6.372	2.126	38.79	1.936
6.389	2.126	38.81	1.94
6.405	2.126	38.82	1.94
6.422	2.126	38.84	1.936
6.439	2.126	38.85	1.94

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
6.455	2.126	38.87	1.94
6.472	2.126	38.89	1.936
6.489	2.126	38.91	1.936
6.505	2.122	38.92	1.936
6.522	2.122	38.94	1.94
6.539	2.122	38.95	1.936
6.555	2.126	38.97	1.936
6.572	2.126	38.99	1.936
6.589	2.122	39.01	1.936
6.605	2.126	39.02	1.936
6.622	2.126	39.04	1.936
6.639	2.126	39.06	1.936
6.655	2.122	39.07	1.936
6.672	2.122	39.09	1.936
6.689	2.126	39.1	1.936
6.705	2.126	39.12	1.936
6.722	2.118	39.14	1.936
6.739	2.122	39.16	1.936
6.755	2.122	39.17	1.936
6.772	2.122	39.19	1.936
6.789	2.122	39.2	1.936
6.805	2.122	39.22	1.936
6.822	2.122	39.24	1.936
6.839	2.122	39.26	1.936
6.855	2.122	39.27	1.932
6.872	2.118	39.29	1.936
6.889	2.122	39.31	1.936
6.905	2.122	39.32	1.936
6.922	2.122	39.34	1.936
6.939	2.122	39.35	1.936
6.955	2.122	39.37	1.936
6.972	2.122	39.39	1.936
6.989	2.122	39.41	1.932
7.005	2.122	39.42	1.932
7.022	2.118	39.44	1.936
7.039	2.122	39.45	1.932
7.055	2.122	39.47	1.936
7.072	2.118	39.49	1.936
7.089	2.122	39.51	1.936
7.105	2.118	39.52	1.936
7.122	2.122	39.54	1.932
7.139	2.122	39.56	1.932
7.155	2.122	39.57	1.932
7.172	2.118	39.59	1.936
7.189	2.122	39.6	1.932
7.205	2.122	39.62	1.932
7.222	2.118	39.64	1.932
7.239	2.122	39.66	1.936
7.255	2.122	39.67	1.936
7.272	2.118	39.69	1.932
7.289	2.118	39.7	1.932
7.305	2.118	39.72	1.932
7.322	2.118	39.74	1.932
7.339	2.118	39.76	1.932
7.355	2.118	39.77	1.932
7.372	2.118	39.79	1.936
7.389	2.118	39.81	1.932
7.405	2.118	39.82	1.932
7.422	2.122	39.84	1.928
7.439	2.118	39.85	1.932
7.455	2.118	39.87	1.932
7.472	2.118	39.89	1.932
7.489	2.118	39.91	1.932

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
7.505	2.118	39.92	1.932
7.522	2.118	39.94	1.932
7.539	2.118	39.95	1.932
7.555	2.118	39.97	1.932
7.572	2.118	39.99	1.932
7.589	2.118	40.01	1.932
7.605	2.118	40.02	1.932
7.622	2.118	40.04	1.932
7.639	2.118	40.06	1.932
7.655	2.122	40.07	1.932
7.672	2.122	40.09	1.932
7.689	2.118	40.1	1.932
7.705	2.122	40.12	1.932
7.722	2.122	40.14	1.932
7.739	2.122	40.16	1.932
7.755	2.118	40.17	1.928
7.772	2.122	40.19	1.932
7.789	2.122	40.2	1.932
7.805	2.118	40.22	1.932
7.822	2.118	40.24	1.928
7.839	2.118	40.26	1.932
7.855	2.118	40.27	1.928
7.872	2.118	40.29	1.932
7.889	2.119	40.31	1.928
7.905	2.122	40.32	1.928
7.922	2.122	40.34	1.928
7.939	2.122	40.35	1.928
7.955	2.122	40.37	1.932
7.972	2.122	40.39	1.928
7.989	2.122	40.41	1.928
8.005	2.118	40.42	1.932
8.022	2.122	40.44	1.932
8.039	2.122	40.45	1.928
8.055	2.122	40.47	1.928
8.072	2.118	40.49	1.928
8.089	2.118	40.51	1.928
8.105	2.118	40.52	1.928
8.122	2.122	40.54	1.928
8.139	2.118	40.56	1.928
8.155	2.118	40.57	1.928
8.172	2.118	40.59	1.928
8.189	2.118	40.6	1.928
8.205	2.118	40.62	1.928
8.222	2.122	40.64	1.928
8.239	2.118	40.66	1.928
8.255	2.122	40.67	1.928
8.272	2.122	40.69	1.928
8.289	2.122	40.7	1.928
8.305	2.118	40.72	1.928
8.322	2.118	40.74	1.928
8.339	2.118	40.76	1.925
8.355	2.118	40.77	1.928
8.372	2.118	40.79	1.928
8.389	2.115	40.81	1.928
8.405	2.118	40.82	1.924
8.422	2.118	40.84	1.924
8.439	2.118	40.85	1.928
8.455	2.118	40.87	1.925
8.472	2.115	40.89	1.924
8.489	2.115	40.91	1.924
8.505	2.118	40.92	1.925
8.522	2.118	40.94	1.928
8.539	2.118	40.95	1.924

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
8.555	2.115	40.97	1.928
8.572	2.115	40.99	1.928
8.589	2.115	41.01	1.924
8.605	2.115	41.02	1.924
8.622	2.118	41.04	1.928
8.639	2.118	41.06	1.924
8.655	2.118	41.07	1.928
8.672	2.115	41.09	1.924
8.689	2.118	41.1	1.924
8.705	2.115	41.12	1.925
8.722	2.115	41.14	1.924
8.739	2.115	41.16	1.925
8.755	2.115	41.17	1.924
8.772	2.115	41.19	1.924
8.789	2.115	41.2	1.924
8.805	2.115	41.22	1.928
8.822	2.115	41.24	1.924
8.839	2.115	41.26	1.924
8.855	2.115	41.27	1.924
8.872	2.115	41.29	1.925
8.889	2.115	41.31	1.928
8.905	2.115	41.32	1.925
8.922	2.111	41.34	1.925
8.939	2.111	41.35	1.924
8.955	2.107	41.37	1.924
8.972	2.111	41.39	1.925
8.989	2.107	41.41	1.924
9.005	2.111	41.42	1.925
9.022	2.111	41.44	1.924
9.039	2.111	41.45	1.921
9.055	2.111	41.47	1.924
9.072	2.111	41.49	1.924
9.089	2.111	41.51	1.924
9.105	2.111	41.52	1.925
9.122	2.111	41.54	1.924
9.139	2.111	41.56	1.921
9.155	2.111	41.57	1.924
9.172	2.111	41.59	1.924
9.189	2.115	41.6	1.924
9.205	2.111	41.62	1.924
9.222	2.111	41.64	1.924
9.239	2.111	41.66	1.921
9.255	2.115	41.67	1.921
9.272	2.115	41.69	1.921
9.289	2.111	41.7	1.924
9.305	2.111	41.72	1.924
9.322	2.111	41.74	1.925
9.339	2.111	41.76	1.921
9.355	2.111	41.77	1.925
9.372	2.111	41.79	1.925
9.389	2.111	41.81	1.925
9.405	2.111	41.82	1.925
9.422	2.111	41.84	1.921
9.439	2.111	41.85	1.921
9.455	2.111	41.87	1.924
9.472	2.111	41.89	1.924
9.489	2.111	41.91	1.921
9.505	2.111	41.92	1.921
9.522	2.107	41.94	1.921
9.539	2.111	41.95	1.921
9.555	2.111	41.97	1.921
9.572	2.111	41.99	1.921
9.589	2.111	42.01	1.921

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
9.605	2.111	42.02	1.921
9.622	2.107	42.04	1.921
9.639	2.111	42.06	1.921
9.655	2.107	42.07	1.921
9.672	2.111	42.09	1.921
9.689	2.111	42.1	1.921
9.705	2.107	42.12	1.921
9.722	2.107	42.14	1.921
9.739	2.107	42.16	1.921
9.755	2.107	42.17	1.921
9.772	2.107	42.19	1.921
9.789	2.107	42.2	1.921
9.805	2.111	42.22	1.921
9.822	2.111	42.24	1.921
9.839	2.107	42.26	1.921
9.855	2.107	42.27	1.921
9.872	2.107	42.29	1.921
9.889	2.107	42.31	1.917
9.905	2.107	42.32	1.917
9.922	2.103	42.34	1.921
9.939	2.107	42.35	1.921
9.955	2.103	42.37	1.917
9.972	2.107	42.39	1.917
9.989	2.103	42.41	1.917
10.01	2.103	42.42	1.921
10.02	2.103	42.44	1.921
10.04	2.103	42.45	1.917
10.06	2.103	42.47	1.917
10.07	2.107	42.49	1.921
10.09	2.103	42.51	1.917
10.11	2.103	42.52	1.921
10.12	2.107	42.54	1.917
10.14	2.103	42.56	1.917
10.15	2.103	42.57	1.917
10.17	2.107	42.59	1.917
10.19	2.103	42.6	1.917
10.21	2.107	42.62	1.917
10.22	2.103	42.64	1.917
10.24	2.103	42.66	1.917
10.26	2.107	42.67	1.921
10.27	2.103	42.69	1.917
10.29	2.103	42.7	1.917
10.31	2.103	42.72	1.917
10.32	2.103	42.74	1.917
10.34	2.103	42.76	1.917
10.36	2.103	42.77	1.917
10.37	2.103	42.79	1.917
10.39	2.107	42.81	1.917
10.4	2.103	42.82	1.917
10.42	2.103	42.84	1.917
10.44	2.103	42.85	1.917
10.46	2.103	42.87	1.917
10.47	2.103	42.89	1.917
10.49	2.099	42.91	1.917
10.51	2.103	42.92	1.917
10.52	2.103	42.94	1.917
10.54	2.103	42.95	1.913
10.56	2.103	42.97	1.913
10.57	2.099	42.99	1.917
10.59	2.103	43.01	1.913
10.61	2.099	43.02	1.913
10.62	2.103	43.04	1.917
10.64	2.103	43.06	1.917

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
10.65	2.099	43.07	1.917
10.67	2.099	43.09	1.917
10.69	2.103	43.1	1.917
10.71	2.103	43.12	1.917
10.72	2.099	43.14	1.913
10.74	2.103	43.16	1.917
10.76	2.099	43.17	1.917
10.77	2.099	43.19	1.917
10.79	2.099	43.2	1.917
10.81	2.099	43.22	1.917
10.82	2.099	43.24	1.917
10.84	2.103	43.26	1.913
10.86	2.099	43.27	1.917
10.87	2.103	43.29	1.917
10.89	2.099	43.31	1.917
10.9	2.099	43.32	1.913
10.92	2.099	43.34	1.913
10.94	2.099	43.35	1.913
10.96	2.099	43.37	1.913
10.97	2.099	43.39	1.913
10.99	2.099	43.41	1.913
11.01	2.099	43.42	1.917
11.02	2.103	43.44	1.913
11.04	2.099	43.45	1.917
11.06	2.099	43.47	1.913
11.07	2.099	43.49	1.913
11.09	2.099	43.51	1.913
11.11	2.099	43.52	1.909
11.12	2.099	43.54	1.913
11.14	2.099	43.56	1.913
11.15	2.099	43.57	1.913
11.17	2.099	43.59	1.913
11.19	2.095	43.6	1.913
11.21	2.099	43.62	1.913
11.22	2.099	43.64	1.917
11.24	2.099	43.66	1.913
11.26	2.099	43.67	1.913
11.27	2.099	43.69	1.913
11.29	2.099	43.7	1.913
11.31	2.099	43.72	1.913
11.32	2.099	43.74	1.913
11.34	2.099	43.76	1.909
11.36	2.095	43.77	1.913
11.37	2.095	43.79	1.913
11.39	2.099	43.81	1.913
11.4	2.099	43.82	1.913
11.42	2.095	43.84	1.913
11.44	2.095	43.85	1.913
11.46	2.095	43.87	1.909
11.47	2.095	43.89	1.913
11.49	2.095	43.91	1.913
11.51	2.095	43.92	1.913
11.52	2.095	43.94	1.913
11.54	2.095	43.95	1.909
11.56	2.095	43.97	1.913
11.57	2.091	43.99	1.913
11.59	2.091	44.01	1.913
11.61	2.091	44.02	1.909
11.62	2.091	44.04	1.909
11.64	2.095	44.06	1.913
11.65	2.091	44.07	1.909
11.67	2.091	44.09	1.913
11.69	2.091	44.1	1.909

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
11.71	2.091	44.12	1.913
11.72	2.091	44.14	1.913
11.74	2.091	44.16	1.913
11.76	2.091	44.17	1.909
11.77	2.091	44.19	1.909
11.79	2.091	44.2	1.913
11.81	2.087	44.22	1.909
11.82	2.091	44.24	1.909
11.84	2.091	44.26	1.909
11.86	2.091	44.27	1.909
11.87	2.091	44.29	1.909
11.89	2.091	44.31	1.905
11.9	2.087	44.32	1.905
11.92	2.087	44.34	1.905
11.94	2.091	44.35	1.909
11.96	2.091	44.37	1.909
11.97	2.091	44.39	1.909
11.99	2.087	44.41	1.909
12.01	2.087	44.42	1.909
12.02	2.091	44.44	1.905
12.04	2.091	44.45	1.909
12.06	2.091	44.47	1.905
12.07	2.087	44.49	1.905
12.09	2.087	44.51	1.909
12.11	2.091	44.52	1.909
12.12	2.091	44.54	1.909
12.14	2.088	44.56	1.913
12.15	2.091	44.57	1.909
12.17	2.087	44.59	1.909
12.19	2.091	44.6	1.909
12.21	2.087	44.62	1.909
12.22	2.091	44.64	1.909
12.24	2.091	44.66	1.909
12.26	2.091	44.67	1.905
12.27	2.087	44.69	1.905
12.29	2.087	44.7	1.905
12.31	2.087	44.72	1.909
12.32	2.091	44.74	1.909
12.34	2.087	44.76	1.909
12.36	2.087	44.77	1.905
12.37	2.087	44.79	1.909
12.39	2.087	44.81	1.905
12.4	2.087	44.82	1.905
12.42	2.087	44.84	1.905
12.44	2.087	44.85	1.909
12.46	2.087	44.87	1.905
12.47	2.087	44.89	1.905
12.49	2.087	44.91	1.905
12.51	2.087	44.92	1.905
12.52	2.087	44.94	1.909
12.54	2.087	44.95	1.905
12.56	2.087	44.97	1.909
12.57	2.087	44.99	1.905
12.59	2.087	45.01	1.905
12.61	2.087	45.02	1.905
12.62	2.084	45.04	1.909
12.64	2.087	45.06	1.905
12.65	2.084	45.07	1.905
12.67	2.087	45.09	1.909
12.69	2.087	45.1	1.905
12.71	2.084	45.12	1.909
12.72	2.084	45.14	1.909
12.74	2.084	45.16	1.905

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
12.76	2.084	45.17	1.905
12.77	2.084	45.19	1.905
12.79	2.084	45.2	1.905
12.81	2.08	45.22	1.905
12.82	2.084	45.24	1.901
12.84	2.084	45.26	1.905
12.86	2.08	45.27	1.905
12.87	2.084	45.29	1.905
12.89	2.084	45.31	1.901
12.9	2.084	45.32	1.901
12.92	2.084	45.34	1.905
12.94	2.084	45.35	1.901
12.96	2.084	45.37	1.905
12.97	2.084	45.39	1.901
12.99	2.084	45.41	1.901
13.01	2.084	45.42	1.905
13.02	2.084	45.44	1.901
13.04	2.084	45.45	1.905
13.06	2.084	45.47	1.901
13.07	2.084	45.49	1.901
13.09	2.084	45.51	1.905
13.11	2.084	45.52	1.905
13.12	2.08	45.54	1.905
13.14	2.084	45.56	1.901
13.15	2.084	45.57	1.901
13.17	2.087	45.59	1.901
13.19	2.084	45.6	1.901
13.21	2.08	45.62	1.901
13.22	2.084	45.64	1.901
13.24	2.084	45.66	1.901
13.26	2.084	45.67	1.901
13.27	2.084	45.69	1.901
13.29	2.084	45.7	1.901
13.31	2.084	45.72	1.901
13.32	2.084	45.74	1.901
13.34	2.084	45.76	1.901
13.36	2.084	45.77	1.901
13.37	2.084	45.79	1.901
13.39	2.084	45.81	1.901
13.4	2.084	45.82	1.901
13.42	2.08	45.84	1.901
13.44	2.084	45.85	1.901
13.46	2.084	45.87	1.901
13.47	2.08	45.89	1.901
13.49	2.08	45.91	1.901
13.51	2.08	45.92	1.901
13.52	2.08	45.94	1.901
13.54	2.084	45.95	1.897
13.56	2.08	45.97	1.897
13.57	2.08	45.99	1.901
13.59	2.08	46.01	1.901
13.61	2.08	46.02	1.901
13.62	2.08	46.04	1.901
13.64	2.08	46.06	1.901
13.65	2.08	46.07	1.901
13.67	2.08	46.09	1.901
13.69	2.08	46.1	1.901
13.71	2.08	46.12	1.901
13.72	2.08	46.14	1.901
13.74	2.08	46.16	1.901
13.76	2.08	46.17	1.901
13.77	2.08	46.19	1.901
13.79	2.08	46.2	1.901

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
13.81	2.08	46.22	1.901
13.82	2.08	46.24	1.901
13.84	2.076	46.26	1.897
13.86	2.076	46.27	1.897
13.87	2.076	46.29	1.897
13.89	2.076	46.31	1.897
13.9	2.076	46.32	1.897
13.92	2.076	46.34	1.897
13.94	2.076	46.35	1.897
13.96	2.076	46.37	1.897
13.97	2.076	46.39	1.897
13.99	2.08	46.41	1.897
14.01	2.076	46.42	1.897
14.02	2.076	46.44	1.897
14.04	2.076	46.45	1.897
14.06	2.076	46.47	1.901
14.07	2.076	46.49	1.897
14.09	2.076	46.51	1.901
14.11	2.08	46.52	1.897
14.12	2.076	46.54	1.897
14.14	2.076	46.56	1.897
14.15	2.076	46.57	1.897
14.17	2.076	46.59	1.897
14.19	2.076	46.6	1.897
14.21	2.076	46.62	1.897
14.22	2.08	46.64	1.897
14.24	2.076	46.66	1.897
14.26	2.072	46.67	1.897
14.27	2.076	46.69	1.901
14.29	2.076	46.7	1.897
14.31	2.076	46.72	1.897
14.32	2.076	46.74	1.897
14.34	2.072	46.76	1.897
14.36	2.076	46.77	1.897
14.37	2.076	46.79	1.897
14.39	2.072	46.81	1.897
14.4	2.072	46.82	1.897
14.42	2.072	46.84	1.897
14.44	2.072	46.85	1.897
14.46	2.072	46.87	1.897
14.47	2.072	46.89	1.897
14.49	2.072	46.91	1.897
14.51	2.072	46.92	1.893
14.52	2.072	46.94	1.893
14.54	2.072	46.95	1.893
14.56	2.072	46.97	1.897
14.57	2.072	46.99	1.897
14.59	2.072	47.01	1.893
14.61	2.068	47.02	1.894
14.62	2.072	47.04	1.893
14.64	2.068	47.06	1.894
14.65	2.068	47.07	1.897
14.67	2.072	47.09	1.893
14.69	2.072	47.1	1.897
14.71	2.072	47.12	1.893
14.72	2.072	47.14	1.897
14.74	2.072	47.16	1.893
14.76	2.072	47.17	1.894
14.77	2.068	47.19	1.893
14.79	2.072	47.2	1.893
14.81	2.072	47.22	1.893
14.82	2.072	47.24	1.893
14.84	2.068	47.26	1.897

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
14.86	2.072	47.27	1.897
14.87	2.072	47.29	1.894
14.89	2.072	47.31	1.893
14.9	2.072	47.32	1.893
14.92	2.068	47.34	1.894
14.94	2.072	47.35	1.893
14.96	2.072	47.37	1.893
14.97	2.068	47.39	1.893
14.99	2.072	47.41	1.893
15.01	2.068	47.42	1.893
15.02	2.072	47.44	1.893
15.04	2.068	47.45	1.893
15.06	2.072	47.47	1.893
15.07	2.068	47.49	1.893
15.09	2.072	47.51	1.894
15.11	2.068	47.52	1.893
15.12	2.072	47.54	1.893
15.14	2.072	47.56	1.893
15.15	2.072	47.57	1.893
15.17	2.068	47.59	1.893
15.19	2.072	47.6	1.893
15.21	2.072	47.62	1.893
15.22	2.068	47.64	1.893
15.24	2.072	47.66	1.89
15.26	2.068	47.67	1.893
15.27	2.068	47.69	1.893
15.29	2.072	47.7	1.89
15.31	2.072	47.72	1.893
15.32	2.072	47.74	1.894
15.34	2.068	47.76	1.893
15.36	2.068	47.77	1.89
15.37	2.072	47.79	1.89
15.39	2.072	47.81	1.894
15.4	2.068	47.82	1.893
15.42	2.068	47.84	1.893
15.44	2.072	47.85	1.89
15.46	2.068	47.87	1.89
15.47	2.072	47.89	1.89
15.49	2.068	47.91	1.89
15.51	2.068	47.92	1.893
15.52	2.068	47.94	1.894
15.54	2.068	47.95	1.89
15.56	2.068	47.97	1.893
15.57	2.068	47.99	1.894
15.59	2.068	48.01	1.893
15.61	2.068	48.02	1.89
15.62	2.068	48.04	1.89
15.64	2.072	48.06	1.89
15.65	2.068	48.07	1.89
15.67	2.068	48.09	1.89
15.69	2.072	48.1	1.89
15.71	2.068	48.12	1.89
15.72	2.072	48.14	1.893
15.74	2.068	48.16	1.894
15.76	2.068	48.17	1.89
15.77	2.068	48.19	1.89
15.79	2.068	48.2	1.89
15.81	2.068	48.22	1.89
15.82	2.068	48.24	1.89
15.84	2.068	48.26	1.89
15.86	2.072	48.27	1.89
15.87	2.072	48.29	1.89
15.89	2.068	48.31	1.89

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
15.9	2.068	48.32	1.89
15.92	2.068	48.34	1.886
15.94	2.068	48.35	1.89
15.96	2.068	48.37	1.89
15.97	2.072	48.39	1.89
15.99	2.068	48.41	1.89
16.	2.068	48.42	1.886
16.02	2.068	48.44	1.89
16.04	2.068	48.45	1.89
16.06	2.068	48.47	1.886
16.07	2.068	48.49	1.89
16.09	2.068	48.51	1.89
16.11	2.068	48.52	1.886
16.12	2.064	48.54	1.89
16.14	2.068	48.56	1.89
16.16	2.064	48.57	1.886
16.17	2.064	48.59	1.886
16.19	2.064	48.6	1.886
16.2	2.068	48.62	1.886
16.22	2.064	48.64	1.886
16.24	2.068	48.66	1.89
16.25	2.064	48.67	1.886
16.27	2.064	48.69	1.886
16.29	2.068	48.7	1.89
16.31	2.064	48.72	1.89
16.32	2.064	48.74	1.89
16.34	2.064	48.76	1.89
16.36	2.068	48.77	1.886
16.37	2.064	48.79	1.89
16.39	2.064	48.81	1.89
16.41	2.064	48.82	1.89
16.42	2.064	48.84	1.886
16.44	2.064	48.85	1.89
16.45	2.064	48.87	1.89
16.47	2.064	48.89	1.886
16.49	2.064	48.91	1.886
16.5	2.064	48.92	1.886
16.52	2.064	48.94	1.886
16.54	2.064	48.95	1.89
16.56	2.064	48.97	1.886
16.57	2.064	48.99	1.886
16.59	2.068	49.01	1.886
16.61	2.064	49.02	1.886
16.62	2.064	49.04	1.886
16.64	2.064	49.06	1.886
16.66	2.064	49.07	1.886
16.67	2.064	49.09	1.886
16.69	2.06	49.1	1.886
16.7	2.064	49.12	1.886
16.72	2.064	49.14	1.886
16.74	2.064	49.16	1.886
16.75	2.06	49.17	1.886
16.77	2.064	49.19	1.886
16.79	2.064	49.2	1.886
16.81	2.06	49.22	1.886
16.82	2.064	49.24	1.886
16.84	2.06	49.26	1.886
16.86	2.06	49.27	1.886
16.87	2.06	49.29	1.886
16.89	2.06	49.31	1.886
16.91	2.06	49.32	1.886
16.92	2.064	49.34	1.886
16.94	2.06	49.35	1.886

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
16.95	2.06	49.37	1.886
16.97	2.06	49.39	1.886
16.99	2.06	49.41	1.886
17.	2.06	49.42	1.886
17.02	2.06	49.44	1.886
17.04	2.06	49.45	1.89
17.06	2.06	49.47	1.886
17.07	2.056	49.49	1.882
17.09	2.06	49.51	1.886
17.11	2.06	49.52	1.886
17.12	2.06	49.54	1.882
17.14	2.06	49.56	1.886
17.16	2.06	49.57	1.882
17.17	2.06	49.59	1.886
17.19	2.06	49.6	1.882
17.2	2.06	49.62	1.882
17.22	2.06	49.64	1.882
17.24	2.06	49.66	1.882
17.25	2.06	49.67	1.886
17.27	2.06	49.69	1.882
17.29	2.06	49.7	1.886
17.31	2.056	49.72	1.886
17.32	2.06	49.74	1.882
17.34	2.056	49.76	1.886
17.36	2.056	49.77	1.886
17.37	2.056	49.79	1.886
17.39	2.056	49.81	1.882
17.41	2.06	49.82	1.886
17.42	2.056	49.84	1.882
17.44	2.056	49.85	1.882
17.45	2.056	49.87	1.886
17.47	2.056	49.89	1.882
17.49	2.056	49.91	1.882
17.5	2.056	49.92	1.882
17.52	2.056	49.94	1.882
17.54	2.056	49.95	1.882
17.56	2.053	49.97	1.886
17.57	2.06	49.99	1.882
17.59	2.056	50.01	1.882
17.61	2.056	50.02	1.886
17.62	2.056	50.04	1.882
17.64	2.056	50.06	1.882
17.66	2.053	50.07	1.882
17.67	2.056	50.09	1.882
17.69	2.056	50.1	1.886
17.7	2.056	50.12	1.882
17.72	2.056	50.14	1.882
17.74	2.056	50.16	1.886
17.75	2.056	50.17	1.886
17.77	2.056	50.19	1.882
17.79	2.056	50.2	1.882
17.81	2.053	50.22	1.882
17.82	2.056	50.24	1.882
17.84	2.056	50.26	1.882
17.86	2.056	50.27	1.882
17.87	2.056	50.29	1.882
17.89	2.056	50.31	1.882
17.91	2.053	50.32	1.882
17.92	2.056	50.34	1.882
17.94	2.056	50.35	1.878
17.95	2.053	50.37	1.878
17.97	2.053	50.39	1.882
17.99	2.056	50.41	1.882

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
18.	2.053	50.42	1.882
18.02	2.053	50.44	1.882
18.04	2.053	50.45	1.882
18.06	2.053	50.47	1.882
18.07	2.053	50.49	1.882
18.09	2.053	50.51	1.882
18.11	2.053	50.52	1.882
18.12	2.053	50.54	1.878
18.14	2.053	50.56	1.882
18.16	2.053	50.57	1.878
18.17	2.049	50.59	1.878
18.19	2.053	50.6	1.878
18.2	2.053	50.62	1.897
18.22	2.049	50.64	1.882
18.24	2.049	50.66	1.878
18.25	2.049	50.67	1.882
18.27	2.049	50.69	1.878
18.29	2.053	50.7	1.878
18.31	2.049	50.72	1.878
18.32	2.049	50.74	1.878
18.34	2.053	50.76	1.878
18.36	2.049	50.77	1.878
18.37	2.053	50.79	1.878
18.39	2.049	50.81	1.901
18.41	2.049	50.82	1.882
18.42	2.049	50.84	1.878
18.44	2.053	50.85	1.878
18.45	2.053	50.87	1.878
18.47	2.049	50.89	1.874
18.49	2.053	50.91	1.878
18.5	2.049	50.92	1.878
18.52	2.049	50.94	1.878
18.54	2.053	50.95	1.878
18.56	2.053	50.97	1.878
18.57	2.053	50.99	1.905
18.59	2.053	51.01	1.882
18.61	2.053	51.02	1.882
18.62	2.053	51.04	1.878
18.64	2.053	51.06	1.878
18.66	2.049	51.07	1.878
18.67	2.049	51.09	1.878
18.69	2.049	51.1	1.878
18.7	2.053	51.12	1.878
18.72	2.049	51.14	1.878
18.74	2.049	51.16	1.878
18.75	2.049	51.17	1.882
18.77	2.049	51.19	1.948
18.79	2.049	51.2	2.149
18.81	2.049	51.22	2.316
18.82	2.049	51.24	1.932
18.84	2.045	51.26	2.243
18.86	2.049	51.27	2.285
18.87	2.049	51.29	2.142
18.89	2.049	51.31	1.828
18.91	2.049	51.32	1.921
18.92	2.045	51.34	2.146
18.94	2.049	51.35	2.126
18.95	2.049	51.37	2.095
18.97	2.049	51.39	1.905
18.99	2.049	51.41	1.886
19.	2.049	51.42	1.878
19.02	2.049	51.44	1.878
19.04	2.049	51.45	1.874

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
19.06	2.049	51.47	1.874
19.07	2.049	51.49	1.874
19.09	2.049	51.51	1.878
19.11	2.049	51.52	1.874
19.12	2.049	51.54	1.878
19.14	2.049	51.56	1.874
19.16	2.049	51.57	1.874
19.17	2.049	51.59	1.874
19.19	2.049	51.6	1.874
19.2	2.049	51.62	1.87
19.22	2.045	51.64	1.874
19.24	2.045	51.66	1.87
19.25	2.045	51.67	1.874
19.27	2.049	51.69	1.874
19.29	2.049	51.7	1.874
19.31	2.045	51.72	1.874
19.32	2.045	51.74	1.874
19.34	2.045	51.76	1.874
19.36	2.049	51.77	1.874
19.37	2.045	51.79	1.874
19.39	2.045	51.81	1.874
19.41	2.045	51.82	1.874
19.42	2.045	51.84	1.874
19.44	2.045	51.85	1.87
19.45	2.041	51.87	1.874
19.47	2.045	51.89	1.874
19.49	2.045	51.91	1.87
19.5	2.045	51.92	1.87
19.52	2.045	51.94	1.874
19.54	2.045	51.95	1.874
19.56	2.045	51.97	1.87
19.57	2.045	51.99	1.87
19.59	2.045	52.01	1.874
19.61	2.045	52.02	1.87
19.62	2.049	52.04	1.87
19.64	2.045	52.06	1.87
19.66	2.045	52.07	1.874
19.67	2.045	52.09	1.87
19.69	2.045	52.1	1.874
19.7	2.049	52.12	1.87
19.72	2.045	52.14	1.87
19.74	2.045	52.16	1.874
19.75	2.041	52.17	1.87
19.77	2.045	52.19	1.87
19.79	2.041	52.2	1.87
19.81	2.041	52.22	1.874
19.82	2.045	52.24	1.87
19.84	2.041	52.26	1.87
19.86	2.041	52.27	1.87
19.87	2.045	52.29	1.874
19.89	2.045	52.31	1.87
19.91	2.045	52.32	1.87
19.92	2.041	52.34	1.87
19.94	2.041	52.35	1.87
19.95	2.041	52.37	1.874
19.97	2.041	52.39	1.87
19.99	2.045	52.41	1.87
20.	2.045	52.42	1.87
20.02	2.041	52.44	1.87
20.04	2.041	52.45	1.87
20.06	2.041	52.47	1.87
20.07	2.041	52.49	1.87
20.09	2.041	52.51	1.87

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
20.11	2.041	52.52	1.87
20.12	2.041	52.54	1.87
20.14	2.045	52.56	1.866
20.16	2.041	52.57	1.87
20.17	2.041	52.59	1.866
20.19	2.045	52.6	1.866
20.2	2.045	52.62	1.87
20.22	2.041	52.64	1.87
20.24	2.041	52.66	1.87
20.25	2.041	52.67	1.87
20.27	2.041	52.69	1.87
20.29	2.041	52.7	1.87
20.31	2.041	52.72	1.87
20.32	2.041	52.74	1.87
20.34	2.041	52.76	1.866
20.36	2.041	52.77	1.87
20.37	2.037	52.79	1.87
20.39	2.041	52.81	1.87
20.41	2.041	52.82	1.87
20.42	2.041	52.84	1.87
20.44	2.037	52.85	1.87
20.45	2.041	52.87	1.87
20.47	2.037	52.89	1.87
20.49	2.041	52.91	1.87
20.5	2.037	52.92	1.87
20.52	2.041	52.94	1.87
20.54	2.037	52.95	1.866
20.56	2.037	52.97	1.866
20.57	2.041	52.99	1.866
20.59	2.041	53.01	1.87
20.61	2.037	53.02	1.87
20.62	2.037	53.04	1.866
20.64	2.037	53.06	1.866
20.66	2.037	53.07	1.87
20.67	2.037	53.09	1.866
20.69	2.037	53.1	1.866
20.7	2.037	53.12	1.866
20.72	2.037	53.14	1.866
20.74	2.037	53.16	1.866
20.75	2.037	53.17	1.866
20.77	2.037	53.19	1.866
20.79	2.037	53.2	1.87
20.81	2.037	53.22	1.866
20.82	2.037	53.24	1.866
20.84	2.037	53.26	1.866
20.86	2.037	53.27	1.866
20.87	2.037	53.29	1.866
20.89	2.037	53.31	1.866
20.91	2.037	53.32	1.866
20.92	2.037	53.34	1.866
20.94	2.037	53.35	1.866
20.95	2.037	53.37	1.866
20.97	2.037	53.39	1.866
20.99	2.037	53.41	1.866
21.	2.037	53.42	1.866
21.02	2.037	53.44	1.866
21.04	2.037	53.45	1.866
21.06	2.037	53.47	1.862
21.07	2.033	53.49	1.862
21.09	2.033	53.51	1.866
21.11	2.037	53.52	1.862
21.12	2.033	53.54	1.866
21.14	2.037	53.56	1.866

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
21.16	2.037	53.57	1.866
21.17	2.033	53.59	1.866
21.19	2.033	53.6	1.866
21.2	2.033	53.62	1.862
21.22	2.033	53.64	1.866
21.24	2.033	53.66	1.862
21.25	2.033	53.67	1.866
21.27	2.033	53.69	1.862
21.29	2.033	53.7	1.866
21.31	2.037	53.72	1.862
21.32	2.037	53.74	1.862
21.34	2.033	53.76	1.866
21.36	2.033	53.77	1.862
21.37	2.033	53.79	1.862
21.39	2.033	53.81	1.866
21.41	2.033	53.82	1.866
21.42	2.033	53.84	1.866
21.44	2.033	53.85	1.862
21.45	2.033	53.87	1.862
21.47	2.033	53.89	1.862
21.49	2.033	53.91	1.866
21.5	2.033	53.92	1.866
21.52	2.033	53.94	1.866
21.54	2.033	53.95	1.866
21.56	2.033	53.97	1.866
21.57	2.033	53.99	1.862
21.59	2.033	54.01	1.866
21.61	2.033	54.02	1.866
21.62	2.033	54.04	1.862
21.64	2.029	54.06	1.862
21.66	2.029	54.07	1.862
21.67	2.029	54.09	1.866
21.69	2.029	54.1	1.866
21.7	2.033	54.12	1.862
21.72	2.033	54.14	1.862
21.74	2.029	54.16	1.862
21.75	2.033	54.17	1.862
21.77	2.029	54.19	1.862
21.79	2.033	54.2	1.862
21.81	2.033	54.22	1.862
21.82	2.033	54.24	1.862
21.84	2.033	54.26	1.862
21.86	2.029	54.27	1.862
21.87	2.033	54.29	1.862
21.89	2.033	54.31	1.862
21.91	2.033	54.32	1.862
21.92	2.029	54.34	1.862
21.94	2.029	54.35	1.862
21.95	2.029	54.37	1.862
21.97	2.029	54.39	1.862
21.99	2.029	54.41	1.862
22.	2.029	54.42	1.862
22.02	2.029	54.44	1.862
22.04	2.029	54.45	1.859
22.06	2.029	54.47	1.859
22.07	2.029	54.49	1.862
22.09	2.029	54.51	1.862
22.11	2.025	54.52	1.862
22.12	2.029	54.54	1.862
22.14	2.029	54.56	1.862
22.16	2.029	54.57	1.859
22.17	2.029	54.59	1.862
22.19	2.029	54.6	1.859

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
22.2	2.025	54.62	1.859
22.22	2.025	54.64	1.859
22.24	2.025	54.66	1.859
22.25	2.025	54.67	1.859
22.27	2.029	54.69	1.859
22.29	2.029	54.7	1.859
22.31	2.025	54.72	1.862
22.32	2.029	54.74	1.862
22.34	2.029	54.76	1.859
22.36	2.025	54.77	1.862
22.37	2.029	54.79	1.862
22.39	2.025	54.81	1.859
22.41	2.029	54.82	1.862
22.42	2.029	54.84	1.859
22.44	2.029	54.85	1.862
22.45	2.029	54.87	1.862
22.47	2.029	54.89	1.859
22.49	2.025	54.91	1.859
22.5	2.029	54.92	1.862
22.52	2.025	54.94	1.859
22.54	2.025	54.95	1.862
22.56	2.025	54.97	1.862
22.57	2.022	54.99	1.862
22.59	2.025	55.01	1.862
22.61	2.025	55.02	1.859
22.62	2.029	55.04	1.859
22.64	2.025	55.06	1.859
22.66	2.025	55.07	1.859
22.67	2.025	55.09	1.859
22.69	2.025	55.1	1.859
22.7	2.025	55.12	1.859
22.72	2.029	55.14	1.859
22.74	2.025	55.16	1.862
22.75	2.025	55.17	1.859
22.77	2.025	55.19	1.859
22.79	2.025	55.2	1.859
22.81	2.025	55.22	1.859
22.82	2.025	55.24	1.859
22.84	2.025	55.26	1.859
22.86	2.025	55.27	1.859
22.87	2.025	55.29	1.862
22.89	2.025	55.31	1.859
22.91	2.025	55.32	1.855
22.92	2.022	55.34	1.855
22.94	2.025	55.35	1.859
22.95	2.025	55.37	1.859
22.97	2.025	55.39	1.859
22.99	2.025	55.41	1.859
23.	2.022	55.42	1.859
23.02	2.025	55.44	1.859
23.04	2.025	55.45	1.859
23.06	2.025	55.47	1.859
23.07	2.022	55.49	1.859
23.09	2.022	55.51	1.855
23.11	2.025	55.52	1.855
23.12	2.022	55.54	1.855
23.14	2.022	55.56	1.855
23.16	2.022	55.57	1.859
23.17	2.022	55.59	1.859
23.19	2.022	55.6	1.859
23.2	2.022	55.62	1.859
23.22	2.022	55.64	1.859
23.24	2.025	55.66	1.859

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
23.25	2.022	55.67	1.855
23.27	2.022	55.69	1.855
23.29	2.022	55.7	1.859
23.31	2.022	55.72	1.855
23.32	2.022	55.74	1.855
23.34	2.022	55.76	1.855
23.36	2.022	55.77	1.855
23.37	2.022	55.79	1.855
23.39	2.022	55.81	1.855
23.41	2.022	55.82	1.855
23.42	2.022	55.84	1.855
23.44	2.022	55.85	1.855
23.45	2.022	55.87	1.855
23.47	2.022	55.89	1.855
23.49	2.018	55.91	1.859
23.5	2.022	55.92	1.855
23.52	2.022	55.94	1.855
23.54	2.022	55.95	1.859
23.56	2.022	55.97	1.855
23.57	2.022	55.99	1.855
23.59	2.018	56.01	1.859
23.61	2.022	56.02	1.855
23.62	2.022	56.04	1.855
23.64	2.022	56.06	1.855
23.66	2.022	56.07	1.855
23.67	2.022	56.09	1.855
23.69	2.022	56.1	1.855
23.7	2.022	56.12	1.855
23.72	2.018	56.14	1.855
23.74	2.018	56.16	1.855
23.75	2.018	56.17	1.855
23.77	2.018	56.19	1.855
23.79	2.018	56.2	1.855
23.81	2.018	56.22	1.855
23.82	2.018	56.24	1.855
23.84	2.018	56.26	1.855
23.86	2.018	56.27	1.855
23.87	2.018	56.29	1.855
23.89	2.018	56.31	1.855
23.91	2.018	56.32	1.851
23.92	2.018	56.34	1.851
23.94	2.022	56.35	1.851
23.95	2.018	56.37	1.851
23.97	2.018	56.39	1.855
23.99	2.018	56.41	1.851
24.	2.018	56.42	1.855
24.02	2.018	56.44	1.855
24.04	2.018	56.45	1.855
24.06	2.018	56.47	1.855
24.07	2.018	56.49	1.851
24.09	2.018	56.51	1.851
24.11	2.018	56.52	1.851
24.12	2.018	56.54	1.851
24.14	2.018	56.56	1.855
24.16	2.018	56.57	1.851
24.17	2.018	56.59	1.855
24.19	2.018	56.6	1.851
24.2	2.018	56.62	1.855
24.22	2.018	56.64	1.855
24.24	2.018	56.66	1.851
24.25	2.018	56.67	1.851
24.27	2.018	56.69	1.851
24.29	2.018	56.7	1.851

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
24.31	2.018	56.72	1.851
24.32	2.018	56.74	1.851
24.34	2.018	56.76	1.855
24.36	2.014	56.77	1.851
24.37	2.014	56.79	1.851
24.39	2.018	56.81	1.851
24.41	2.018	56.82	1.851
24.42	2.014	56.84	1.851
24.44	2.014	56.85	1.851
24.45	2.014	56.87	1.851
24.47	2.014	56.89	1.851
24.49	2.014	56.91	1.851
24.5	2.014	56.92	1.851
24.52	2.018	56.94	1.847
24.54	2.014	56.95	1.851
24.56	2.014	56.97	1.851
24.57	2.014	56.99	1.851
24.59	2.014	57.01	1.851
24.61	2.018	57.02	1.851
24.62	2.014	57.04	1.851
24.64	2.014	57.06	1.851
24.66	2.014	57.07	1.851
24.67	2.014	57.09	1.851
24.69	2.014	57.1	1.851
24.7	2.01	57.12	1.851
24.72	2.014	57.14	1.851
24.74	2.014	57.16	1.847
24.75	2.014	57.17	1.851
24.77	2.014	57.19	1.851
24.79	2.014	57.2	1.851
24.81	2.014	57.22	1.851
24.82	2.01	57.24	1.847
24.84	2.014	57.26	1.851
24.86	2.014	57.27	1.851
24.87	2.014	57.29	1.847
24.89	2.014	57.31	1.847
24.91	2.01	57.32	1.851
24.92	2.014	57.34	1.847
24.94	2.01	57.35	1.847
24.95	2.014	57.37	1.847
24.97	2.014	57.39	1.847
24.99	2.014	57.41	1.851
25.	2.01	57.42	1.851
25.02	2.01	57.44	1.851
25.04	2.01	57.45	1.843
25.06	2.01	57.47	1.847
25.07	2.01	57.49	1.847
25.09	2.01	57.51	1.847
25.11	2.01	57.52	1.847
25.12	2.01	57.54	1.847
25.14	2.01	57.56	1.847
25.16	2.01	57.57	1.847
25.17	2.01	57.59	1.847
25.19	2.006	57.6	1.847
25.2	2.01	57.62	1.847
25.22	2.01	57.64	1.847
25.24	2.01	57.66	1.847
25.25	2.01	57.67	1.847
25.27	2.01	57.69	1.843
25.29	2.01	57.7	1.847
25.31	2.01	57.72	1.847
25.32	2.01	57.74	1.847
25.34	2.01	57.76	1.847

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
25.36	2.01	57.77	1.847
25.37	2.006	57.79	1.847
25.39	2.01	57.81	1.847
25.41	2.01	57.82	1.847
25.42	2.006	57.84	1.847
25.44	2.01	57.85	1.847
25.45	2.01	57.87	1.847
25.47	2.01	57.89	1.847
25.49	2.006	57.91	1.847
25.5	2.006	57.92	1.847
25.52	2.006	57.94	1.847
25.54	2.006	57.95	1.847
25.56	2.006	57.97	1.847
25.57	2.006	57.99	1.847
25.59	2.006	58.01	1.847
25.61	2.006	58.02	1.843
25.62	2.006	58.04	1.847
25.64	2.006	58.06	1.847
25.66	2.006	58.07	1.843
25.67	2.006	58.09	1.843
25.69	2.006	58.1	1.843
25.7	2.006	58.12	1.843
25.72	2.01	58.14	1.847
25.74	2.01	58.16	1.847
25.75	2.006	58.17	1.847
25.77	2.006	58.19	1.847
25.79	2.006	58.2	1.847
25.81	2.006	58.22	1.843
25.82	2.006	58.24	1.847
25.84	2.006	58.26	1.847
25.86	2.006	58.27	1.847
25.87	2.006	58.29	1.847
25.89	2.006	58.31	1.843
25.91	2.006	58.32	1.847
25.92	2.006	58.34	1.847
25.94	2.006	58.35	1.843
25.95	2.006	58.37	1.843
25.97	2.006	58.39	1.843
25.99	2.006	58.41	1.843
26.	2.006	58.42	1.843
26.02	2.006	58.44	1.843
26.04	2.006	58.45	1.843
26.06	2.006	58.47	1.843
26.07	2.006	58.49	1.843
26.09	2.006	58.51	1.843
26.11	2.006	58.52	1.843
26.12	2.006	58.54	1.843
26.14	2.006	58.56	1.843
26.16	2.006	58.57	1.843
26.17	2.002	58.59	1.843
26.19	2.006	58.6	1.843
26.2	2.002	58.62	1.839
26.22	2.002	58.64	1.839
26.24	2.006	58.66	1.843
26.25	2.006	58.67	1.843
26.27	2.006	58.69	1.843
26.29	2.002	58.7	1.843
26.31	2.006	58.72	1.839
26.32	2.006	58.74	1.843
26.34	2.002	58.76	1.843
26.36	2.006	58.77	1.843
26.37	2.006	58.79	1.839
26.39	2.002	58.81	1.843

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
26.41	2.002	58.82	1.839
26.42	2.006	58.84	1.843
26.44	2.006	58.85	1.843
26.45	2.006	58.87	1.843
26.47	2.006	58.89	1.843
26.49	2.002	58.91	1.843
26.5	2.002	58.92	1.843
26.52	2.006	58.94	1.843
26.54	2.002	58.95	1.843
26.56	2.002	58.97	1.843
26.57	2.002	58.99	1.843
26.59	2.002	59.01	1.843
26.61	2.006	59.02	1.843
26.62	2.006	59.04	1.843
26.64	2.002	59.06	1.839
26.66	2.006	59.07	1.839
26.67	2.002	59.09	1.839
26.69	2.002	59.1	1.839
26.7	2.002	59.12	1.839
26.72	2.002	59.14	1.839
26.74	2.002	59.16	1.839
26.75	2.006	59.17	1.839
26.77	2.006	59.19	1.839
26.79	2.006	59.2	1.839
26.81	2.002	59.22	1.839
26.82	2.002	59.24	1.839
26.84	2.002	59.26	1.839
26.86	2.002	59.27	1.839
26.87	2.002	59.29	1.843
26.89	2.002	59.31	1.843
26.91	1.998	59.32	1.839
26.92	2.002	59.34	1.839
26.94	2.002	59.35	1.839
26.95	2.002	59.37	1.839
26.97	2.002	59.39	1.839
26.99	2.002	59.41	1.839
27.	2.002	59.42	1.839
27.02	2.002	59.44	1.839
27.04	2.002	59.45	1.839
27.06	2.002	59.47	1.843
27.07	2.002	59.49	1.843
27.09	2.002	59.51	1.839
27.11	1.998	59.52	1.839
27.12	2.002	59.54	1.839
27.14	2.002	59.56	1.839
27.16	2.002	59.57	1.839
27.17	2.002	59.59	1.839
27.19	2.002	59.6	1.839
27.2	2.002	59.62	1.839
27.22	2.002	59.64	1.839
27.24	1.998	59.66	1.839
27.25	1.998	59.67	1.839
27.27	2.002	59.69	1.839
27.29	1.998	59.7	1.835
27.31	2.002	59.72	1.839
27.32	2.002	59.74	1.839
27.34	1.998	59.76	1.839
27.36	1.998	59.77	1.839
27.37	1.998	59.79	1.839
27.39	1.998	59.81	1.835
27.41	1.998	59.82	1.839
27.42	1.998	59.84	1.835
27.44	1.998	59.85	1.839

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
27.45	1.998	59.87	1.839
27.47	1.998	59.89	1.839
27.49	1.998	59.91	1.835
27.5	1.998	59.92	1.835
27.52	1.998	59.94	1.835
27.54	1.998	59.95	1.835
27.56	1.998	59.97	1.839
27.57	2.002	59.99	1.839
27.59	1.998	60.01	1.835
27.61	1.998	60.02	1.835
27.62	1.998	60.04	1.839
27.64	1.998	60.06	1.839
27.66	1.998	60.07	1.835
27.67	1.998	60.09	1.839
27.69	1.998	60.1	1.835
27.7	1.998	60.12	1.839
27.72	1.998	60.14	1.835
27.74	1.998	60.16	1.839
27.75	1.998	60.17	1.839
27.77	1.994	60.19	1.835
27.79	1.998	60.2	1.835
27.81	1.998	60.22	1.835
27.82	1.998	60.24	1.835
27.84	1.998	60.26	1.835
27.86	1.998	60.27	1.835
27.87	1.998	60.29	1.835
27.89	1.994	60.31	1.835
27.91	1.994	60.32	1.835
27.92	1.998	60.34	1.835
27.94	1.998	60.35	1.835
27.95	1.994	60.37	1.835
27.97	1.994	60.39	1.835
27.99	1.994	60.41	1.835
28.	1.994	60.42	1.839
28.02	1.994	60.44	1.835
28.04	1.994	60.45	1.835
28.06	1.998	60.47	1.835
28.07	1.998	60.49	1.831
28.09	1.994	60.51	1.835
28.11	1.998	60.52	1.835
28.12	1.994	60.54	1.835
28.14	1.994	60.56	1.835
28.16	1.998	60.57	1.835
28.17	1.998	60.59	1.831
28.19	1.994	60.6	1.835
28.2	1.994	60.62	1.831
28.22	1.994	60.64	1.831
28.24	1.994	60.66	1.831
28.25	1.994	60.67	1.831
28.27	1.994	60.69	1.831
28.29	1.994	60.7	1.831
28.31	1.994	60.72	1.831
28.32	1.994	60.74	1.835
28.34	1.99	60.76	1.831
28.36	1.994	60.77	1.831
28.37	1.994	60.79	1.835
28.39	1.99	60.81	1.831
28.41	1.994	60.82	1.835
28.42	1.994	60.84	1.831
28.44	1.994	60.85	1.831
28.45	1.994	60.87	1.831
28.47	1.994	60.89	1.835
28.49	1.994	60.91	1.831

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
28.5	1.994	60.92	1.831
28.52	1.994	60.94	1.831
28.54	1.994	60.95	1.831
28.56	1.99	60.97	1.831
28.57	1.994	60.99	1.831
28.59	1.994	61.01	1.831
28.61	1.994	61.02	1.831
28.62	1.994	61.04	1.831
28.64	1.994	61.06	1.831
28.66	1.99	61.07	1.831
28.67	1.994	61.09	1.831
28.69	1.99	61.1	1.831
28.7	1.99	61.12	1.831
28.72	1.99	61.14	1.835
28.74	1.99	61.16	1.831
28.75	1.99	61.17	1.831
28.77	1.99	61.19	1.831
28.79	1.99	61.2	1.831
28.81	1.99	61.22	1.831
28.82	1.99	61.24	1.831
28.84	1.99	61.26	1.831
28.86	1.99	61.27	1.831
28.87	1.99	61.29	1.831
28.89	1.99	61.31	1.828
28.91	1.99	61.32	1.831
28.92	1.99	61.34	1.831
28.94	1.99	61.35	1.831
28.95	1.99	61.37	1.831
28.97	1.99	61.39	1.831
28.99	1.99	61.41	1.828
29.	1.99	61.42	1.831
29.02	1.99	61.44	1.831
29.04	1.99	61.45	1.828
29.06	1.99	61.47	1.831
29.07	1.99	61.49	1.828
29.09	1.987	61.51	1.831
29.11	1.99	61.52	1.831
29.12	1.987	61.54	1.828
29.14	1.99	61.56	1.831
29.16	1.99	61.57	1.828
29.17	1.99	61.59	1.831
29.19	1.99	61.6	1.831
29.2	1.99	61.62	1.831
29.22	1.99	61.64	1.831
29.24	1.99	61.66	1.831
29.25	1.99	61.67	1.828
29.27	1.99	61.69	1.828
29.29	1.99	61.7	1.831
29.31	1.99	61.72	1.828
29.32	1.987	61.74	1.828
29.34	1.99	61.76	1.828
29.36	1.99	61.77	1.828
29.37	1.987	61.79	1.828
29.39	1.987	61.81	1.828
29.41	1.99	61.82	1.831
29.42	1.987	61.84	1.831
29.44	1.987	61.85	1.828
29.45	1.987	61.87	1.828
29.47	1.987	61.89	1.828
29.49	1.99	61.91	1.828
29.5	1.987	61.92	1.828
29.52	1.987	61.94	1.831
29.54	1.99	61.95	1.831

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
29.56	1.99	61.97	1.828
29.57	1.987	61.99	1.828
29.59	1.987	62.01	1.828
29.61	1.987	62.02	1.828
29.62	1.987	62.04	1.828
29.64	1.987	62.06	1.828
29.66	1.987	62.07	1.828
29.67	1.987	62.09	1.828
29.69	1.987	62.1	1.824
29.7	1.987	62.12	1.828
29.72	1.987	62.14	1.828
29.74	1.987	62.16	1.828
29.75	1.987	62.17	1.828
29.77	1.983	62.19	1.828
29.79	1.987	62.2	1.828
29.81	1.987	62.22	1.828
29.82	1.987	62.24	1.828
29.84	1.987	62.26	1.828
29.86	1.987	62.27	1.828
29.87	1.987	62.29	1.828
29.89	1.987	62.31	1.828
29.91	1.987	62.32	1.828
29.92	1.987	62.34	1.828
29.94	1.983	62.35	1.824
29.95	1.983	62.37	1.828
29.97	1.983	62.39	1.828
29.99	1.983	62.41	1.824
30.	1.983	62.42	1.828
30.02	1.987	62.44	1.824
30.04	1.987	62.45	1.828
30.06	1.987	62.47	1.828
30.07	1.987	62.49	1.828
30.09	1.983	62.51	1.824
30.11	1.983	62.52	1.828
30.12	1.987	62.54	1.824
30.14	1.983	62.56	1.824
30.16	1.983	62.57	1.824
30.17	1.983	62.59	1.824
30.19	1.983	62.6	1.828
30.2	1.987	62.62	1.824
30.22	1.987	62.64	1.824
30.24	1.983	62.66	1.828
30.25	1.983	62.67	1.828
30.27	1.983	62.69	1.828
30.29	1.983	62.7	1.824
30.31	1.983	62.72	1.824
30.32	1.983	62.74	1.824
30.34	1.983	62.76	1.824
30.36	1.983	62.77	1.824
30.37	1.983	62.79	1.824
30.39	1.983	62.81	1.824
30.41	1.983	62.82	1.824
30.42	1.983	62.84	1.824
30.44	1.983	62.85	1.824
30.45	1.983	62.87	1.824
30.47	1.979	62.89	1.824
30.49	1.979	62.91	1.824
30.5	1.983	62.92	1.824
30.52	1.979	62.94	1.824
30.54	1.983	62.95	1.824
30.56	1.979	62.97	1.82
30.57	1.979	62.99	1.824
30.59	1.983	63.01	1.824

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
30.61	1.983	63.02	1.824
30.62	1.979	63.04	1.824
30.64	1.983	63.06	1.82
30.66	1.979	63.07	1.824
30.67	1.979	63.09	1.824
30.69	1.983	63.1	1.824
30.7	1.979	63.12	1.82
30.72	1.979	63.14	1.824
30.74	1.979	63.16	1.82
30.75	1.983	63.17	1.824
30.77	1.983	63.19	1.824
30.79	1.979	63.2	1.824
30.81	1.979	63.22	1.824
30.82	1.979	63.24	1.824
30.84	1.979	63.26	1.82
30.86	1.979	63.27	1.824
30.87	1.979	63.29	1.82
30.89	1.979	63.31	1.824
30.91	1.975	63.32	1.824
30.92	1.979	63.34	1.82
30.94	1.979	63.35	1.82
30.95	1.979	63.37	1.824
30.97	1.979	63.39	1.824
30.99	1.979	63.41	1.82
31.	1.979	63.42	1.82
31.02	1.979	63.44	1.824
31.04	1.979	63.45	1.824
31.06	1.979	63.47	1.824
31.07	1.979	63.49	1.824
31.09	1.979	63.51	1.824
31.11	1.979	63.52	1.824
31.12	1.979	63.54	1.82
31.14	1.975	63.56	1.82
31.16	1.979	63.57	1.82
31.17	1.975	63.59	1.82
31.19	1.975	63.6	1.824
31.2	1.979	63.62	1.82
31.22	1.975	63.64	1.82
31.24	1.975	63.66	1.82
31.25	1.979	63.67	1.82
31.27	1.979	63.69	1.82
31.29	1.979	63.7	1.82
31.31	1.979	63.72	1.82
31.32	1.975	63.74	1.82
31.34	1.979	63.76	1.82
31.36	1.979	63.77	1.82
31.37	1.975	63.79	1.824
31.39	1.975	63.81	1.82
31.41	1.975	63.82	1.82
31.42	1.979	63.84	1.82
31.44	1.975	63.85	1.82
31.45	1.975	63.87	1.82
31.47	1.975	63.89	1.82
31.49	1.979	63.91	1.82
31.5	1.979	63.92	1.82
31.52	1.975	63.94	1.82
31.54	1.975	63.95	1.82
31.56	1.975	63.97	1.82
31.57	1.975	63.99	1.816
31.59	1.975	64.	1.82
31.61	1.975	64.02	1.82
31.62	1.975	64.04	1.82
31.64	1.979	64.06	1.82

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
31.66	1.975	64.07	1.82
31.67	1.975	64.09	1.82
31.69	1.975	64.11	1.816
31.7	1.975	64.12	1.816
31.72	1.975	64.14	1.82
31.74	1.975	64.16	1.816
31.75	1.975	64.17	1.82
31.77	1.975	64.19	1.816
31.79	1.975	64.2	1.816
31.81	1.971	64.22	1.82
31.82	1.975	64.24	1.82
31.84	1.971	64.25	1.816
31.86	1.975	64.27	1.816
31.87	1.975	64.29	1.816
31.89	1.975	64.31	1.816
31.91	1.975	64.32	1.816
31.92	1.975	64.34	1.816
31.94	1.975	64.36	1.82
31.95	1.975	64.37	1.816
31.97	1.971	64.39	1.816
31.99	1.975	64.41	1.816
32.01	1.971	64.42	1.816
32.02	1.975	64.44	1.816
32.04	1.975	64.45	1.816
32.06	1.975	64.47	1.816
32.07	1.975	64.49	1.816
32.09	1.975	64.5	1.816
32.1	1.971		

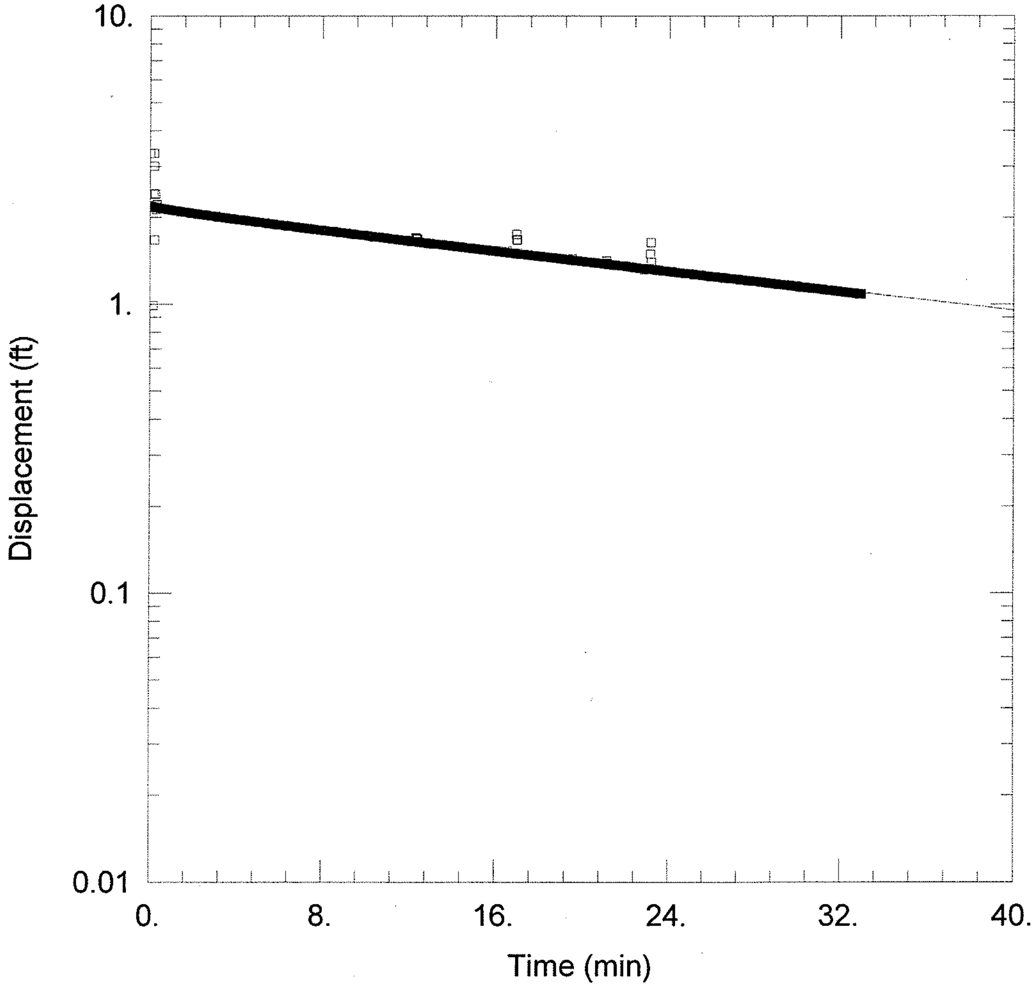
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.382

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.468E-06	ft/min
y0	2.208	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw03f.aqt
Date: 07/15/08 Time: 11:14:24

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW03f

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW03F)

Initial Displacement: 3.331 ft
Total Well Penetration Depth: 14.64 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.64 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.698E-05 ft/min y0 = 2.133 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:37:10

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW03f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW03F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.331 ft
Static Water Column Height: 14.64 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 14.64 ft

No. of Observations: 1999

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.008	16.37	1.516
0.022	2.179	16.39	1.516
0.033	-0.004	16.41	1.513
0.039	2.187	16.42	1.513
0.05	-0.008	16.44	1.513
0.055	2.195	16.45	1.516
0.067	-0.008	16.47	1.513
0.072	2.187	16.49	1.513
0.083	-0.008	16.5	1.509
0.089	2.183	16.52	1.513
0.1	-0.004	16.54	1.509
0.105	2.183	16.56	1.528
0.117	-0.008	16.57	1.513
0.122	2.183	16.59	1.509
0.133	0.	16.61	1.509
0.139	2.179	16.62	1.509
0.15	0.989	16.64	1.509
0.155	2.179	16.66	1.509
0.167	2.408	16.67	1.509
0.172	2.179	16.69	1.505
0.183	3.331	16.7	1.505
0.189	2.179	16.72	1.501
0.2	3.009	16.74	1.505
0.205	2.176	16.75	1.501
0.217	1.671	16.77	1.505
0.222	2.172	16.79	1.505
0.233	2.168	16.81	1.501
0.239	2.172	16.82	1.501

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	2.416	16.84	1.501
0.255	2.172	16.86	1.501
0.267	2.175	16.87	1.501
0.272	2.172	16.89	1.501
0.283	2.129	16.91	1.497
0.289	2.172	16.92	1.497
0.3	2.222	16.94	1.497
0.305	2.168	16.95	1.497
0.317	2.214	16.97	1.493
0.322	2.168	16.99	1.745
0.339	2.164	17.	1.675
0.355	2.164	17.02	1.672
0.372	2.16	17.04	1.505
0.389	2.16	17.06	1.493
0.405	2.16	17.07	1.493
0.422	2.16	17.09	1.493
0.439	2.16	17.11	1.493
0.455	2.156	17.12	1.489
0.472	2.152	17.14	1.489
0.489	2.152	17.16	1.493
0.505	2.152	17.17	1.493
0.522	2.152	17.19	1.489
0.539	2.148	17.2	1.489
0.555	2.148	17.22	1.489
0.572	2.148	17.24	1.489
0.589	2.148	17.25	1.489
0.605	2.148	17.27	1.489
0.622	2.145	17.29	1.489
0.639	2.141	17.31	1.485
0.655	2.145	17.32	1.489
0.672	2.145	17.34	1.485
0.689	2.141	17.36	1.485
0.705	2.141	17.37	1.485
0.722	2.141	17.39	1.485
0.739	2.141	17.41	1.485
0.755	2.137	17.42	1.485
0.772	2.137	17.44	1.485
0.789	2.137	17.45	1.481
0.805	2.133	17.47	1.481
0.822	2.133	17.49	1.481
0.839	2.133	17.5	1.481
0.855	2.129	17.52	1.482
0.872	2.129	17.54	1.482
0.889	2.129	17.56	1.481
0.905	2.129	17.57	1.478
0.922	2.125	17.59	1.478
0.939	2.125	17.61	1.478
0.955	2.125	17.62	1.478
0.972	2.125	17.64	1.478
0.989	2.125	17.66	1.478
1.005	2.121	17.67	1.478
1.022	2.121	17.69	1.478
1.039	2.121	17.7	1.474
1.055	2.121	17.72	1.474
1.072	2.118	17.74	1.474
1.089	2.118	17.75	1.474
1.105	2.118	17.77	1.474
1.122	2.114	17.79	1.474
1.139	2.118	17.81	1.474
1.155	2.114	17.82	1.474
1.172	2.114	17.84	1.47
1.189	2.114	17.86	1.47
1.205	2.11	17.87	1.47

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	2.11	17.89	1.47
1.239	2.11	17.91	1.47
1.255	2.11	17.92	1.47
1.272	2.106	17.94	1.466
1.289	2.102	17.95	1.47
1.305	2.106	17.97	1.466
1.322	2.106	17.99	1.466
1.339	2.102	18.	1.466
1.355	2.102	18.02	1.466
1.372	2.102	18.04	1.462
1.389	2.102	18.06	1.462
1.405	2.102	18.07	1.466
1.422	2.094	18.09	1.466
1.439	2.098	18.11	1.466
1.455	2.094	18.12	1.462
1.472	2.098	18.14	1.462
1.489	2.094	18.16	1.462
1.505	2.094	18.17	1.462
1.522	2.094	18.19	1.462
1.539	2.094	18.2	1.458
1.555	2.09	18.22	1.462
1.572	2.09	18.24	1.458
1.589	2.09	18.25	1.458
1.605	2.087	18.27	1.458
1.622	2.087	18.29	1.458
1.639	2.087	18.31	1.458
1.655	2.083	18.32	1.458
1.672	2.087	18.34	1.454
1.689	2.083	18.36	1.454
1.705	2.083	18.37	1.454
1.722	2.083	18.39	1.454
1.739	2.079	18.41	1.454
1.755	2.079	18.42	1.454
1.772	2.079	18.44	1.454
1.789	2.079	18.45	1.454
1.805	2.079	18.47	1.454
1.822	2.079	18.49	1.45
1.839	2.075	18.5	1.45
1.855	2.075	18.52	1.45
1.872	2.075	18.54	1.45
1.889	2.075	18.56	1.45
1.905	2.071	18.57	1.45
1.922	2.071	18.59	1.45
1.939	2.071	18.61	1.447
1.955	2.071	18.62	1.447
1.972	2.067	18.64	1.45
1.989	2.067	18.66	1.45
2.005	2.067	18.67	1.447
2.022	2.063	18.69	1.447
2.039	2.063	18.7	1.447
2.055	2.063	18.72	1.447
2.072	2.063	18.74	1.443
2.089	2.063	18.75	1.443
2.105	2.063	18.77	1.443
2.122	2.059	18.79	1.443
2.139	2.059	18.81	1.443
2.155	2.059	18.82	1.443
2.172	2.059	18.84	1.439
2.189	2.056	18.86	1.443
2.205	2.056	18.87	1.443
2.222	2.056	18.89	1.439
2.239	2.056	18.91	1.439
2.255	2.056	18.92	1.439

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.272	2.052	18.94	1.439
2.289	2.052	18.95	1.439
2.305	2.052	18.97	1.435
2.322	2.052	18.99	1.435
2.339	2.052	19.	1.439
2.355	2.052	19.02	1.435
2.372	2.048	19.04	1.435
2.389	2.048	19.06	1.435
2.405	2.048	19.07	1.435
2.422	2.044	19.09	1.431
2.439	2.048	19.11	1.435
2.455	2.044	19.12	1.431
2.472	2.044	19.14	1.431
2.489	2.044	19.16	1.431
2.505	2.044	19.17	1.431
2.522	2.04	19.19	1.431
2.539	2.04	19.2	1.427
2.555	2.04	19.22	1.427
2.572	2.04	19.24	1.431
2.589	2.04	19.25	1.427
2.605	2.04	19.27	1.427
2.622	2.036	19.29	1.431
2.639	2.036	19.31	1.431
2.655	2.036	19.32	1.427
2.672	2.036	19.34	1.427
2.689	2.032	19.36	1.427
2.705	2.032	19.37	1.427
2.722	2.032	19.39	1.427
2.739	2.032	19.41	1.423
2.755	2.028	19.42	1.427
2.772	2.028	19.44	1.423
2.789	2.028	19.45	1.423
2.805	2.028	19.47	1.423
2.822	2.028	19.49	1.423
2.839	2.025	19.5	1.419
2.855	2.025	19.52	1.435
2.872	2.025	19.54	1.423
2.889	2.025	19.56	1.419
2.905	2.025	19.57	1.419
2.922	2.021	19.59	1.419
2.939	2.021	19.61	1.419
2.955	2.021	19.62	1.419
2.972	2.021	19.64	1.419
2.989	2.021	19.66	1.416
3.005	2.017	19.67	1.416
3.022	2.021	19.69	1.416
3.039	2.021	19.7	1.416
3.055	2.017	19.72	1.416
3.072	2.013	19.74	1.416
3.089	2.013	19.75	1.416
3.105	2.013	19.77	1.416
3.122	2.009	19.79	1.416
3.139	2.013	19.81	1.416
3.155	2.009	19.82	1.412
3.172	2.009	19.84	1.412
3.189	2.009	19.86	1.412
3.205	2.009	19.87	1.412
3.222	2.009	19.89	1.412
3.239	2.005	19.91	1.412
3.255	2.005	19.92	1.412
3.272	2.005	19.94	1.408
3.289	2.005	19.95	1.408
3.305	2.001	19.97	1.408

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.322	2.005	19.99	1.408
3.339	2.001	20.	1.408
3.355	2.001	20.02	1.408
3.372	2.001	20.04	1.408
3.389	1.997	20.06	1.408
3.405	1.997	20.07	1.404
3.422	1.997	20.09	1.404
3.439	1.997	20.11	1.404
3.455	1.997	20.12	1.404
3.472	1.997	20.14	1.404
3.489	1.994	20.16	1.404
3.505	1.994	20.17	1.404
3.522	1.994	20.19	1.4
3.539	1.994	20.2	1.404
3.555	1.994	20.22	1.4
3.572	1.994	20.24	1.4
3.589	1.99	20.25	1.4
3.605	1.99	20.27	1.4
3.622	1.99	20.29	1.4
3.639	1.99	20.31	1.4
3.655	1.99	20.32	1.4
3.672	1.986	20.34	1.4
3.689	1.986	20.36	1.396
3.705	1.986	20.37	1.4
3.722	1.982	20.39	1.396
3.739	1.986	20.41	1.396
3.755	1.986	20.42	1.396
3.772	1.982	20.44	1.396
3.789	1.982	20.45	1.396
3.805	1.982	20.47	1.396
3.822	1.978	20.49	1.396
3.839	1.982	20.5	1.392
3.855	1.978	20.52	1.392
3.872	1.978	20.54	1.388
3.889	1.978	20.56	1.392
3.905	1.974	20.57	1.392
3.922	1.974	20.59	1.392
3.939	1.974	20.61	1.392
3.955	1.974	20.62	1.388
3.972	1.974	20.64	1.388
3.989	1.97	20.66	1.388
4.005	1.97	20.67	1.388
4.022	1.97	20.69	1.388
4.039	1.97	20.7	1.385
4.055	1.966	20.72	1.388
4.072	1.966	20.74	1.385
4.089	1.966	20.75	1.385
4.105	1.966	20.77	1.385
4.122	1.966	20.79	1.385
4.139	1.963	20.81	1.385
4.155	1.966	20.82	1.385
4.172	1.963	20.84	1.381
4.189	1.966	20.86	1.385
4.205	1.963	20.87	1.381
4.222	1.963	20.89	1.381
4.239	1.963	20.91	1.381
4.255	1.963	20.92	1.381
4.272	1.959	20.94	1.381
4.289	1.959	20.95	1.377
4.305	1.955	20.97	1.381
4.322	1.959	20.99	1.381
4.339	1.955	21.	1.381
4.355	1.955	21.02	1.377

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
4.372	1.955	21.04	1.377
4.389	1.955	21.06	1.377
4.405	1.951	21.07	1.377
4.422	1.951	21.09	1.381
4.439	1.951	21.11	1.377
4.455	1.951	21.12	1.412
4.472	1.951	21.14	1.385
4.489	1.951	21.16	1.377
4.505	1.951	21.17	1.373
4.522	1.947	21.19	1.373
4.539	1.947	21.2	1.373
4.555	1.947	21.22	1.377
4.572	1.947	21.24	1.373
4.589	1.947	21.25	1.369
4.605	1.947	21.27	1.373
4.622	1.943	21.29	1.369
4.639	1.943	21.31	1.373
4.655	1.943	21.32	1.369
4.672	1.943	21.34	1.369
4.689	1.943	21.36	1.373
4.705	1.943	21.37	1.369
4.722	1.943	21.39	1.369
4.739	1.939	21.41	1.365
4.755	1.939	21.42	1.369
4.772	1.939	21.44	1.365
4.789	1.939	21.45	1.369
4.805	1.935	21.47	1.369
4.822	1.935	21.49	1.365
4.839	1.935	21.5	1.365
4.855	1.935	21.52	1.365
4.872	1.931	21.54	1.365
4.889	1.931	21.56	1.365
4.905	1.932	21.57	1.365
4.922	1.932	21.59	1.361
4.939	1.932	21.61	1.361
4.955	1.932	21.62	1.361
4.972	1.928	21.64	1.361
4.989	1.928	21.66	1.361
5.005	1.928	21.67	1.361
5.022	1.928	21.69	1.361
5.039	1.928	21.7	1.361
5.055	1.924	21.72	1.361
5.072	1.924	21.74	1.361
5.089	1.924	21.75	1.361
5.105	1.924	21.77	1.357
5.122	1.92	21.79	1.357
5.139	1.92	21.81	1.357
5.155	1.92	21.82	1.357
5.172	1.92	21.84	1.357
5.189	1.92	21.86	1.357
5.205	1.916	21.87	1.353
5.222	1.92	21.89	1.353
5.239	1.92	21.91	1.353
5.255	1.916	21.92	1.353
5.272	1.916	21.94	1.353
5.289	1.916	21.95	1.357
5.305	1.916	21.97	1.353
5.322	1.916	21.99	1.353
5.339	1.912	22.	1.353
5.355	1.912	22.02	1.35
5.372	1.912	22.04	1.35
5.389	1.912	22.06	1.35
5.405	1.908	22.07	1.35

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
5.422	1.912	22.09	1.35
5.439	1.912	22.11	1.35
5.455	1.908	22.12	1.35
5.472	1.908	22.14	1.35
5.489	1.908	22.16	1.346
5.505	1.908	22.17	1.346
5.522	1.904	22.19	1.35
5.539	1.904	22.2	1.35
5.555	1.904	22.22	1.346
5.572	1.904	22.24	1.346
5.589	1.901	22.25	1.346
5.605	1.904	22.27	1.346
5.622	1.904	22.29	1.346
5.639	1.901	22.31	1.342
5.655	1.901	22.32	1.342
5.672	1.9	22.34	1.342
5.689	1.897	22.36	1.342
5.705	1.897	22.37	1.342
5.722	1.897	22.39	1.338
5.739	1.893	22.41	1.338
5.755	1.893	22.42	1.342
5.772	1.893	22.44	1.338
5.789	1.893	22.45	1.338
5.805	1.893	22.47	1.338
5.822	1.893	22.49	1.338
5.839	1.889	22.5	1.338
5.855	1.893	22.52	1.338
5.872	1.889	22.54	1.338
5.889	1.889	22.56	1.334
5.905	1.889	22.57	1.334
5.922	1.885	22.59	1.334
5.939	1.889	22.61	1.334
5.955	1.885	22.62	1.334
5.972	1.885	22.64	1.33
5.989	1.885	22.66	1.334
6.005	1.885	22.67	1.334
6.022	1.881	22.69	1.334
6.039	1.881	22.7	1.334
6.055	1.885	22.72	1.334
6.072	1.885	22.74	1.334
6.089	1.881	22.75	1.334
6.105	1.881	22.77	1.334
6.122	1.881	22.79	1.33
6.139	1.881	22.81	1.33
6.155	1.877	22.82	1.33
6.172	1.877	22.84	1.33
6.189	1.877	22.86	1.315
6.205	1.877	22.87	1.33
6.222	1.877	22.89	1.326
6.239	1.877	22.91	1.326
6.255	1.873	22.92	1.326
6.272	1.873	22.94	1.326
6.289	1.873	22.95	1.326
6.305	1.873	22.97	1.326
6.322	1.869	22.99	1.326
6.339	1.869	23.	1.322
6.355	1.869	23.02	1.322
6.372	1.873	23.04	1.322
6.389	1.869	23.06	1.322
6.405	1.866	23.07	1.322
6.422	1.869	23.09	1.319
6.439	1.866	23.11	1.322
6.455	1.866	23.12	1.322

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
6.472	1.866	23.14	1.319
6.489	1.862	23.16	1.493
6.505	1.862	23.17	1.637
6.522	1.862	23.19	1.396
6.539	1.862	23.2	1.33
6.555	1.862	23.22	1.319
6.572	1.862	23.24	1.319
6.589	1.862	23.25	1.319
6.605	1.862	23.27	1.319
6.622	1.862	23.29	1.319
6.639	1.858	23.31	1.315
6.655	1.862	23.32	1.315
6.672	1.858	23.34	1.319
6.689	1.858	23.36	1.315
6.705	1.858	23.37	1.315
6.722	1.858	23.39	1.315
6.739	1.858	23.41	1.315
6.755	1.854	23.42	1.315
6.772	1.854	23.44	1.311
6.789	1.854	23.45	1.311
6.805	1.854	23.47	1.315
6.822	1.85	23.49	1.315
6.839	1.85	23.5	1.311
6.855	1.85	23.52	1.311
6.872	1.85	23.54	1.307
6.889	1.85	23.56	1.311
6.905	1.85	23.57	1.311
6.922	1.846	23.59	1.311
6.939	1.846	23.61	1.307
6.955	1.846	23.62	1.311
6.972	1.846	23.64	1.307
6.989	1.842	23.66	1.307
7.005	1.846	23.67	1.307
7.022	1.846	23.69	1.307
7.039	1.842	23.7	1.303
7.055	1.842	23.72	1.307
7.072	1.842	23.74	1.307
7.089	1.842	23.75	1.307
7.105	1.842	23.77	1.307
7.122	1.838	23.79	1.303
7.139	1.842	23.81	1.303
7.155	1.838	23.82	1.303
7.172	1.838	23.84	1.303
7.189	1.838	23.86	1.303
7.205	1.838	23.87	1.299
7.222	1.834	23.89	1.299
7.239	1.838	23.91	1.299
7.255	1.834	23.92	1.299
7.272	1.835	23.94	1.299
7.289	1.834	23.95	1.299
7.305	1.831	23.97	1.299
7.322	1.835	23.99	1.299
7.339	1.831	24.	1.299
7.355	1.834	24.02	1.299
7.372	1.827	24.04	1.295
7.389	1.831	24.06	1.299
7.405	1.827	24.07	1.295
7.422	1.827	24.09	1.299
7.439	1.827	24.11	1.295
7.455	1.827	24.12	1.295
7.472	1.823	24.14	1.295
7.489	1.823	24.16	1.295
7.505	1.827	24.17	1.295

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
7.522	1.823	24.19	1.295
7.539	1.823	24.2	1.291
7.555	1.823	24.22	1.291
7.572	1.823	24.24	1.291
7.589	1.819	24.25	1.291
7.605	1.823	24.27	1.291
7.622	1.819	24.29	1.291
7.639	1.819	24.31	1.291
7.655	1.819	24.32	1.291
7.672	1.819	24.34	1.291
7.689	1.815	24.36	1.288
7.705	1.819	24.37	1.288
7.722	1.815	24.39	1.288
7.739	1.815	24.41	1.288
7.755	1.811	24.42	1.288
7.772	1.811	24.44	1.284
7.789	1.815	24.45	1.284
7.805	1.811	24.47	1.288
7.822	1.811	24.49	1.288
7.839	1.811	24.5	1.288
7.855	1.811	24.52	1.284
7.872	1.811	24.54	1.284
7.889	1.811	24.56	1.284
7.905	1.811	24.57	1.284
7.922	1.811	24.59	1.284
7.939	1.807	24.61	1.284
7.955	1.807	24.62	1.284
7.972	1.807	24.64	1.284
7.989	1.804	24.66	1.28
8.005	1.804	24.67	1.284
8.022	1.803	24.69	1.28
8.039	1.804	24.7	1.28
8.055	1.803	24.72	1.28
8.072	1.804	24.74	1.28
8.089	1.803	24.75	1.28
8.105	1.8	24.77	1.276
8.122	1.8	24.79	1.276
8.139	1.8	24.81	1.276
8.155	1.8	24.82	1.276
8.172	1.8	24.84	1.276
8.189	1.796	24.86	1.276
8.205	1.796	24.87	1.276
8.222	1.796	24.89	1.276
8.239	1.796	24.91	1.276
8.255	1.796	24.92	1.272
8.272	1.796	24.94	1.276
8.289	1.796	24.95	1.276
8.305	1.796	24.97	1.276
8.322	1.792	24.99	1.272
8.339	1.792	25.	1.272
8.355	1.792	25.02	1.272
8.372	1.792	25.04	1.272
8.389	1.788	25.06	1.272
8.405	1.788	25.07	1.272
8.422	1.792	25.09	1.272
8.439	1.788	25.11	1.272
8.455	1.788	25.12	1.272
8.472	1.788	25.14	1.272
8.489	1.788	25.16	1.268
8.505	1.788	25.17	1.268
8.522	1.784	25.19	1.268
8.539	1.784	25.2	1.264
8.555	1.784	25.22	1.264

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
8.572	1.784	25.24	1.264
8.589	1.784	25.25	1.264
8.605	1.784	25.27	1.264
8.622	1.78	25.29	1.264
8.639	1.78	25.31	1.264
8.655	1.784	25.32	1.264
8.672	1.78	25.34	1.264
8.689	1.776	25.36	1.264
8.705	1.78	25.37	1.264
8.722	1.776	25.39	1.264
8.739	1.776	25.41	1.264
8.755	1.776	25.42	1.264
8.772	1.776	25.44	1.26
8.789	1.776	25.45	1.264
8.805	1.776	25.47	1.26
8.822	1.776	25.49	1.26
8.839	1.776	25.5	1.26
8.855	1.772	25.52	1.26
8.872	1.769	25.54	1.26
8.889	1.769	25.56	1.257
8.905	1.769	25.57	1.257
8.922	1.772	25.59	1.257
8.939	1.769	25.61	1.257
8.955	1.769	25.62	1.257
8.972	1.765	25.64	1.257
8.989	1.769	25.66	1.257
9.005	1.769	25.67	1.257
9.022	1.769	25.69	1.253
9.039	1.765	25.7	1.253
9.055	1.765	25.72	1.253
9.072	1.769	25.74	1.253
9.089	1.769	25.75	1.253
9.105	1.765	25.77	1.253
9.122	1.761	25.79	1.253
9.139	1.761	25.81	1.253
9.155	1.761	25.82	1.249
9.172	1.761	25.84	1.253
9.189	1.761	25.86	1.249
9.205	1.761	25.87	1.249
9.222	1.761	25.89	1.249
9.239	1.757	25.91	1.249
9.255	1.757	25.92	1.245
9.272	1.757	25.94	1.249
9.289	1.757	25.95	1.249
9.305	1.757	25.97	1.249
9.322	1.757	25.99	1.249
9.339	1.753	26.	1.249
9.355	1.753	26.02	1.249
9.372	1.753	26.04	1.249
9.389	1.753	26.06	1.245
9.405	1.749	26.07	1.245
9.422	1.753	26.09	1.245
9.439	1.749	26.11	1.245
9.455	1.745	26.12	1.245
9.472	1.749	26.14	1.245
9.489	1.749	26.16	1.245
9.505	1.749	26.17	1.245
9.522	1.745	26.19	1.245
9.539	1.745	26.2	1.245
9.555	1.745	26.22	1.241
9.572	1.745	26.24	1.241
9.589	1.745	26.25	1.241
9.605	1.745	26.27	1.241

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
9.622	1.745	26.29	1.237
9.639	1.745	26.31	1.241
9.655	1.745	26.32	1.241
9.672	1.741	26.34	1.237
9.689	1.741	26.36	1.237
9.705	1.738	26.37	1.237
9.722	1.741	26.39	1.237
9.739	1.738	26.41	1.237
9.755	1.741	26.42	1.237
9.772	1.738	26.44	1.237
9.789	1.738	26.45	1.237
9.805	1.738	26.47	1.237
9.822	1.738	26.49	1.233
9.839	1.738	26.5	1.233
9.855	1.738	26.52	1.233
9.872	1.738	26.54	1.233
9.889	1.734	26.56	1.237
9.905	1.734	26.57	1.233
9.922	1.734	26.59	1.233
9.939	1.734	26.61	1.233
9.955	1.73	26.62	1.229
9.972	1.734	26.64	1.233
9.989	1.73	26.66	1.229
10.01	1.73	26.67	1.233
10.02	1.73	26.69	1.229
10.04	1.73	26.7	1.229
10.06	1.73	26.72	1.229
10.07	1.73	26.74	1.229
10.09	1.73	26.75	1.229
10.11	1.726	26.77	1.229
10.12	1.726	26.79	1.229
10.14	1.726	26.81	1.226
10.15	1.726	26.82	1.226
10.17	1.722	26.84	1.226
10.19	1.722	26.86	1.226
10.21	1.722	26.87	1.226
10.22	1.722	26.89	1.226
10.24	1.722	26.91	1.226
10.26	1.722	26.92	1.222
10.27	1.722	26.94	1.226
10.29	1.718	26.95	1.226
10.31	1.718	26.97	1.226
10.32	1.718	26.99	1.222
10.34	1.718	27.	1.222
10.36	1.718	27.02	1.222
10.37	1.714	27.04	1.222
10.39	1.71	27.06	1.222
10.4	1.714	27.07	1.222
10.42	1.714	27.09	1.222
10.44	1.71	27.11	1.222
10.46	1.714	27.12	1.222
10.47	1.71	27.14	1.218
10.49	1.71	27.16	1.218
10.51	1.714	27.17	1.222
10.52	1.71	27.19	1.218
10.54	1.71	27.2	1.218
10.56	1.71	27.22	1.218
10.57	1.707	27.24	1.218
10.59	1.707	27.25	1.218
10.61	1.707	27.27	1.218
10.62	1.71	27.29	1.214
10.64	1.707	27.31	1.214
10.65	1.707	27.32	1.214

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
10.67	1.707	27.34	1.214
10.69	1.707	27.36	1.214
10.71	1.707	27.37	1.214
10.72	1.703	27.39	1.214
10.74	1.703	27.41	1.214
10.76	1.703	27.42	1.214
10.77	1.703	27.44	1.214
10.79	1.703	27.45	1.21
10.81	1.703	27.47	1.21
10.82	1.703	27.49	1.21
10.84	1.699	27.5	1.21
10.86	1.699	27.52	1.21
10.87	1.695	27.54	1.21
10.89	1.695	27.56	1.21
10.9	1.695	27.57	1.21
10.92	1.699	27.59	1.21
10.94	1.699	27.61	1.21
10.96	1.695	27.62	1.206
10.97	1.695	27.64	1.206
10.99	1.695	27.66	1.206
11.01	1.691	27.67	1.206
11.02	1.691	27.69	1.206
11.04	1.691	27.7	1.202
11.06	1.691	27.72	1.202
11.07	1.691	27.74	1.206
11.09	1.691	27.75	1.206
11.11	1.687	27.77	1.206
11.12	1.691	27.79	1.206
11.14	1.687	27.81	1.202
11.15	1.687	27.82	1.202
11.17	1.687	27.84	1.202
11.19	1.687	27.86	1.202
11.21	1.687	27.87	1.202
11.22	1.687	27.89	1.202
11.24	1.683	27.91	1.202
11.26	1.683	27.92	1.198
11.27	1.687	27.94	1.198
11.29	1.683	27.95	1.202
11.31	1.683	27.97	1.202
11.32	1.683	27.99	1.198
11.34	1.683	28.	1.198
11.36	1.679	28.02	1.198
11.37	1.683	28.04	1.198
11.39	1.679	28.06	1.198
11.4	1.679	28.07	1.198
11.42	1.679	28.09	1.198
11.44	1.679	28.11	1.194
11.46	1.675	28.12	1.198
11.47	1.675	28.14	1.194
11.49	1.675	28.16	1.194
11.51	1.675	28.17	1.194
11.52	1.675	28.19	1.194
11.54	1.675	28.2	1.194
11.56	1.675	28.22	1.194
11.57	1.672	28.24	1.194
11.59	1.675	28.25	1.191
11.61	1.672	28.27	1.191
11.62	1.672	28.29	1.191
11.64	1.672	28.31	1.191
11.65	1.672	28.32	1.191
11.67	1.672	28.34	1.191
11.69	1.672	28.36	1.187
11.71	1.668	28.37	1.191

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
11.72	1.668	28.39	1.191
11.74	1.668	28.41	1.187
11.76	1.668	28.42	1.187
11.77	1.668	28.44	1.187
11.79	1.668	28.45	1.187
11.81	1.664	28.47	1.187
11.82	1.664	28.49	1.187
11.84	1.664	28.5	1.183
11.86	1.664	28.52	1.183
11.87	1.664	28.54	1.183
11.89	1.664	28.56	1.187
11.9	1.664	28.57	1.183
11.92	1.664	28.59	1.183
11.94	1.656	28.61	1.183
11.96	1.66	28.62	1.183
11.97	1.66	28.64	1.183
11.99	1.66	28.66	1.183
12.01	1.656	28.67	1.179
12.02	1.656	28.69	1.183
12.04	1.656	28.7	1.179
12.06	1.656	28.72	1.183
12.07	1.656	28.74	1.183
12.09	1.656	28.75	1.179
12.11	1.656	28.77	1.179
12.12	1.652	28.79	1.179
12.14	1.648	28.81	1.179
12.15	1.652	28.82	1.175
12.17	1.652	28.84	1.175
12.19	1.652	28.86	1.179
12.21	1.648	28.87	1.179
12.22	1.648	28.89	1.175
12.24	1.648	28.91	1.175
12.26	1.648	28.92	1.175
12.27	1.652	28.94	1.175
12.29	1.648	28.95	1.175
12.31	1.648	28.97	1.171
12.32	1.648	28.99	1.171
12.34	1.648	29.	1.175
12.36	1.699	29.02	1.175
12.37	1.691	29.04	1.171
12.39	1.683	29.06	1.171
12.4	1.683	29.07	1.171
12.42	1.683	29.09	1.171
12.44	1.679	29.11	1.167
12.46	1.648	29.12	1.171
12.47	1.641	29.14	1.171
12.49	1.644	29.16	1.171
12.51	1.641	29.17	1.171
12.52	1.641	29.19	1.171
12.54	1.641	29.2	1.167
12.56	1.641	29.22	1.167
12.57	1.637	29.24	1.167
12.59	1.641	29.25	1.167
12.61	1.641	29.27	1.167
12.62	1.641	29.29	1.167
12.64	1.637	29.31	1.167
12.65	1.637	29.32	1.167
12.67	1.637	29.34	1.167
12.69	1.637	29.36	1.163
12.71	1.633	29.37	1.167
12.72	1.633	29.39	1.163
12.74	1.633	29.41	1.167
12.76	1.633	29.42	1.163

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
12.77	1.633	29.44	1.167
12.79	1.633	29.45	1.167
12.81	1.633	29.47	1.163
12.82	1.633	29.49	1.16
12.84	1.629	29.5	1.16
12.86	1.629	29.52	1.163
12.87	1.625	29.54	1.16
12.89	1.629	29.56	1.16
12.9	1.629	29.57	1.16
12.92	1.629	29.59	1.16
12.94	1.625	29.61	1.163
12.96	1.625	29.62	1.16
12.97	1.629	29.64	1.16
12.99	1.625	29.66	1.16
13.01	1.625	29.67	1.156
13.02	1.621	29.69	1.16
13.04	1.625	29.7	1.156
13.06	1.625	29.72	1.156
13.07	1.621	29.74	1.156
13.09	1.621	29.75	1.156
13.11	1.621	29.77	1.156
13.12	1.621	29.79	1.156
13.14	1.621	29.81	1.156
13.15	1.617	29.82	1.156
13.17	1.617	29.84	1.156
13.19	1.613	29.86	1.152
13.21	1.617	29.87	1.156
13.22	1.617	29.89	1.152
13.24	1.613	29.91	1.152
13.26	1.617	29.92	1.152
13.27	1.613	29.94	1.152
13.29	1.613	29.95	1.152
13.31	1.613	29.97	1.156
13.32	1.613	29.99	1.148
13.34	1.613	30.	1.148
13.36	1.613	30.02	1.152
13.37	1.613	30.04	1.152
13.39	1.613	30.06	1.148
13.4	1.613	30.07	1.148
13.42	1.61	30.09	1.148
13.44	1.61	30.11	1.144
13.46	1.61	30.12	1.148
13.47	1.61	30.14	1.148
13.49	1.61	30.16	1.148
13.51	1.61	30.17	1.148
13.52	1.61	30.19	1.148
13.54	1.61	30.2	1.144
13.56	1.609	30.22	1.14
13.57	1.606	30.24	1.144
13.59	1.606	30.25	1.144
13.61	1.606	30.27	1.144
13.62	1.606	30.29	1.14
13.64	1.602	30.31	1.144
13.65	1.602	30.32	1.144
13.67	1.602	30.34	1.144
13.69	1.602	30.36	1.144
13.71	1.602	30.37	1.144
13.72	1.602	30.39	1.144
13.74	1.602	30.41	1.14
13.76	1.598	30.42	1.14
13.77	1.598	30.44	1.14
13.79	1.598	30.45	1.14
13.81	1.598	30.47	1.136

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
13.82	1.598	30.49	1.136
13.84	1.598	30.5	1.136
13.86	1.594	30.52	1.136
13.87	1.598	30.54	1.136
13.89	1.594	30.56	1.14
13.9	1.594	30.57	1.136
13.92	1.594	30.59	1.14
13.94	1.594	30.61	1.136
13.96	1.594	30.62	1.136
13.97	1.594	30.64	1.136
13.99	1.59	30.66	1.136
14.01	1.59	30.67	1.132
14.02	1.59	30.69	1.136
14.04	1.59	30.7	1.132
14.06	1.59	30.72	1.136
14.07	1.59	30.74	1.136
14.09	1.59	30.75	1.136
14.11	1.586	30.77	1.132
14.12	1.59	30.79	1.132
14.14	1.586	30.81	1.132
14.15	1.586	30.82	1.132
14.17	1.586	30.84	1.132
14.19	1.586	30.86	1.132
14.21	1.586	30.87	1.132
14.22	1.582	30.89	1.129
14.24	1.582	30.91	1.129
14.26	1.582	30.92	1.132
14.27	1.582	30.94	1.132
14.29	1.579	30.95	1.129
14.31	1.582	30.97	1.129
14.32	1.582	30.99	1.129
14.34	1.579	31.	1.129
14.36	1.579	31.02	1.129
14.37	1.579	31.04	1.129
14.39	1.582	31.06	1.129
14.4	1.579	31.07	1.125
14.42	1.575	31.09	1.125
14.44	1.575	31.11	1.125
14.46	1.579	31.12	1.125
14.47	1.575	31.14	1.125
14.49	1.575	31.16	1.129
14.51	1.575	31.17	1.125
14.52	1.575	31.19	1.125
14.54	1.575	31.2	1.121
14.56	1.571	31.22	1.121
14.57	1.571	31.24	1.121
14.59	1.571	31.25	1.121
14.61	1.571	31.27	1.121
14.62	1.571	31.29	1.121
14.64	1.571	31.31	1.121
14.65	1.571	31.32	1.121
14.67	1.571	31.34	1.121
14.69	1.571	31.36	1.121
14.71	1.571	31.37	1.121
14.72	1.571	31.39	1.117
14.74	1.571	31.41	1.117
14.76	1.567	31.42	1.117
14.77	1.567	31.44	1.117
14.79	1.567	31.45	1.121
14.81	1.567	31.47	1.121
14.82	1.567	31.49	1.117
14.84	1.563	31.5	1.117
14.86	1.563	31.52	1.113

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
14.87	1.567	31.54	1.117
14.89	1.563	31.56	1.113
14.9	1.563	31.57	1.117
14.92	1.563	31.59	1.113
14.94	1.559	31.61	1.113
14.96	1.563	31.62	1.117
14.97	1.559	31.64	1.117
14.99	1.559	31.66	1.113
15.01	1.559	31.67	1.113
15.02	1.559	31.69	1.113
15.04	1.555	31.7	1.113
15.06	1.559	31.72	1.113
15.07	1.559	31.74	1.113
15.09	1.555	31.75	1.109
15.11	1.559	31.77	1.113
15.12	1.555	31.79	1.109
15.14	1.555	31.81	1.109
15.15	1.555	31.82	1.109
15.17	1.555	31.84	1.109
15.19	1.551	31.86	1.105
15.21	1.551	31.87	1.109
15.22	1.551	31.89	1.109
15.24	1.551	31.91	1.109
15.26	1.551	31.92	1.109
15.27	1.551	31.94	1.105
15.29	1.551	31.95	1.105
15.31	1.547	31.97	1.105
15.32	1.547	31.99	1.105
15.34	1.547	32.01	1.101
15.36	1.547	32.02	1.105
15.37	1.547	32.04	1.105
15.39	1.547	32.06	1.101
15.4	1.544	32.07	1.105
15.42	1.544	32.09	1.101
15.44	1.547	32.1	1.101
15.46	1.544	32.12	1.101
15.47	1.544	32.14	1.105
15.49	1.544	32.16	1.101
15.51	1.544	32.17	1.101
15.52	1.544	32.19	1.101
15.54	1.544	32.2	1.101
15.56	1.54	32.22	1.101
15.57	1.54	32.24	1.098
15.59	1.54	32.26	1.098
15.61	1.54	32.27	1.101
15.62	1.544	32.29	1.101
15.64	1.54	32.31	1.098
15.65	1.54	32.32	1.097
15.67	1.54	32.34	1.097
15.69	1.54	32.35	1.098
15.71	1.536	32.37	1.098
15.72	1.536	32.39	1.094
15.74	1.536	32.41	1.094
15.76	1.536	32.42	1.094
15.77	1.536	32.44	1.098
15.79	1.536	32.45	1.097
15.81	1.532	32.47	1.094
15.82	1.532	32.49	1.094
15.84	1.532	32.51	1.094
15.86	1.528	32.52	1.094
15.87	1.532	32.54	1.094
15.89	1.532	32.56	1.094
15.9	1.532	32.57	1.09

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
15.92	1.532	32.59	1.09
15.94	1.528	32.6	1.094
15.96	1.528	32.62	1.09
15.97	1.528	32.64	1.094
15.99	1.528	32.66	1.094
16.	1.528	32.67	1.09
16.02	1.528	32.69	1.09
16.04	1.528	32.7	1.09
16.06	1.524	32.72	1.09
16.07	1.524	32.74	1.09
16.09	1.524	32.76	1.09
16.11	1.536	32.77	1.086
16.12	1.524	32.79	1.086
16.14	1.524	32.81	1.086
16.16	1.524	32.82	1.086
16.17	1.524	32.84	1.086
16.19	1.516	32.85	1.086
16.2	1.52	32.87	1.082
16.22	1.524	32.89	1.082
16.24	1.52	32.91	1.082
16.25	1.52	32.92	1.082
16.27	1.52	32.94	1.086
16.29	1.52	32.95	1.082
16.31	1.516	32.97	1.082
16.32	1.516	32.99	1.086
16.34	1.516	33.01	1.082
16.36	1.516		

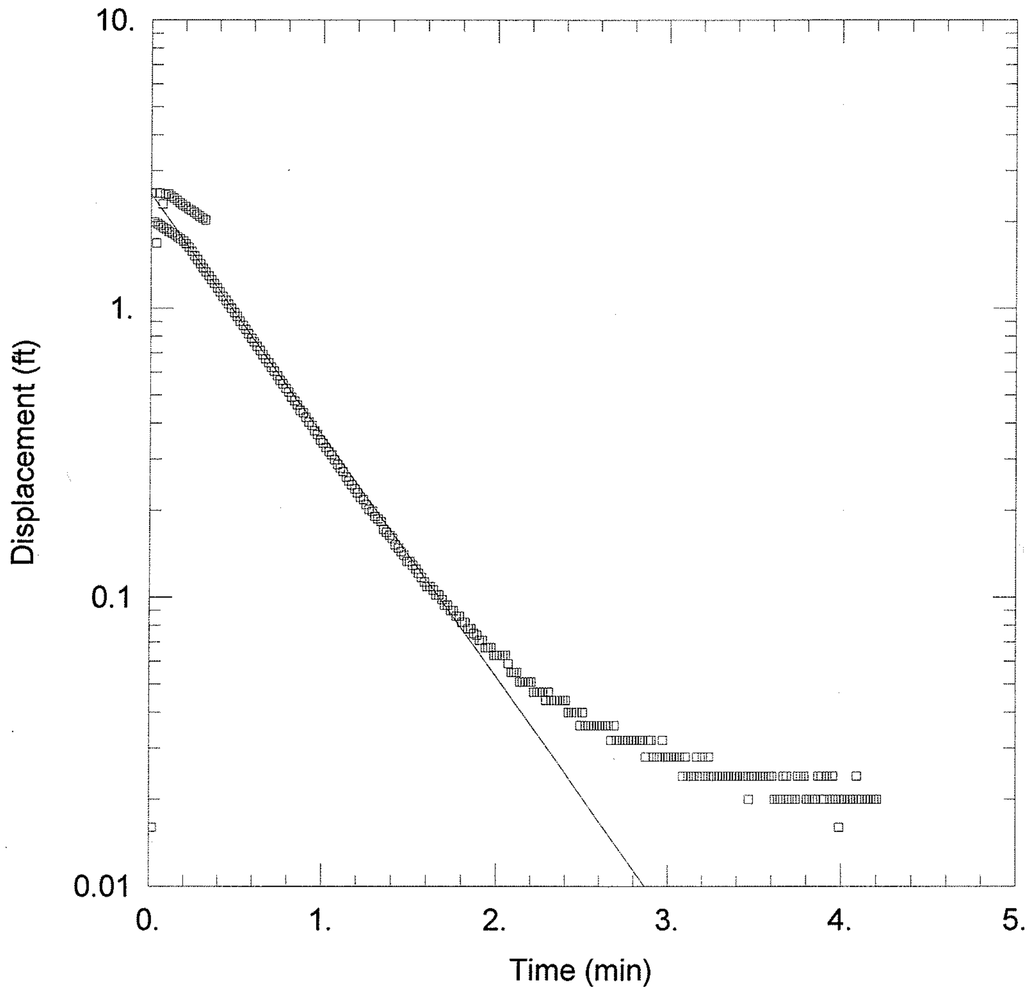
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.443

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	1.698E-05	ft/min
y0	2.133	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw06f.aqt
Date: 07/15/08 Time: 11:14:17

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW06f
Test Date: 4/30/08

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW06F)

Initial Displacement: 2.51 ft
Total Well Penetration Depth: 15.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.5 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.001638 ft/min
y0 = 2.492 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:37:04

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Date: 4/30/08
Test Well: 56GW06f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW06F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.51 ft
Static Water Column Height: 15.5 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.5 ft

No. of Observations: 271

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.016	1.972	0.067
0.022	1.991	1.989	0.063
0.033	1.684	2.005	0.063
0.039	1.963	2.022	0.063
0.05	2.51	2.039	0.063
0.055	1.936	2.055	0.063
0.067	2.301	2.072	0.059
0.072	1.905	2.089	0.055
0.083	2.483	2.105	0.055
0.089	1.878	2.122	0.055
0.1	2.487	2.139	0.051
0.105	1.847	2.155	0.051
0.117	2.448	2.172	0.051
0.122	1.82	2.189	0.051
0.133	2.405	2.205	0.051
0.139	1.793	2.222	0.047
0.15	2.363	2.239	0.047
0.155	1.766	2.255	0.047
0.167	2.324	2.272	0.047
0.172	1.738	2.289	0.044
0.183	2.289	2.305	0.047
0.189	1.711	2.322	0.044
0.2	2.254	2.339	0.044
0.205	1.676	2.355	0.044
0.217	2.215	2.372	0.044
0.222	1.626	2.389	0.044
0.233	2.184	2.405	0.044

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.239	1.576	2.422	0.04
0.25	2.15	2.439	0.04
0.255	1.521	2.455	0.04
0.267	2.119	2.472	0.04
0.272	1.475	2.489	0.036
0.283	2.087	2.505	0.04
0.289	1.424	2.522	0.036
0.3	2.053	2.539	0.036
0.305	1.378	2.555	0.036
0.317	2.022	2.572	0.036
0.322	1.335	2.589	0.036
0.339	1.292	2.605	0.036
0.355	1.254	2.622	0.036
0.372	1.215	2.639	0.036
0.389	1.172	2.655	0.036
0.405	1.137	2.672	0.032
0.422	1.098	2.689	0.036
0.439	1.064	2.705	0.032
0.455	1.032	2.722	0.032
0.472	0.998	2.739	0.032
0.489	0.967	2.755	0.032
0.505	0.936	2.772	0.032
0.522	0.901	2.789	0.032
0.539	0.873	2.805	0.032
0.555	0.846	2.822	0.032
0.572	0.815	2.839	0.032
0.589	0.788	2.855	0.032
0.605	0.765	2.872	0.028
0.622	0.738	2.889	0.032
0.639	0.714	2.905	0.032
0.655	0.691	2.922	0.028
0.672	0.668	2.939	0.028
0.689	0.648	2.955	0.028
0.705	0.625	2.972	0.032
0.722	0.606	2.989	0.028
0.739	0.583	3.005	0.028
0.755	0.563	3.022	0.028
0.772	0.548	3.039	0.028
0.789	0.528	3.055	0.028
0.805	0.513	3.072	0.028
0.822	0.493	3.089	0.024
0.839	0.478	3.105	0.028
0.855	0.462	3.122	0.024
0.872	0.443	3.139	0.024
0.889	0.435	3.155	0.024
0.905	0.42	3.172	0.028
0.922	0.404	3.189	0.024
0.939	0.393	3.205	0.028
0.955	0.377	3.222	0.024
0.972	0.365	3.239	0.028
0.989	0.35	3.255	0.024
1.005	0.342	3.272	0.024
1.022	0.33	3.289	0.024
1.039	0.319	3.305	0.024
1.055	0.311	3.322	0.024
1.072	0.299	3.339	0.024
1.089	0.288	3.355	0.024
1.105	0.28	3.372	0.024
1.122	0.272	3.389	0.024
1.139	0.261	3.405	0.024
1.155	0.253	3.422	0.024
1.172	0.245	3.439	0.024
1.189	0.237	3.455	0.024

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.205	0.23	3.472	0.02
1.222	0.222	3.489	0.024
1.239	0.218	3.505	0.024
1.255	0.21	3.522	0.024
1.272	0.202	3.539	0.024
1.289	0.199	3.555	0.024
1.305	0.191	3.572	0.024
1.322	0.187	3.589	0.024
1.339	0.183	3.605	0.024
1.355	0.172	3.622	0.02
1.372	0.168	3.639	0.02
1.389	0.164	3.655	0.02
1.405	0.16	3.672	0.024
1.422	0.152	3.689	0.024
1.439	0.148	3.705	0.02
1.455	0.144	3.722	0.02
1.472	0.14	3.739	0.02
1.489	0.133	3.755	0.024
1.505	0.133	3.772	0.024
1.522	0.129	3.789	0.024
1.539	0.125	3.805	0.02
1.555	0.121	3.822	0.02
1.572	0.117	3.839	0.02
1.589	0.113	3.855	0.02
1.605	0.109	3.872	0.024
1.622	0.109	3.889	0.024
1.639	0.106	3.905	0.02
1.655	0.102	3.922	0.024
1.672	0.102	3.939	0.02
1.689	0.098	3.955	0.024
1.705	0.094	3.972	0.02
1.722	0.094	3.989	0.016
1.739	0.09	4.005	0.02
1.755	0.09	4.022	0.02
1.772	0.086	4.039	0.02
1.789	0.086	4.055	0.02
1.805	0.082	4.072	0.02
1.822	0.082	4.089	0.024
1.839	0.078	4.105	0.02
1.855	0.078	4.122	0.02
1.872	0.075	4.139	0.02
1.889	0.074	4.155	0.02
1.905	0.071	4.172	0.02
1.922	0.071	4.189	0.02
1.939	0.067	4.205	0.02
1.955	0.067		

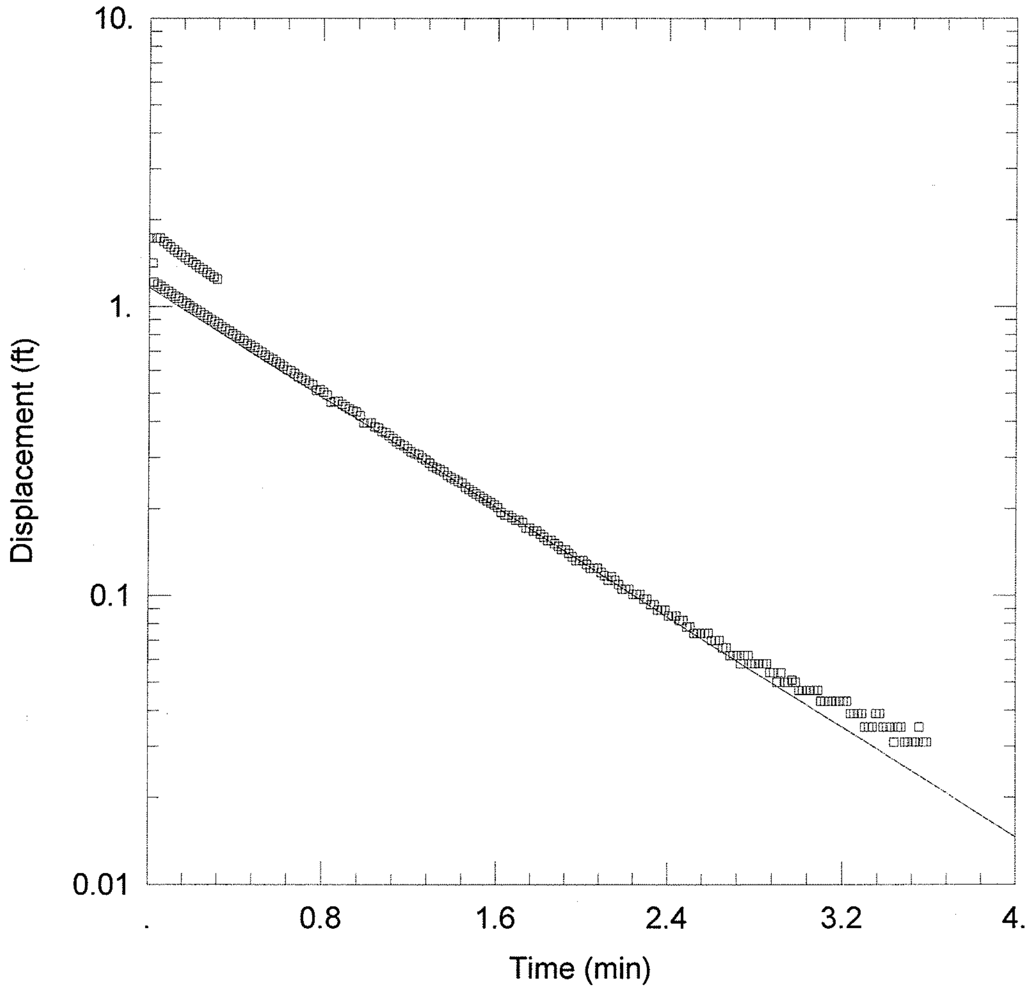
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.473

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.001638	ft/min
y0	2.492	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw06r.aqt
Date: 07/15/08 Time: 11:14:10

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW06r
Test Date: 4/30/08

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW06R)

Initial Displacement: 1.727 ft Static Water Column Height: 15.5 ft
Total Well Penetration Depth: 15.5 ft Screen Length: 10. ft
Casing Radius: 0.083 ft Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
K = 0.0009326 ft/min y0 = 1.164 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:36:57

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Date: 4/30/08
Test Well: 56GW06r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW06R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.727 ft
Static Water Column Height: 15.5 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.5 ft

No. of Observations: 234

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	1.416	1.655	0.19
0.022	1.214	1.672	0.186
0.033	1.727	1.689	0.182
0.039	1.191	1.705	0.182
0.05	1.727	1.722	0.179
0.055	1.172	1.739	0.171
0.067	1.68	1.755	0.171
0.072	1.148	1.772	0.167
0.083	1.645	1.789	0.167
0.089	1.125	1.805	0.163
0.1	1.606	1.822	0.159
0.105	1.106	1.839	0.155
0.117	1.571	1.855	0.155
0.122	1.083	1.872	0.151
0.133	1.54	1.889	0.148
0.139	1.067	1.905	0.144
0.15	1.509	1.922	0.144
0.155	1.044	1.939	0.14
0.167	1.478	1.955	0.136
0.172	1.024	1.972	0.132
0.183	1.447	1.989	0.132
0.189	1.005	2.005	0.132
0.2	1.42	2.022	0.128
0.205	0.986	2.039	0.124
0.217	1.393	2.055	0.124
0.222	0.97	2.072	0.124
0.233	1.362	2.089	0.12

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.239	0.951	2.105	0.117
0.25	1.339	2.122	0.113
0.255	0.931	2.139	0.116
0.267	1.311	2.155	0.113
0.272	0.916	2.172	0.109
0.283	1.288	2.189	0.105
0.289	0.9	2.205	0.105
0.3	1.265	2.222	0.105
0.305	0.885	2.239	0.101
0.317	1.242	2.255	0.101
0.322	0.869	2.272	0.101
0.339	0.85	2.289	0.097
0.355	0.834	2.305	0.097
0.372	0.823	2.322	0.093
0.389	0.803	2.339	0.093
0.405	0.792	2.355	0.089
0.422	0.776	2.372	0.089
0.439	0.761	2.389	0.089
0.455	0.745	2.405	0.085
0.472	0.733	2.422	0.085
0.489	0.722	2.439	0.085
0.505	0.706	2.455	0.082
0.522	0.695	2.472	0.082
0.539	0.679	2.489	0.078
0.555	0.667	2.505	0.078
0.572	0.656	2.522	0.074
0.589	0.644	2.539	0.074
0.605	0.633	2.555	0.074
0.622	0.621	2.572	0.074
0.639	0.605	2.589	0.074
0.655	0.598	2.605	0.07
0.672	0.586	2.622	0.07
0.689	0.57	2.639	0.07
0.705	0.563	2.655	0.066
0.722	0.555	2.672	0.066
0.739	0.543	2.689	0.062
0.755	0.536	2.705	0.062
0.772	0.512	2.722	0.062
0.789	0.516	2.739	0.058
0.805	0.504	2.755	0.062
0.822	0.493	2.772	0.062
0.839	0.466	2.789	0.058
0.855	0.47	2.805	0.058
0.872	0.469	2.822	0.058
0.889	0.458	2.839	0.058
0.905	0.45	2.855	0.058
0.922	0.442	2.872	0.054
0.939	0.435	2.889	0.054
0.955	0.431	2.905	0.05
0.972	0.419	2.922	0.054
0.989	0.396	2.939	0.05
1.005	0.396	2.955	0.05
1.022	0.396	2.972	0.051
1.039	0.384	2.989	0.05
1.055	0.38	3.005	0.047
1.072	0.369	3.022	0.047
1.089	0.365	3.039	0.047
1.105	0.357	3.055	0.047
1.122	0.349	3.072	0.047
1.139	0.341	3.089	0.047
1.155	0.334	3.105	0.043
1.172	0.33	3.122	0.043
1.189	0.322	3.139	0.043

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.205	0.314	3.155	0.043
1.222	0.31	3.172	0.043
1.239	0.307	3.189	0.043
1.255	0.299	3.205	0.043
1.272	0.295	3.222	0.043
1.289	0.287	3.239	0.039
1.305	0.279	3.255	0.039
1.322	0.276	3.272	0.039
1.339	0.272	3.289	0.039
1.355	0.268	3.305	0.035
1.372	0.26	3.322	0.035
1.389	0.256	3.339	0.035
1.405	0.252	3.355	0.039
1.422	0.248	3.372	0.039
1.439	0.245	3.389	0.035
1.455	0.237	3.405	0.035
1.472	0.233	3.422	0.035
1.489	0.229	3.439	0.031
1.505	0.225	3.455	0.035
1.522	0.221	3.472	0.035
1.539	0.217	3.489	0.031
1.555	0.213	3.505	0.031
1.572	0.21	3.522	0.031
1.589	0.206	3.539	0.031
1.605	0.202	3.555	0.035
1.622	0.194	3.572	0.031
1.639	0.19	3.589	0.031

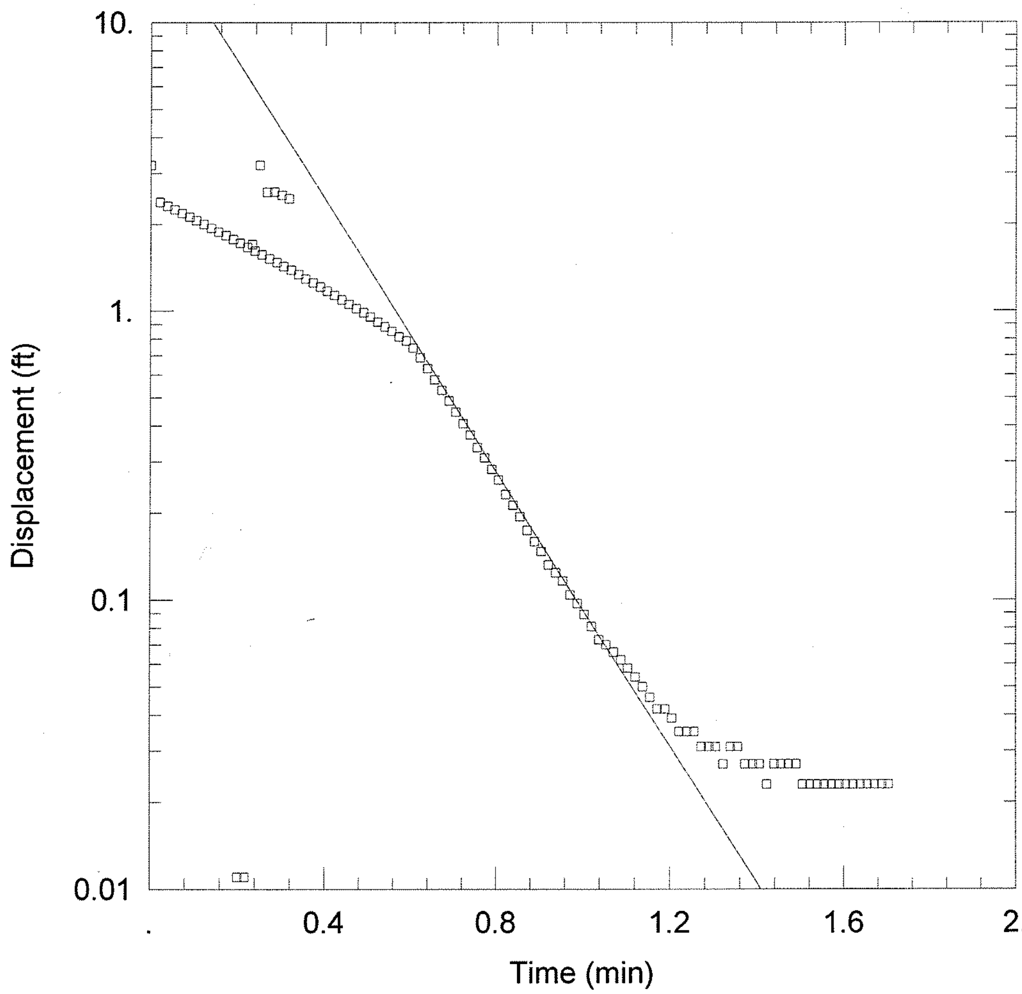
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.473

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0009326	ft/min
y0	1.164	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw07f.aqt
Date: 07/15/08 | Time: 11:14:03

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW07f
Test Date: 5/1/08

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW07F)

Initial Displacement: 3.195 ft
Total Well Penetration Depth: 11.95 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.95 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.004398 ft/min
y0 = 21.64 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:36:50

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Date: 5/1/08
Test Well: 56GW07f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW07F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.195 ft
Static Water Column Height: 11.95 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.95 ft

No. of Observations: 121

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.008	0.722	0.407
0.022	2.381	0.739	0.372
0.033	-0.008	0.755	0.337
0.039	2.311	0.772	0.31
0.05	-0.008	0.789	0.283
0.055	2.245	0.805	0.26
0.067	-0.008	0.822	0.232
0.072	2.179	0.839	0.213
0.083	-0.004	0.855	0.194
0.089	2.117	0.872	0.174
0.1	-0.008	0.889	0.159
0.105	2.059	0.905	0.147
0.117	-0.008	0.922	0.132
0.122	1.997	0.939	0.124
0.133	-0.004	0.955	0.116
0.139	1.939	0.972	0.104
0.15	-0.004	0.989	0.097
0.155	1.881	1.005	0.089
0.167	0.	1.022	0.081
0.172	1.826	1.039	0.073
0.183	0.007	1.055	0.07
0.189	1.772	1.072	0.066
0.2	0.011	1.089	0.062
0.205	1.718	1.105	0.058
0.217	0.011	1.122	0.054
0.222	1.663	1.139	0.05
0.233	1.702	1.155	0.046

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.239	1.617	1.172	0.042
0.25	3.195	1.189	0.042
0.255	1.567	1.205	0.039
0.267	2.579	1.222	0.035
0.272	1.516	1.239	0.035
0.283	2.59	1.255	0.035
0.289	1.473	1.272	0.031
0.3	2.521	1.289	0.031
0.305	1.427	1.305	0.031
0.317	2.451	1.322	0.027
0.322	1.384	1.339	0.031
0.339	1.338	1.355	0.031
0.355	1.291	1.372	0.027
0.372	1.252	1.389	0.027
0.389	1.21	1.405	0.027
0.405	1.171	1.422	0.023
0.422	1.132	1.439	0.027
0.439	1.093	1.455	0.027
0.455	1.055	1.472	0.027
0.472	1.02	1.489	0.027
0.489	0.985	1.505	0.023
0.505	0.954	1.522	0.023
0.522	0.915	1.539	0.023
0.539	0.88	1.555	0.023
0.555	0.849	1.572	0.023
0.572	0.814	1.589	0.023
0.589	0.787	1.605	0.023
0.605	0.744	1.622	0.023
0.622	0.69	1.639	0.023
0.639	0.632	1.655	0.023
0.655	0.578	1.672	0.023
0.672	0.531	1.689	0.023
0.689	0.488	1.705	0.023
0.705	0.446		

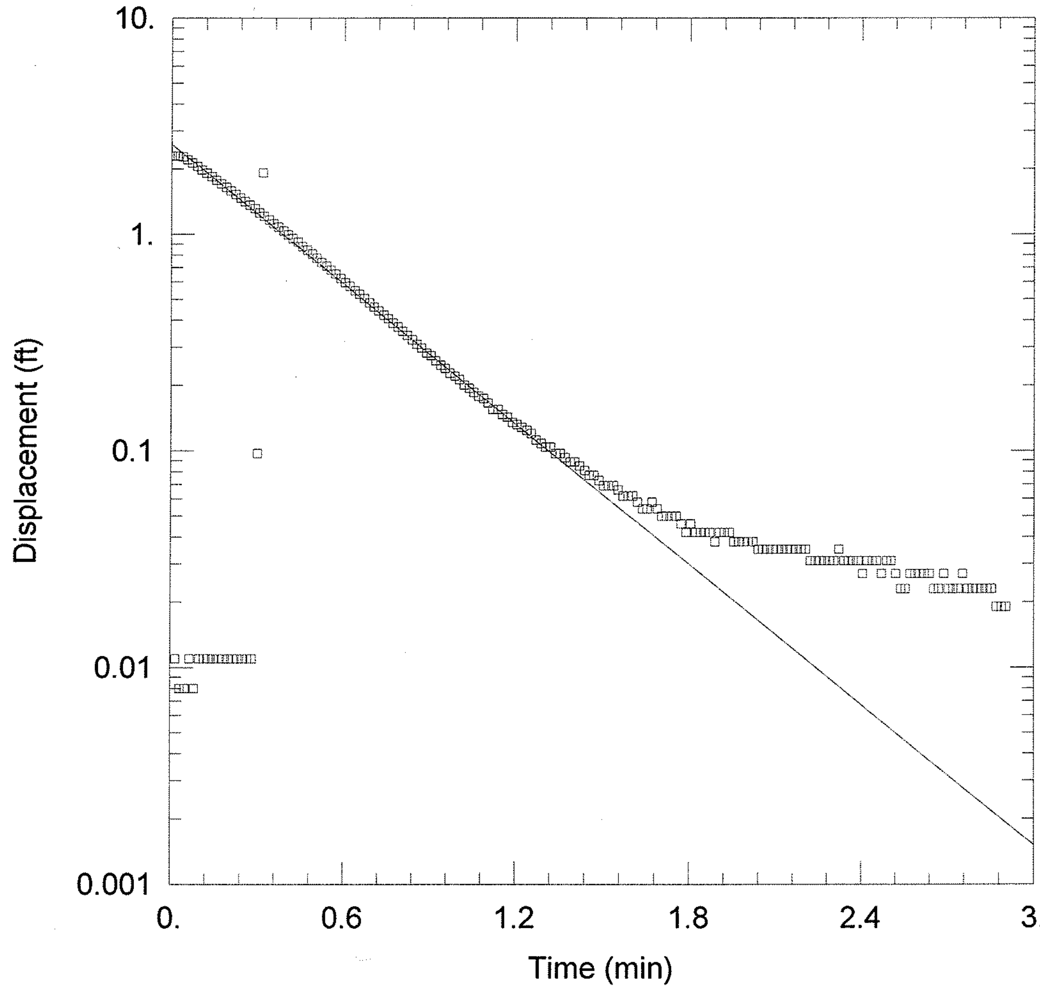
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.342

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.004398	ft/min
y0	21.64	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw07r.aqt
Date: 07/15/08 Time: 11:13:58

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW07r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW07R)

Initial Displacement: 2.303 ft
Total Well Penetration Depth: 11.95 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.95 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.002002 ft/min
y0 = 2.605 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:36:40

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW07r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW07R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.303 ft
Static Water Column Height: 11.95 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.95 ft

No. of Observations: 193

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.011	1.322	0.104
0.022	2.303	1.339	0.097
0.033	0.008	1.355	0.097
0.039	2.28	1.372	0.093
0.05	0.008	1.389	0.089
0.055	2.207	1.405	0.089
0.067	0.011	1.422	0.085
0.072	2.133	1.439	0.081
0.083	0.008	1.455	0.077
0.089	2.059	1.472	0.077
0.1	0.011	1.489	0.073
0.105	1.985	1.505	0.069
0.117	0.011	1.522	0.069
0.122	1.912	1.539	0.069
0.133	0.011	1.555	0.066
0.139	1.842	1.572	0.062
0.15	0.011	1.589	0.062
0.155	1.776	1.605	0.062
0.167	0.011	1.622	0.058
0.172	1.71	1.639	0.054
0.183	0.011	1.655	0.054
0.189	1.648	1.672	0.058
0.2	0.011	1.689	0.054
0.205	1.59	1.705	0.05
0.217	0.011	1.722	0.05
0.222	1.528	1.739	0.05
0.233	0.011	1.755	0.05
0.239	1.474	1.772	0.046

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.25	0.011	1.789	0.042
0.255	1.419	1.805	0.046
0.267	0.011	1.822	0.042
0.272	1.365	1.839	0.042
0.283	0.011	1.855	0.042
0.289	1.314	1.872	0.042
0.3	0.097	1.889	0.038
0.305	1.26	1.905	0.042
0.317	1.92	1.922	0.042
0.322	1.214	1.939	0.042
0.339	1.167	1.955	0.038
0.355	1.121	1.972	0.038
0.372	1.078	1.989	0.038
0.389	1.035	2.005	0.038
0.405	0.996	2.022	0.038
0.422	0.954	2.039	0.035
0.439	0.919	2.055	0.035
0.455	0.876	2.072	0.035
0.472	0.845	2.089	0.035
0.489	0.81	2.105	0.035
0.505	0.775	2.122	0.035
0.522	0.74	2.139	0.035
0.539	0.713	2.155	0.035
0.555	0.682	2.172	0.035
0.572	0.655	2.189	0.035
0.589	0.624	2.205	0.035
0.605	0.597	2.222	0.031
0.622	0.574	2.239	0.031
0.639	0.547	2.255	0.031
0.655	0.527	2.272	0.031
0.672	0.504	2.289	0.031
0.689	0.481	2.305	0.031
0.705	0.461	2.322	0.035
0.722	0.442	2.339	0.031
0.739	0.422	2.355	0.031
0.755	0.407	2.372	0.031
0.772	0.388	2.389	0.031
0.789	0.372	2.405	0.027
0.805	0.356	2.422	0.031
0.822	0.341	2.439	0.031
0.839	0.325	2.455	0.031
0.855	0.31	2.472	0.027
0.872	0.298	2.489	0.031
0.889	0.283	2.505	0.031
0.905	0.275	2.522	0.027
0.922	0.26	2.539	0.023
0.939	0.248	2.555	0.023
0.955	0.24	2.572	0.027
0.972	0.228	2.589	0.027
0.989	0.221	2.605	0.027
1.005	0.213	2.622	0.027
1.022	0.201	2.639	0.027
1.039	0.194	2.655	0.023
1.055	0.186	2.672	0.023
1.072	0.178	2.689	0.027
1.089	0.174	2.705	0.023
1.105	0.166	2.722	0.023
1.122	0.155	2.739	0.023
1.139	0.155	2.755	0.027
1.155	0.147	2.772	0.023
1.172	0.143	2.789	0.023
1.189	0.135	2.805	0.023
1.205	0.132	2.822	0.023

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.222	0.128	2.839	0.023
1.239	0.124	2.855	0.023
1.255	0.12	2.872	0.019
1.272	0.112	2.889	0.019
1.289	0.108	2.905	0.019
1.305	0.104		

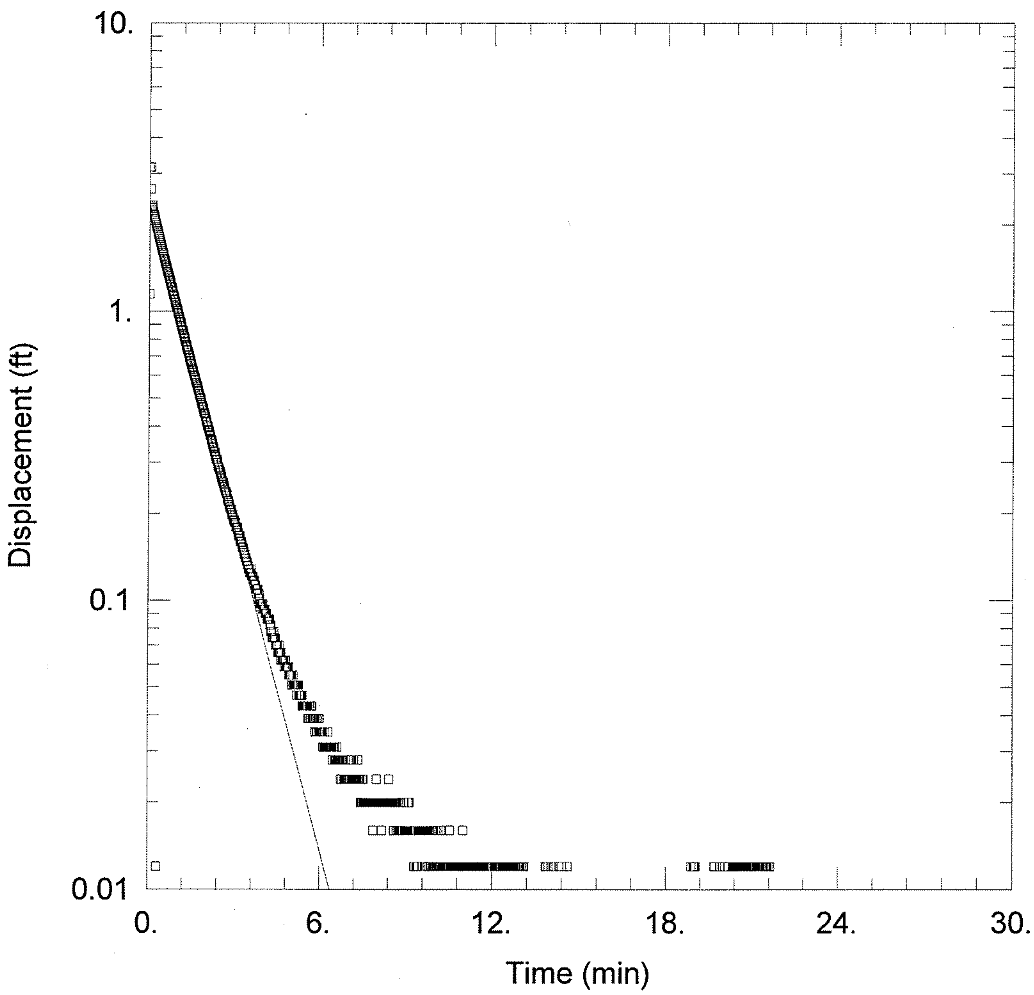
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.342

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.002002	ft/min
y0	2.605	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw08f.aqt
Date: 07/15/08 Time: 11:13:51

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW08f
Test Date: 5/1/08

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW08F)

Initial Displacement: 3.161 ft
Total Well Penetration Depth: 11.43 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.43 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0006844 ft/min y0 = 2.343 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:36:29

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Date: 5/1/08
Test Well: 56GW08f

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW08F

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.161 ft
Static Water Column Height: 11.43 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.43 ft

No. of Observations: 1470

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	0.	11.96	0.012
0.022	1.148	11.97	0.012
0.033	-0.004	11.99	0.012
0.039	2.657	12.01	0.012
0.05	-0.004	12.02	0.012
0.055	3.161	12.04	0.012
0.067	-0.004	12.06	0.008
0.072	2.308	12.07	0.008
0.083	-0.004	12.09	0.008
0.089	2.331	12.11	0.012
0.1	0.	12.12	0.012
0.105	2.281	12.14	0.012
0.117	-0.004	12.15	0.012
0.122	2.242	12.17	0.012
0.133	0.	12.19	0.012
0.139	2.203	12.21	0.012
0.15	-0.004	12.22	0.012
0.155	2.164	12.24	0.012
0.167	-0.004	12.26	0.012
0.172	2.129	12.27	0.012
0.183	0.	12.29	0.008
0.189	2.091	12.31	0.012
0.2	-0.004	12.32	0.012
0.205	2.06	12.34	0.012
0.217	-0.004	12.36	0.008
0.222	2.025	12.37	0.012
0.233	-0.004	12.39	0.012

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.239	1.994	12.4	0.012
0.25	-0.004	12.42	0.012
0.255	1.963	12.44	0.008
0.267	-0.004	12.46	0.008
0.272	1.932	12.47	0.012
0.283	0.	12.49	0.012
0.289	1.897	12.51	0.012
0.3	0.008	12.52	0.008
0.305	1.87	12.54	0.012
0.317	0.012	12.56	0.012
0.322	1.842	12.57	0.012
0.339	1.811	12.59	0.012
0.355	1.784	12.61	0.012
0.372	1.753	12.62	0.012
0.389	1.726	12.64	0.012
0.405	1.699	12.65	0.012
0.422	1.676	12.67	0.012
0.439	1.649	12.69	0.008
0.455	1.621	12.71	0.012
0.472	1.598	12.72	0.012
0.489	1.575	12.74	0.012
0.505	1.548	12.76	0.012
0.522	1.524	12.77	0.012
0.539	1.505	12.79	0.004
0.555	1.482	12.81	0.012
0.572	1.458	12.82	0.012
0.589	1.435	12.84	0.012
0.605	1.416	12.86	0.012
0.622	1.393	12.87	0.008
0.639	1.373	12.89	0.012
0.655	1.354	12.9	0.012
0.672	1.334	12.92	0.012
0.689	1.315	12.94	0.012
0.705	1.296	12.96	0.012
0.722	1.276	12.97	0.012
0.739	1.257	12.99	0.012
0.755	1.237	13.01	0.008
0.772	1.218	13.02	0.008
0.789	1.203	13.04	0.012
0.805	1.183	13.06	0.012
0.822	1.168	13.07	0.008
0.839	1.148	13.09	0.012
0.855	1.133	13.11	0.012
0.872	1.117	13.12	0.012
0.889	1.098	13.14	0.008
0.905	1.082	13.15	0.008
0.922	1.067	13.17	0.008
0.939	1.051	13.19	0.008
0.955	1.036	13.21	0.008
0.972	1.02	13.22	0.008
0.989	1.005	13.24	0.008
1.005	0.989	13.26	0.008
1.022	0.978	13.27	0.008
1.039	0.962	13.29	0.008
1.055	0.95	13.31	0.008
1.072	0.935	13.32	0.008
1.089	0.919	13.34	0.008
1.105	0.908	13.36	0.008
1.122	0.892	13.37	0.008
1.139	0.881	13.39	0.008
1.155	0.865	13.4	0.008
1.172	0.857	13.42	0.008
1.189	0.842	13.44	0.008

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.205	0.83	13.46	0.008
1.222	0.819	13.47	0.008
1.239	0.807	13.49	0.008
1.255	0.795	13.51	0.004
1.272	0.784	13.52	0.004
1.289	0.768	13.54	0.008
1.305	0.76	13.56	0.004
1.322	0.749	13.57	0.008
1.339	0.737	13.59	0.004
1.355	0.729	13.61	0.008
1.372	0.718	13.62	0.008
1.389	0.706	13.64	0.008
1.405	0.695	13.65	0.008
1.422	0.687	13.67	0.004
1.439	0.675	13.69	0.004
1.455	0.667	13.71	0.008
1.472	0.656	13.72	0.008
1.489	0.644	13.74	0.008
1.505	0.636	13.76	0.008
1.522	0.629	13.77	0.008
1.539	0.621	13.79	0.008
1.555	0.613	13.81	0.008
1.572	0.601	13.82	0.008
1.589	0.594	13.84	0.008
1.605	0.586	13.86	0.012
1.622	0.578	13.87	0.012
1.639	0.567	13.89	0.008
1.655	0.563	13.9	0.012
1.672	0.555	13.92	0.008
1.689	0.547	13.94	0.008
1.705	0.539	13.96	0.012
1.722	0.532	13.97	0.008
1.739	0.524	13.99	0.008
1.755	0.516	14.01	0.008
1.772	0.508	14.02	0.008
1.789	0.501	14.04	0.008
1.805	0.497	14.06	0.012
1.822	0.489	14.07	0.012
1.839	0.481	14.09	0.008
1.855	0.473	14.11	0.008
1.872	0.466	14.12	0.012
1.889	0.462	14.14	0.008
1.905	0.454	14.15	0.008
1.922	0.446	14.17	0.008
1.939	0.442	14.19	0.008
1.955	0.439	14.21	0.008
1.972	0.431	14.22	0.008
1.989	0.423	14.24	0.008
2.005	0.415	14.26	0.008
2.022	0.411	14.27	0.008
2.039	0.404	14.29	0.008
2.055	0.4	14.31	0.008
2.072	0.396	14.32	0.008
2.089	0.388	14.34	0.008
2.105	0.384	14.36	0.008
2.122	0.38	14.37	0.008
2.139	0.373	14.39	0.008
2.155	0.369	14.4	0.008
2.172	0.361	14.42	0.012
2.189	0.357	14.44	0.008
2.205	0.353	14.46	0.008
2.222	0.349	14.47	0.008
2.239	0.342	14.49	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.255	0.338	14.51	0.004
2.272	0.334	14.52	0.008
2.289	0.326	14.54	0.008
2.305	0.326	14.56	0.008
2.322	0.318	14.57	0.008
2.339	0.314	14.59	0.008
2.355	0.307	14.61	0.012
2.372	0.307	14.62	0.008
2.389	0.307	14.64	0.008
2.405	0.299	14.65	0.008
2.422	0.291	14.67	0.008
2.439	0.287	14.69	0.008
2.455	0.287	14.71	0.008
2.472	0.283	14.72	0.008
2.489	0.28	14.74	0.008
2.505	0.276	14.76	0.008
2.522	0.272	14.77	0.008
2.539	0.268	14.79	0.008
2.555	0.264	14.81	0.004
2.572	0.26	14.82	0.008
2.589	0.256	14.84	0.008
2.605	0.256	14.86	0.008
2.622	0.252	14.87	0.008
2.639	0.249	14.89	0.004
2.655	0.245	14.9	0.008
2.672	0.241	14.92	0.004
2.689	0.237	14.94	0.004
2.705	0.237	14.96	0.008
2.722	0.233	14.97	0.004
2.739	0.233	14.99	0.004
2.755	0.225	15.01	0.004
2.772	0.221	15.02	0.004
2.789	0.221	15.04	0.004
2.805	0.218	15.06	0.004
2.822	0.214	15.07	0.004
2.839	0.21	15.09	0.004
2.855	0.21	15.11	0.004
2.872	0.206	15.12	0.008
2.889	0.206	15.14	0.004
2.905	0.202	15.15	0.008
2.922	0.198	15.17	0.008
2.939	0.198	15.19	0.008
2.955	0.194	15.21	0.004
2.972	0.19	15.22	0.004
2.989	0.19	15.24	0.004
3.005	0.186	15.26	0.004
3.022	0.186	15.27	0.004
3.039	0.186	15.29	0.004
3.055	0.179	15.31	0.004
3.072	0.179	15.32	0.004
3.089	0.179	15.34	0.004
3.105	0.179	15.36	0.004
3.122	0.175	15.37	0.004
3.139	0.171	15.39	0.004
3.155	0.167	15.4	0.004
3.172	0.167	15.42	0.004
3.189	0.167	15.44	0.004
3.205	0.163	15.46	0.
3.222	0.159	15.47	0.004
3.239	0.159	15.49	0.
3.255	0.159	15.51	0.
3.272	0.156	15.52	0.
3.289	0.152	15.54	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.305	0.152	15.56	0.004
3.322	0.152	15.57	0.004
3.339	0.148	15.59	0.004
3.355	0.144	15.61	0.004
3.372	0.144	15.62	0.004
3.389	0.14	15.64	0.004
3.405	0.14	15.65	0.004
3.422	0.14	15.67	0.004
3.439	0.136	15.69	0.004
3.455	0.136	15.71	0.004
3.472	0.132	15.72	0.004
3.489	0.132	15.74	0.004
3.505	0.128	15.76	0.004
3.522	0.128	15.77	0.004
3.539	0.128	15.79	0.004
3.555	0.124	15.81	0.004
3.572	0.124	15.82	0.004
3.589	0.128	15.84	0.004
3.605	0.124	15.86	0.004
3.622	0.121	15.87	0.004
3.639	0.121	15.89	0.004
3.655	0.121	15.9	0.008
3.672	0.121	15.92	0.004
3.689	0.117	15.94	0.004
3.705	0.117	15.96	0.004
3.722	0.117	15.97	0.004
3.739	0.113	15.99	0.004
3.755	0.113	16.	0.004
3.772	0.109	16.02	0.004
3.789	0.109	16.04	0.004
3.805	0.109	16.06	0.004
3.822	0.109	16.07	0.004
3.839	0.109	16.09	0.004
3.855	0.105	16.11	0.004
3.872	0.101	16.12	0.004
3.889	0.105	16.14	0.004
3.905	0.101	16.16	0.004
3.922	0.097	16.17	0.004
3.939	0.097	16.19	0.004
3.955	0.097	16.2	0.
3.972	0.097	16.22	0.004
3.989	0.093	16.24	0.004
4.005	0.097	16.25	0.004
4.022	0.097	16.27	0.004
4.039	0.093	16.29	0.004
4.055	0.093	16.31	0.004
4.072	0.093	16.32	0.004
4.089	0.093	16.34	0.004
4.105	0.09	16.36	0.004
4.122	0.09	16.37	0.004
4.139	0.09	16.39	0.008
4.155	0.09	16.41	0.004
4.172	0.086	16.42	0.004
4.189	0.086	16.44	0.004
4.205	0.086	16.45	0.004
4.222	0.086	16.47	0.004
4.239	0.086	16.49	0.004
4.255	0.086	16.5	0.004
4.272	0.082	16.52	0.004
4.289	0.082	16.54	0.004
4.305	0.078	16.56	0.004
4.322	0.078	16.57	0.004
4.339	0.078	16.59	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
4.355	0.074	16.61	0.004
4.372	0.074	16.62	0.004
4.389	0.078	16.64	0.004
4.405	0.074	16.66	0.004
4.422	0.074	16.67	0.004
4.439	0.074	16.69	0.004
4.455	0.074	16.7	0.004
4.472	0.07	16.72	0.004
4.489	0.07	16.74	0.004
4.505	0.07	16.75	0.004
4.522	0.07	16.77	0.004
4.539	0.07	16.79	0.004
4.555	0.066	16.81	0.008
4.572	0.066	16.82	0.008
4.589	0.07	16.84	0.008
4.605	0.066	16.86	0.008
4.622	0.066	16.87	0.008
4.639	0.066	16.89	0.008
4.655	0.062	16.91	0.008
4.672	0.066	16.92	0.008
4.689	0.062	16.94	0.008
4.705	0.062	16.95	0.008
4.722	0.062	16.97	0.004
4.739	0.062	16.99	0.004
4.755	0.062	17.	0.004
4.772	0.059	17.02	0.004
4.789	0.062	17.04	0.004
4.805	0.062	17.06	0.004
4.822	0.059	17.07	0.004
4.839	0.059	17.09	0.004
4.855	0.059	17.11	0.004
4.872	0.059	17.12	0.004
4.889	0.059	17.14	0.004
4.905	0.059	17.16	0.004
4.922	0.059	17.17	0.004
4.939	0.055	17.19	0.004
4.955	0.055	17.2	0.004
4.972	0.055	17.22	0.004
4.989	0.055	17.24	0.004
5.005	0.055	17.25	0.004
5.022	0.055	17.27	0.004
5.039	0.051	17.29	0.004
5.055	0.051	17.31	0.004
5.072	0.055	17.32	0.004
5.089	0.051	17.34	0.004
5.105	0.051	17.36	0.004
5.122	0.051	17.37	0.004
5.139	0.051	17.39	0.004
5.155	0.051	17.41	0.004
5.172	0.051	17.42	0.004
5.189	0.051	17.44	0.004
5.205	0.047	17.45	0.004
5.222	0.051	17.47	0.004
5.239	0.051	17.49	0.004
5.255	0.051	17.5	0.004
5.272	0.051	17.52	0.
5.289	0.047	17.54	0.004
5.305	0.047	17.56	0.004
5.322	0.047	17.57	0.004
5.339	0.047	17.59	0.008
5.355	0.047	17.61	0.004
5.372	0.047	17.62	0.004
5.389	0.047	17.64	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
5.405	0.043	17.66	0.008
5.422	0.043	17.67	0.004
5.439	0.043	17.69	0.004
5.455	0.043	17.7	0.004
5.472	0.043	17.72	0.004
5.489	0.043	17.74	0.004
5.505	0.043	17.75	0.004
5.522	0.043	17.77	0.004
5.539	0.043	17.79	0.004
5.555	0.043	17.81	0.008
5.572	0.043	17.82	0.004
5.589	0.043	17.84	0.004
5.605	0.039	17.86	0.004
5.622	0.039	17.87	0.004
5.639	0.043	17.89	0.004
5.655	0.039	17.91	0.004
5.672	0.043	17.92	0.004
5.689	0.039	17.94	0.004
5.705	0.039	17.95	0.004
5.722	0.043	17.97	0.004
5.739	0.043	17.99	0.004
5.755	0.039	18.	0.004
5.772	0.039	18.02	0.008
5.789	0.039	18.04	0.004
5.805	0.039	18.06	0.004
5.822	0.039	18.07	0.008
5.839	0.039	18.09	0.004
5.855	0.035	18.11	0.008
5.872	0.039	18.12	0.008
5.889	0.035	18.14	0.004
5.905	0.039	18.16	0.008
5.922	0.035	18.17	0.008
5.939	0.039	18.19	0.008
5.955	0.035	18.2	0.004
5.972	0.039	18.22	0.008
5.989	0.035	18.24	0.008
6.005	0.039	18.25	0.008
6.022	0.035	18.27	0.008
6.039	0.035	18.29	0.004
6.055	0.035	18.31	0.008
6.072	0.035	18.32	0.008
6.089	0.035	18.34	0.004
6.105	0.035	18.36	0.008
6.122	0.035	18.37	0.008
6.139	0.031	18.39	0.008
6.155	0.031	18.41	0.008
6.172	0.035	18.42	0.008
6.189	0.031	18.44	0.008
6.205	0.031	18.45	0.004
6.222	0.031	18.47	0.004
6.239	0.031	18.49	0.004
6.255	0.031	18.5	0.004
6.272	0.031	18.52	0.008
6.289	0.031	18.54	0.008
6.305	0.035	18.56	0.008
6.322	0.031	18.57	0.008
6.339	0.031	18.59	0.008
6.355	0.031	18.61	0.008
6.372	0.031	18.62	0.004
6.389	0.031	18.64	0.004
6.405	0.031	18.66	0.008
6.422	0.031	18.67	0.004
6.439	0.031	18.69	0.008

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
6.455	0.031	18.7	0.004
6.472	0.028	18.72	0.008
6.489	0.031	18.74	0.008
6.505	0.031	18.75	0.008
6.522	0.031	18.77	0.004
6.539	0.031	18.79	0.008
6.555	0.028	18.81	0.008
6.572	0.028	18.82	0.008
6.589	0.028	18.84	0.008
6.605	0.028	18.86	0.008
6.622	0.031	18.87	0.008
6.639	0.028	18.89	0.012
6.655	0.028	18.91	0.008
6.672	0.028	18.92	0.008
6.689	0.028	18.94	0.008
6.705	0.028	18.95	0.008
6.722	0.028	18.97	0.012
6.739	0.028	18.99	0.012
6.755	0.024	19.	0.008
6.772	0.028	19.02	0.012
6.789	0.024	19.04	0.012
6.805	0.028	19.06	0.008
6.822	0.028	19.07	0.008
6.839	0.028	19.09	0.008
6.855	0.028	19.11	0.008
6.872	0.024	19.12	0.008
6.889	0.024	19.14	0.008
6.905	0.024	19.16	0.008
6.922	0.024	19.17	0.008
6.939	0.024	19.19	0.008
6.955	0.024	19.2	0.008
6.972	0.024	19.22	0.008
6.989	0.024	19.24	0.008
7.005	0.024	19.25	0.008
7.022	0.028	19.27	0.008
7.039	0.024	19.29	0.008
7.055	0.024	19.31	0.008
7.072	0.024	19.32	0.008
7.089	0.028	19.34	0.008
7.105	0.028	19.36	0.008
7.122	0.024	19.37	0.008
7.139	0.028	19.39	0.004
7.155	0.024	19.41	0.004
7.172	0.024	19.42	0.004
7.189	0.024	19.44	0.004
7.205	0.028	19.45	0.004
7.222	0.024	19.47	0.008
7.239	0.024	19.49	0.004
7.255	0.024	19.5	0.008
7.272	0.024	19.52	0.008
7.289	0.024	19.54	0.008
7.305	0.024	19.56	0.004
7.322	0.024	19.57	0.008
7.339	0.024	19.59	0.008
7.355	0.028	19.61	0.008
7.372	0.024	19.62	0.008
7.389	0.024	19.64	0.008
7.405	0.024	19.66	0.008
7.422	0.024	19.67	0.008
7.439	0.024	19.69	0.008
7.455	0.02	19.7	0.012
7.472	0.02	19.72	0.012
7.489	0.02	19.74	0.008

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
7.505	0.024	19.75	0.008
7.522	0.02	19.77	0.008
7.539	0.024	19.79	0.008
7.555	0.02	19.81	0.008
7.572	0.02	19.82	0.008
7.589	0.02	19.84	0.008
7.605	0.02	19.86	0.008
7.622	0.02	19.87	0.008
7.639	0.02	19.89	0.012
7.655	0.02	19.91	0.008
7.672	0.02	19.92	0.012
7.689	0.02	19.94	0.008
7.705	0.02	19.95	0.008
7.722	0.02	19.97	0.008
7.739	0.02	19.99	0.008
7.755	0.02	20.	0.008
7.772	0.02	20.02	0.008
7.789	0.02	20.04	0.008
7.805	0.02	20.06	0.008
7.822	0.02	20.07	0.012
7.839	0.02	20.09	0.008
7.855	0.02	20.11	0.008
7.872	0.02	20.12	0.008
7.889	0.016	20.14	0.008
7.905	0.02	20.16	0.008
7.922	0.02	20.17	0.008
7.939	0.02	20.19	0.008
7.955	0.02	20.2	0.008
7.972	0.02	20.22	0.008
7.989	0.02	20.24	0.008
8.005	0.024	20.25	0.008
8.022	0.02	20.27	0.008
8.039	0.02	20.29	0.008
8.055	0.02	20.31	0.008
8.072	0.02	20.32	0.008
8.089	0.02	20.34	0.012
8.105	0.02	20.36	0.008
8.122	0.02	20.37	0.012
8.139	0.02	20.39	0.008
8.155	0.02	20.41	0.012
8.172	0.02	20.42	0.012
8.189	0.016	20.44	0.012
8.205	0.02	20.45	0.012
8.222	0.02	20.47	0.012
8.239	0.02	20.49	0.012
8.255	0.02	20.5	0.012
8.272	0.02	20.52	0.012
8.289	0.02	20.54	0.012
8.305	0.02	20.56	0.012
8.322	0.02	20.57	0.012
8.339	0.02	20.59	0.012
8.355	0.02	20.61	0.008
8.372	0.02	20.62	0.012
8.389	0.02	20.64	0.012
8.405	0.02	20.66	0.012
8.422	0.02	20.67	0.012
8.439	0.024	20.69	0.012
8.455	0.02	20.7	0.012
8.472	0.02	20.72	0.012
8.489	0.02	20.74	0.012
8.505	0.02	20.75	0.008
8.522	0.02	20.77	0.012
8.539	0.02	20.79	0.012

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
8.555	0.02	20.81	0.012
8.572	0.02	20.82	0.012
8.589	0.02	20.84	0.008
8.605	0.02	20.86	0.008
8.622	0.016	20.87	0.008
8.639	0.02	20.89	0.012
8.655	0.02	20.91	0.008
8.672	0.02	20.92	0.008
8.689	0.02	20.94	0.008
8.705	0.016	20.95	0.008
8.722	0.02	20.97	0.012
8.739	0.02	20.99	0.008
8.755	0.016	21.	0.008
8.772	0.02	21.02	0.012
8.789	0.016	21.04	0.012
8.805	0.016	21.06	0.008
8.822	0.016	21.07	0.012
8.839	0.016	21.09	0.012
8.855	0.016	21.11	0.012
8.872	0.016	21.12	0.012
8.889	0.016	21.14	0.012
8.905	0.016	21.16	0.012
8.922	0.016	21.17	0.008
8.939	0.016	21.19	0.008
8.955	0.02	21.2	0.012
8.972	0.02	21.22	0.012
8.989	0.016	21.24	0.012
9.005	0.016	21.25	0.008
9.022	0.016	21.27	0.012
9.039	0.016	21.29	0.012
9.055	0.016	21.31	0.012
9.072	0.016	21.32	0.012
9.089	0.02	21.34	0.008
9.105	0.016	21.36	0.012
9.122	0.016	21.37	0.012
9.139	0.02	21.39	0.012
9.155	0.02	21.41	0.012
9.172	0.016	21.42	0.012
9.189	0.016	21.44	0.012
9.205	0.016	21.45	0.008
9.222	0.016	21.47	0.012
9.239	0.016	21.49	0.012
9.255	0.016	21.5	0.012
9.272	0.016	21.52	0.012
9.289	0.016	21.54	0.012
9.305	0.016	21.56	0.012
9.322	0.012	21.57	0.008
9.339	0.012	21.59	0.012
9.355	0.016	21.61	0.008
9.372	0.016	21.62	0.008
9.389	0.016	21.64	0.012
9.405	0.012	21.66	0.008
9.422	0.012	21.67	0.008
9.439	0.012	21.69	0.008
9.455	0.012	21.7	0.004
9.472	0.012	21.72	0.008
9.489	0.016	21.74	0.008
9.505	0.016	21.75	0.008
9.522	0.016	21.77	0.008
9.539	0.016	21.79	0.008
9.555	0.016	21.81	0.008
9.572	0.016	21.82	0.008
9.589	0.016	21.84	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
9.605	0.016	21.86	0.008
9.622	0.016	21.87	0.004
9.639	0.016	21.89	0.004
9.655	0.016	21.91	0.004
9.672	0.016	21.92	0.004
9.689	0.016	21.94	0.008
9.705	0.016	21.95	0.004
9.722	0.016	21.97	0.004
9.739	0.016	21.99	0.004
9.755	0.016	22.	0.004
9.772	0.016	22.02	0.004
9.789	0.016	22.04	0.
9.805	0.012	22.06	0.004
9.822	0.016	22.07	0.004
9.839	0.012	22.09	0.004
9.855	0.016	22.11	0.004
9.872	0.016	22.12	0.
9.889	0.012	22.14	0.
9.905	0.012	22.16	-0.007
9.922	0.016	22.17	-0.023
9.939	0.012	22.19	0.
9.955	0.016	22.2	0.004
9.972	0.012	22.22	0.004
9.989	0.016	22.24	0.004
10.01	0.012	22.25	0.004
10.02	0.012	22.27	0.008
10.04	0.012	22.29	0.004
10.06	0.016	22.31	0.008
10.07	0.012	22.32	0.004
10.09	0.016	22.34	0.004
10.11	0.012	22.36	0.008
10.12	0.012	22.37	0.004
10.14	0.012	22.39	0.004
10.15	0.016	22.41	0.004
10.17	0.012	22.42	-0.007
10.19	0.012	22.44	0.004
10.21	0.012	22.45	0.004
10.22	0.012	22.47	0.004
10.24	0.012	22.49	0.004
10.26	0.016	22.5	0.004
10.27	0.016	22.52	0.004
10.29	0.012	22.54	0.004
10.31	0.012	22.56	0.004
10.32	0.012	22.57	0.004
10.34	0.012	22.59	0.004
10.36	0.012	22.61	0.004
10.37	0.012	22.62	0.004
10.39	0.012	22.64	0.004
10.4	0.012	22.66	0.004
10.42	0.012	22.67	0.004
10.44	0.012	22.69	0.004
10.46	0.012	22.7	0.
10.47	0.012	22.72	0.004
10.49	0.012	22.74	-0.046
10.51	0.012	22.75	-0.015
10.52	0.012	22.77	0.004
10.54	0.012	22.79	0.004
10.56	0.016	22.81	0.
10.57	0.012	22.82	0.
10.59	0.012	22.84	0.
10.61	0.012	22.86	0.004
10.62	0.012	22.87	0.
10.64	0.012	22.89	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
10.65	0.012	22.91	0.004
10.67	0.012	22.92	0.004
10.69	0.012	22.94	-0.038
10.71	0.012	22.95	0.
10.72	0.008	22.97	0.
10.74	0.012	22.99	0.004
10.76	0.012	23.	0.004
10.77	0.012	23.02	0.004
10.79	0.012	23.04	0.
10.81	0.012	23.06	0.004
10.82	0.012	23.07	0.004
10.84	0.012	23.09	0.004
10.86	0.012	23.11	0.
10.87	0.012	23.12	0.004
10.89	0.012	23.14	0.004
10.9	0.012	23.16	0.004
10.92	0.012	23.17	0.
10.94	0.012	23.19	0.
10.96	0.012	23.2	0.004
10.97	0.012	23.22	0.004
10.99	0.012	23.24	0.004
11.01	0.016	23.25	0.004
11.02	0.012	23.27	-0.186
11.04	0.012	23.29	-0.232
11.06	0.012	23.31	-0.12
11.07	0.012	23.32	-0.201
11.09	0.012	23.34	-0.077
11.11	0.012	23.36	-0.155
11.12	0.012	23.37	-0.019
11.14	0.012	23.39	0.
11.15	0.012	23.41	0.
11.17	0.012	23.42	0.004
11.19	0.012	23.44	0.004
11.21	0.012	23.45	0.004
11.22	0.012	23.47	0.
11.24	0.012	23.49	0.008
11.26	0.012	23.5	0.008
11.27	0.012	23.52	0.
11.29	0.012	23.54	0.004
11.31	0.012	23.56	0.004
11.32	0.012	23.57	0.004
11.34	0.012	23.59	0.008
11.36	0.012	23.61	0.004
11.37	0.012	23.62	0.004
11.39	0.012	23.64	0.004
11.4	0.012	23.66	0.004
11.42	0.012	23.67	0.
11.44	0.012	23.69	0.004
11.46	0.012	23.7	0.004
11.47	0.012	23.72	0.
11.49	0.012	23.74	0.004
11.51	0.008	23.75	0.004
11.52	0.012	23.77	0.004
11.54	0.012	23.79	0.
11.56	0.012	23.81	0.
11.57	0.012	23.82	0.004
11.59	0.012	23.84	0.004
11.61	0.008	23.86	0.
11.62	0.008	23.87	0.004
11.64	0.008	23.89	0.004
11.65	0.008	23.91	0.008
11.67	0.012	23.92	0.004
11.69	0.008	23.94	0.

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
11.71	0.012	23.95	0.004
11.72	0.008	23.97	0.
11.74	0.012	23.99	-0.05
11.76	0.012	24.	-0.007
11.77	0.012	24.02	0.
11.79	0.008	24.04	0.004
11.81	0.008	24.06	0.004
11.82	0.012	24.07	0.004
11.84	0.012	24.09	0.004
11.86	0.012	24.11	0.004
11.87	0.012	24.12	0.004
11.89	0.012	24.14	0.004
11.9	0.012	24.16	0.004
11.92	0.012	24.17	0.004
11.94	0.012	24.19	0.

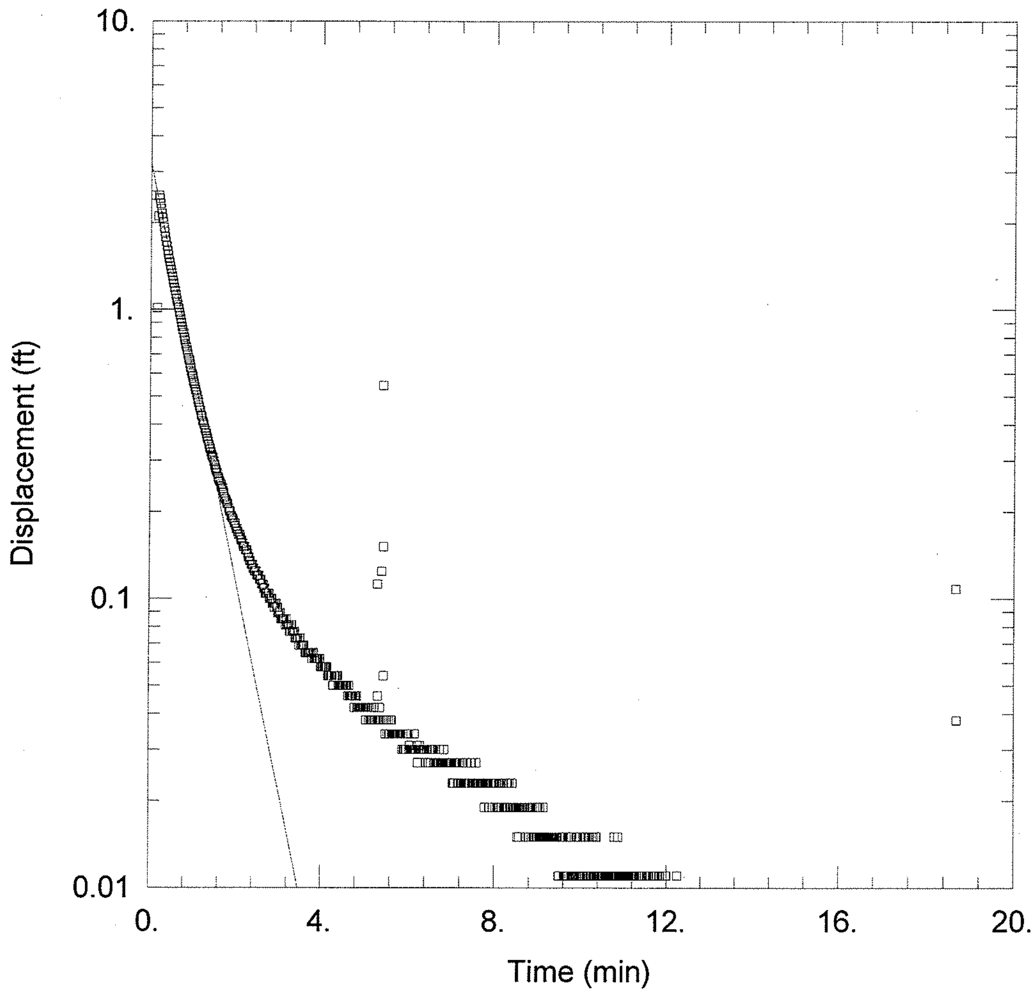
SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.32

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0006844	ft/min
y0	2.343	ft



WELL TEST ANALYSIS

Data Set: K:\...\56gw08r.aqt
Date: 07/15/08 Time: 11:13:40

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Well: 56GW08r
Test Date: 5/1/08

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (56GW08R)

Initial Displacement: 2.482 ft
Total Well Penetration Depth: 11.43 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.43 ft
Screen Length: 10. ft
Wellbore Radius: 0.302 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001325 ft/min y0 = 3.208 ft

Data Set: K:_SOUTHNAVFAC\111626 DO2\Task 15 - CMS Inv 56 61 69\56 CMS Report\Draft\Slug Test Data\
Date: 07/15/08
Time: 11:36:14

PROJECT INFORMATION

Company: Michael Baker Jr. Inc.
Client: US Navy
Project: Naval Activity Puerto Rico
Location: SWMU 56
Test Date: 5/1/08
Test Well: 56GW08r

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: : 56GW08R

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.482 ft
Static Water Column Height: 11.43 ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.302 ft
Well Skin Radius: 0.302 ft
Screen Length: 10. ft
Total Well Penetration Depth: 11.43 ft

No. of Observations: 1151

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.017	-0.004	9.305	0.015
0.022	-0.008	9.322	0.015
0.033	-0.004	9.339	0.015
0.039	-0.008	9.355	0.015
0.05	-0.008	9.372	0.015
0.055	-0.008	9.389	0.015
0.067	-0.008	9.405	0.015
0.072	-0.008	9.422	0.015
0.083	-0.008	9.439	0.015
0.089	-0.008	9.455	0.015
0.1	-0.008	9.472	0.015
0.105	-0.004	9.489	0.011
0.117	-0.008	9.505	0.011
0.122	-0.008	9.522	0.015
0.133	-0.008	9.539	0.015
0.139	-0.008	9.555	0.015
0.15	-0.008	9.572	0.015
0.155	1.012	9.589	0.015
0.167	-0.008	9.605	0.015
0.172	2.109	9.622	0.011
0.183	-0.008	9.639	0.011
0.189	2.482	9.655	0.011
0.2	-0.004	9.672	0.011
0.205	2.424	9.689	0.011
0.217	-0.008	9.705	0.011
0.222	2.327	9.722	0.011
0.233	-0.004	9.739	0.015

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.239	2.233	9.755	0.011
0.25	-0.008	9.772	0.015
0.255	2.152	9.789	0.011
0.267	-0.008	9.805	0.015
0.272	2.074	9.822	0.011
0.283	-0.004	9.839	0.011
0.289	2.001	9.855	0.011
0.3	-0.008	9.872	0.015
0.305	1.923	9.889	0.011
0.317	-0.008	9.905	0.015
0.322	1.853	9.922	0.011
0.339	1.787	9.939	0.015
0.355	1.718	9.955	0.011
0.372	1.656	9.972	0.011
0.389	1.597	9.989	0.015
0.405	1.547	10.01	0.011
0.422	1.5	10.02	0.011
0.439	1.458	10.04	0.011
0.455	1.415	10.06	0.011
0.472	1.376	10.07	0.011
0.489	1.338	10.09	0.015
0.505	1.299	10.11	0.011
0.522	1.26	10.12	0.015
0.539	1.229	10.14	0.015
0.555	1.19	10.15	0.011
0.572	1.159	10.17	0.011
0.589	1.124	10.19	0.011
0.605	1.089	10.21	0.015
0.622	1.062	10.22	0.015
0.639	1.035	10.24	0.011
0.655	1.008	10.26	0.015
0.672	0.977	10.27	0.011
0.689	0.954	10.29	0.015
0.705	0.926	10.31	0.011
0.722	0.899	10.32	0.011
0.739	0.872	10.34	0.011
0.755	0.849	10.36	0.015
0.772	0.829	10.37	0.015
0.789	0.802	10.39	0.011
0.805	0.783	10.4	0.011
0.822	0.76	10.42	0.011
0.839	0.74	10.44	0.011
0.855	0.721	10.46	0.011
0.872	0.701	10.47	0.011
0.889	0.678	10.49	0.011
0.905	0.667	10.51	0.011
0.922	0.647	10.52	0.011
0.939	0.628	10.54	0.011
0.955	0.612	10.56	0.011
0.972	0.597	10.57	0.011
0.989	0.585	10.59	0.011
1.005	0.566	10.61	0.011
1.022	0.554	10.62	0.011
1.039	0.539	10.64	0.011
1.055	0.527	10.65	0.011
1.072	0.515	10.67	0.011
1.089	0.504	10.69	0.011
1.105	0.488	10.71	0.011
1.122	0.477	10.72	0.011
1.139	0.465	10.74	0.011
1.155	0.457	10.76	0.011
1.172	0.446	10.77	0.011
1.189	0.43	10.79	0.015

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.205	0.426	10.81	0.011
1.222	0.411	10.82	0.011
1.239	0.407	10.84	0.011
1.255	0.399	10.86	0.011
1.272	0.387	10.87	0.015
1.289	0.38	10.89	0.011
1.305	0.372	10.9	0.011
1.322	0.364	10.92	0.011
1.339	0.356	10.94	0.011
1.355	0.349	10.96	0.011
1.372	0.341	10.97	0.011
1.389	0.333	10.99	0.011
1.405	0.329	11.01	0.011
1.422	0.321	11.02	0.011
1.439	0.314	11.04	0.011
1.455	0.31	11.06	0.011
1.472	0.306	11.07	0.011
1.489	0.298	11.09	0.011
1.505	0.29	11.11	0.011
1.522	0.283	11.12	0.011
1.539	0.279	11.14	0.011
1.555	0.275	11.15	0.011
1.572	0.271	11.17	0.011
1.589	0.263	11.19	0.011
1.605	0.259	11.21	0.007
1.622	0.255	11.22	0.011
1.639	0.252	11.24	0.011
1.655	0.248	11.26	0.011
1.672	0.244	11.27	0.011
1.689	0.24	11.29	0.007
1.705	0.236	11.31	0.011
1.722	0.232	11.32	0.007
1.739	0.224	11.34	0.007
1.755	0.221	11.36	0.007
1.772	0.221	11.37	0.011
1.789	0.217	11.39	0.007
1.805	0.213	11.4	0.011
1.822	0.213	11.42	0.011
1.839	0.205	11.44	0.011
1.855	0.201	11.46	0.011
1.872	0.201	11.47	0.007
1.889	0.193	11.49	0.007
1.905	0.193	11.51	0.011
1.922	0.19	11.52	0.007
1.939	0.19	11.54	0.007
1.955	0.186	11.56	0.011
1.972	0.182	11.57	0.007
1.989	0.182	11.59	0.011
2.005	0.178	11.61	0.007
2.022	0.174	11.62	0.007
2.039	0.174	11.64	0.011
2.055	0.17	11.65	0.007
2.072	0.166	11.67	0.007
2.089	0.166	11.69	0.011
2.105	0.166	11.71	0.011
2.122	0.162	11.72	0.011
2.139	0.159	11.74	0.011
2.155	0.159	11.76	0.011
2.172	0.155	11.77	0.007
2.189	0.151	11.79	0.011
2.205	0.151	11.81	0.007
2.222	0.151	11.82	0.007
2.239	0.147	11.84	0.011

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.255	0.147	11.86	0.011
2.272	0.147	11.87	0.007
2.289	0.143	11.89	0.007
2.305	0.139	11.9	0.007
2.322	0.139	11.92	0.007
2.339	0.135	11.94	0.007
2.355	0.135	11.96	0.007
2.372	0.131	11.97	0.007
2.389	0.131	11.99	0.011
2.405	0.131	12.01	0.011
2.422	0.127	12.02	0.007
2.439	0.127	12.04	0.007
2.455	0.124	12.06	0.007
2.472	0.124	12.07	0.007
2.489	0.124	12.09	0.007
2.505	0.12	12.11	0.007
2.522	0.12	12.12	0.007
2.539	0.12	12.14	0.007
2.555	0.12	12.15	0.007
2.572	0.116	12.17	0.007
2.589	0.116	12.19	0.007
2.605	0.116	12.21	0.007
2.622	0.112	12.22	0.007
2.639	0.112	12.24	0.007
2.655	0.112	12.26	0.011
2.672	0.108	12.27	0.007
2.689	0.108	12.29	0.007
2.705	0.104	12.31	0.007
2.722	0.104	12.32	0.007
2.739	0.104	12.34	0.007
2.755	0.104	12.36	0.007
2.772	0.104	12.37	0.007
2.789	0.104	12.39	0.007
2.805	0.1	12.4	0.007
2.822	0.1	12.42	0.007
2.839	0.1	12.44	0.007
2.855	0.1	12.46	0.007
2.872	0.096	12.47	0.007
2.889	0.096	12.49	0.007
2.905	0.096	12.51	0.007
2.922	0.093	12.52	0.007
2.939	0.096	12.54	0.003
2.955	0.096	12.56	0.007
2.972	0.093	12.57	0.007
2.989	0.093	12.59	0.007
3.005	0.089	12.61	0.003
3.022	0.089	12.62	0.007
3.039	0.089	12.64	0.007
3.055	0.089	12.65	0.007
3.072	0.085	12.67	0.007
3.089	0.085	12.69	0.003
3.105	0.085	12.71	0.007
3.122	0.085	12.72	0.007
3.139	0.085	12.74	0.007
3.155	0.085	12.76	0.007
3.172	0.081	12.77	0.007
3.189	0.085	12.79	0.007
3.205	0.081	12.81	0.007
3.222	0.081	12.82	0.007
3.239	0.081	12.84	0.007
3.255	0.081	12.86	0.007
3.272	0.077	12.87	0.007
3.289	0.077	12.89	0.007

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.305	0.081	12.9	0.007
3.322	0.081	12.92	0.003
3.339	0.077	12.94	0.003
3.355	0.077	12.96	0.003
3.372	0.077	12.97	0.007
3.389	0.077	12.99	0.007
3.405	0.073	13.01	0.003
3.422	0.073	13.02	0.007
3.439	0.073	13.04	0.007
3.455	0.073	13.06	0.007
3.472	0.073	13.07	0.003
3.489	0.069	13.09	0.007
3.505	0.073	13.11	0.003
3.522	0.073	13.12	0.007
3.539	0.069	13.14	0.007
3.555	0.069	13.15	0.007
3.572	0.069	13.17	0.007
3.589	0.069	13.19	0.007
3.605	0.069	13.21	0.003
3.622	0.069	13.22	0.007
3.639	0.065	13.24	0.007
3.655	0.065	13.26	0.007
3.672	0.065	13.27	0.007
3.689	0.065	13.29	0.007
3.705	0.065	13.31	0.007
3.722	0.065	13.32	0.007
3.739	0.065	13.34	0.007
3.755	0.065	13.36	0.007
3.772	0.065	13.37	0.007
3.789	0.065	13.39	0.003
3.805	0.062	13.4	0.007
3.822	0.065	13.42	0.007
3.839	0.065	13.44	0.007
3.855	0.062	13.46	0.007
3.872	0.062	13.47	0.003
3.889	0.062	13.49	0.003
3.905	0.062	13.51	0.003
3.922	0.062	13.52	0.003
3.939	0.062	13.54	0.007
3.955	0.062	13.56	0.007
3.972	0.062	13.57	0.007
3.989	0.062	13.59	0.007
4.005	0.058	13.61	0.007
4.022	0.058	13.62	0.007
4.039	0.058	13.64	0.007
4.055	0.058	13.65	0.007
4.072	0.058	13.67	0.007
4.089	0.058	13.69	0.007
4.105	0.058	13.71	0.007
4.122	0.058	13.72	0.007
4.139	0.058	13.74	0.007
4.155	0.058	13.76	0.007
4.172	0.054	13.77	0.007
4.189	0.054	13.79	0.007
4.205	0.054	13.81	0.007
4.222	0.054	13.82	0.003
4.239	0.054	13.84	0.007
4.255	0.054	13.86	0.007
4.272	0.054	13.87	0.007
4.289	0.05	13.89	0.007
4.305	0.05	13.9	0.007
4.322	0.054	13.92	0.007
4.339	0.054	13.94	0.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
4.355	0.054	13.96	0.007
4.372	0.054	13.97	0.007
4.389	0.054	13.99	0.007
4.405	0.054	14.01	0.007
4.422	0.05	14.02	0.007
4.439	0.05	14.04	0.007
4.455	0.05	14.06	0.003
4.472	0.05	14.07	0.003
4.489	0.05	14.09	0.003
4.505	0.05	14.11	0.003
4.522	0.05	14.12	0.003
4.539	0.05	14.14	0.003
4.555	0.05	14.15	0.003
4.572	0.05	14.17	0.003
4.589	0.05	14.19	0.007
4.605	0.05	14.21	0.007
4.622	0.05	14.22	0.003
4.639	0.046	14.24	0.003
4.655	0.05	14.26	0.003
4.672	0.046	14.27	0.007
4.689	0.046	14.29	0.003
4.705	0.046	14.31	0.003
4.722	0.046	14.32	0.007
4.739	0.046	14.34	0.003
4.755	0.046	14.36	0.003
4.772	0.046	14.37	0.003
4.789	0.042	14.39	0.003
4.805	0.046	14.4	0.003
4.822	0.046	14.42	0.003
4.839	0.046	14.44	0.003
4.855	0.042	14.46	0.003
4.872	0.042	14.47	0.003
4.889	0.042	14.49	0.003
4.905	0.042	14.51	0.003
4.922	0.042	14.52	0.003
4.939	0.042	14.54	0.003
4.955	0.042	14.56	0.003
4.972	0.042	14.57	0.003
4.989	0.042	14.59	0.003
5.005	0.042	14.61	0.003
5.022	0.042	14.62	0.007
5.039	0.042	14.64	0.003
5.055	0.038	14.65	0.003
5.072	0.042	14.67	0.003
5.089	0.042	14.69	0.003
5.105	0.042	14.71	0.003
5.122	0.038	14.72	0.003
5.139	0.042	14.74	0.003
5.155	0.038	14.76	0.003
5.172	0.038	14.77	0.003
5.189	0.038	14.79	0.003
5.205	0.038	14.81	0.003
5.222	0.038	14.82	0.007
5.239	0.042	14.84	0.007
5.255	0.038	14.86	0.007
5.272	0.038	14.87	0.003
5.289	0.038	14.89	0.007
5.305	0.112	14.9	0.007
5.322	0.046	14.92	0.003
5.339	0.038	14.94	0.003
5.355	0.038	14.96	0.003
5.372	0.042	14.97	0.003
5.389	0.038	14.99	0.007

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
5.405	0.124	15.01	0.003
5.422	0.546	15.02	0.007
5.439	0.151	15.04	0.003
5.455	0.054	15.06	0.003
5.472	0.038	15.07	0.003
5.489	0.038	15.09	0.003
5.505	0.034	15.11	0.003
5.522	0.038	15.12	0.003
5.539	0.038	15.14	0.003
5.555	0.034	15.15	0.003
5.572	0.038	15.17	0.003
5.589	0.034	15.19	0.003
5.605	0.034	15.21	0.003
5.622	0.038	15.22	0.003
5.639	0.038	15.24	0.003
5.655	0.034	15.26	0.003
5.672	0.034	15.27	0.003
5.689	0.034	15.29	-0.001
5.705	0.034	15.31	0.003
5.722	0.034	15.32	0.003
5.739	0.034	15.34	0.003
5.755	0.034	15.36	-0.001
5.772	0.034	15.37	-0.001
5.789	0.034	15.39	0.003
5.805	0.034	15.4	0.003
5.822	0.034	15.42	0.003
5.839	0.034	15.44	0.003
5.855	0.034	15.46	0.003
5.872	0.034	15.47	0.003
5.889	0.03	15.49	0.003
5.905	0.034	15.51	0.003
5.922	0.03	15.52	-0.001
5.939	0.03	15.54	0.003
5.955	0.03	15.56	0.003
5.972	0.03	15.57	0.003
5.989	0.03	15.59	0.003
6.005	0.034	15.61	0.003
6.022	0.034	15.62	0.003
6.039	0.034	15.64	0.003
6.055	0.03	15.65	0.003
6.072	0.031	15.67	0.003
6.089	0.03	15.69	0.003
6.105	0.03	15.71	0.003
6.122	0.03	15.72	0.003
6.139	0.03	15.74	0.003
6.155	0.03	15.76	0.003
6.172	0.034	15.77	0.003
6.189	0.03	15.79	0.003
6.205	0.03	15.81	0.003
6.222	0.03	15.82	0.003
6.239	0.031	15.84	0.003
6.255	0.027	15.86	0.003
6.272	0.03	15.87	0.003
6.289	0.031	15.89	-0.001
6.305	0.03	15.9	0.003
6.322	0.03	15.92	-0.001
6.339	0.03	15.94	-0.001
6.355	0.03	15.96	-0.001
6.372	0.03	15.97	0.003
6.389	0.03	15.99	0.003
6.405	0.03	16.	0.003
6.422	0.03	16.02	0.003
6.439	0.027	16.04	0.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
6.455	0.03	16.06	0.003
6.472	0.03	16.07	0.003
6.489	0.027	16.09	0.003
6.505	0.027	16.11	-0.001
6.522	0.03	16.12	0.003
6.539	0.03	16.14	0.003
6.555	0.027	16.16	0.007
6.572	0.03	16.17	0.003
6.589	0.03	16.19	0.003
6.605	0.03	16.2	0.003
6.622	0.03	16.22	0.003
6.639	0.027	16.24	0.007
6.655	0.03	16.25	0.003
6.672	0.027	16.27	0.003
6.689	0.027	16.29	0.003
6.705	0.027	16.31	0.003
6.722	0.027	16.32	0.003
6.739	0.027	16.34	0.003
6.755	0.03	16.36	-0.001
6.772	0.027	16.37	0.003
6.789	0.027	16.39	0.007
6.805	0.027	16.41	0.003
6.822	0.027	16.42	0.003
6.839	0.027	16.44	0.003
6.855	0.03	16.45	0.003
6.872	0.027	16.47	0.003
6.889	0.027	16.49	0.003
6.905	0.027	16.5	0.003
6.922	0.027	16.52	-0.001
6.939	0.027	16.54	0.003
6.955	0.027	16.56	0.003
6.972	0.027	16.57	0.003
6.989	0.027	16.59	0.003
7.005	0.027	16.61	0.003
7.022	0.027	16.62	-0.001
7.039	0.027	16.64	0.003
7.055	0.023	16.66	-0.001
7.072	0.023	16.67	0.003
7.089	0.023	16.69	0.003
7.105	0.027	16.7	0.003
7.122	0.027	16.72	0.003
7.139	0.027	16.74	0.003
7.155	0.027	16.75	0.003
7.172	0.023	16.77	0.003
7.189	0.023	16.79	0.003
7.205	0.023	16.81	0.003
7.222	0.027	16.82	0.003
7.239	0.023	16.84	0.003
7.255	0.023	16.86	0.003
7.272	0.027	16.87	0.003
7.289	0.027	16.89	0.003
7.305	0.023	16.91	0.003
7.322	0.023	16.92	0.003
7.339	0.023	16.94	0.003
7.355	0.023	16.95	0.003
7.372	0.027	16.97	0.003
7.389	0.023	16.99	0.003
7.405	0.023	17.	-0.001
7.422	0.023	17.02	0.003
7.439	0.023	17.04	0.003
7.455	0.023	17.06	-0.001
7.472	0.027	17.07	0.003
7.489	0.027	17.09	0.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
7.505	0.023	17.11	0.003
7.522	0.023	17.12	0.003
7.539	0.023	17.14	-0.001
7.555	0.023	17.16	0.003
7.572	0.023	17.17	-0.001
7.589	0.027	17.19	0.003
7.605	0.023	17.2	0.003
7.622	0.023	17.22	0.003
7.639	0.023	17.24	-0.001
7.655	0.023	17.25	0.003
7.672	0.023	17.27	-0.001
7.689	0.023	17.29	-0.001
7.705	0.023	17.31	0.003
7.722	0.023	17.32	0.003
7.739	0.023	17.34	0.003
7.755	0.023	17.36	0.003
7.772	0.023	17.37	0.
7.789	0.019	17.39	0.003
7.805	0.023	17.41	0.003
7.822	0.023	17.42	-0.001
7.839	0.023	17.44	0.003
7.855	0.023	17.45	0.003
7.872	0.023	17.47	0.003
7.889	0.019	17.49	0.003
7.905	0.019	17.5	0.003
7.922	0.023	17.52	0.003
7.939	0.023	17.54	0.003
7.955	0.023	17.56	-0.001
7.972	0.019	17.57	-0.001
7.989	0.023	17.59	0.003
8.005	0.023	17.61	0.003
8.022	0.023	17.62	0.003
8.039	0.019	17.64	0.003
8.055	0.023	17.66	0.003
8.072	0.023	17.67	0.003
8.089	0.019	17.69	0.003
8.105	0.019	17.7	0.003
8.122	0.019	17.72	-0.001
8.139	0.019	17.74	0.003
8.155	0.023	17.75	0.003
8.172	0.023	17.77	-0.001
8.189	0.019	17.79	-0.001
8.205	0.023	17.81	0.003
8.222	0.023	17.82	0.003
8.239	0.019	17.84	-0.001
8.255	0.019	17.86	-0.001
8.272	0.019	17.87	-0.001
8.289	0.023	17.89	-0.001
8.305	0.023	17.91	-0.001
8.322	0.023	17.92	-0.001
8.339	0.019	17.94	0.
8.355	0.023	17.95	-0.001
8.372	0.019	17.97	-0.001
8.389	0.019	17.99	-0.001
8.405	0.019	18.	-0.001
8.422	0.023	18.02	-0.001
8.439	0.019	18.04	-0.001
8.455	0.019	18.06	-0.001
8.472	0.019	18.07	-0.001
8.489	0.019	18.09	0.003
8.505	0.019	18.11	0.003
8.522	0.019	18.12	-0.001
8.539	0.015	18.14	0.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
8.555	0.019	18.16	-0.001
8.572	0.015	18.17	0.003
8.589	0.019	18.19	-0.001
8.605	0.019	18.2	-0.001
8.622	0.019	18.22	0.003
8.639	0.019	18.24	-0.001
8.655	0.019	18.25	0.003
8.672	0.019	18.27	0.003
8.689	0.019	18.29	0.003
8.705	0.019	18.31	0.003
8.722	0.019	18.32	0.003
8.739	0.015	18.34	0.003
8.755	0.019	18.36	0.003
8.772	0.019	18.37	0.003
8.789	0.019	18.39	0.003
8.805	0.015	18.41	-0.001
8.822	0.015	18.42	0.003
8.839	0.019	18.44	0.003
8.855	0.019	18.45	0.003
8.872	0.015	18.47	0.003
8.889	0.019	18.49	0.003
8.905	0.015	18.5	0.003
8.922	0.015	18.52	0.003
8.939	0.015	18.54	0.003
8.955	0.015	18.56	0.003
8.972	0.015	18.57	-0.001
8.989	0.019	18.59	0.003
9.005	0.019	18.61	0.003
9.022	0.019	18.62	0.003
9.039	0.015	18.64	-0.001
9.055	0.019	18.66	-0.001
9.072	0.015	18.67	0.108
9.089	0.015	18.69	0.038
9.105	0.015	18.7	0.007
9.122	0.015	18.72	0.003
9.139	0.019	18.74	0.
9.155	0.015	18.75	-0.001
9.172	0.015	18.77	-0.001
9.189	0.015	18.79	0.003
9.205	0.015	18.81	-0.001
9.222	0.015	18.82	0.003
9.239	0.015	18.84	0.003
9.255	0.015	18.86	-0.001
9.272	0.015	18.87	0.003
9.289	0.015		

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
Shape Factor: 2.32

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.001325	ft/min
y0	3.208	ft

APPENDIX B
LABORATORY ANALYTICAL RESULTS

SOIL DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03	
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB03-00D	
Date	4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	0.0-1.0		0.0-1.0		0.0-1.0		0.0-1.0	
Volatile Organic Compounds (ug/kg)								
1,1,1,2-Tetrachloroethane	0.62	U	0.62	U	0.55	U	0.56	U
1,1,1-Trichloroethane	0.56	U	0.56	U	0.5	U	0.51	U
1,1,2,2-Tetrachloroethane	1.3	U	1.4	U	1.2	U	1.2	U
1,1,2-Trichloroethane	1.2	U	1.2	U	1	U	1.1	U
1,1-Dichloroethane	0.48	U	0.48	U	0.43	U	0.44	U
1,1-Dichloroethene	0.52	U	0.52	U	0.46	U	0.48	U
1,2,3-Trichloropropane	1.3	U	1.4	U	1.2	U	1.2	U
1,2-Dibromo-3-Chloropropane	2.7	U	2.7	U	2.4	U	2.5	U
1,2-Dichloroethane	0.96	U	0.96	U	0.86	U	0.88	U
1,2-Dichloropropane	1.1	U	1.1	U	0.95	U	0.97	U
2-Butanone (MEK)	2.6	U	2.6	U	12	U	19	U
2-Chloro-1,3-butadiene	0.55	UJ	0.55	U	0.49	U	0.5	U
2-Hexanone	2	U	2	U	1.8	U	1.9	U
3-Chloro-1-propene	1.4	R	1.4	UJ	1.3	UJ	1.3	UJ
4-Methyl-2-pentanone (MIBK)	2.8	U	2.8	U	2.5	U	2.6	U
Acetone	50	J	89	J	130	J	270	J
Acetonitrile	43	UJ	43	U	39	U	40	U
Acrolein	18	R	18	R	16	R	17	R
Acrylonitrile	22	UJ	22	U	20	U	20	U
Benzene	0.76	U	0.76	U	0.68	U	0.7	U
Bromoform	1.1	U	1.1	U	0.95	U	0.97	U
Bromomethane	1.5	UJ	1.5	U	1.4	U	1.4	U
Carbon disulfide	0.49	U	0.49	U	0.44	U	0.45	U
Carbon tetrachloride	0.96	U	0.96	U	0.86	U	0.88	U
Chlorobenzene	0.7	U	0.7	U	0.63	U	0.64	U
Chlorodibromomethane	0.48	U	0.48	U	0.43	U	0.44	U
Chloroethane	1.2	U	1.2	U	1	U	1.1	U
Chloroform	0.48	U	0.48	U	0.43	U	0.44	U
Chloromethane	0.68	U	0.69	U	1.1	J	2.2	J
cis-1,3-Dichloropropene	0.84	U	0.84	U	0.75	U	0.77	U
Dibromomethane	1.2	U	1.2	U	1	U	1.1	U
Dichlorobromomethane	0.8	U	0.8	U	0.71	U	0.73	U
Dichlorodifluoromethane	0.86	U	0.86	U	0.77	U	0.78	U
Ethyl methacrylate	2.1	U	2.1	U	1.9	U	1.9	U
Ethylbenzene	0.72	U	0.72	U	0.65	U	0.66	U
Ethylene Dibromide	1.4	U	1.4	U	1.3	U	1.3	U
Iodomethane	1	J	0.96	UJ	2.2	J	1.8	J
Isobutyl alcohol	66	U	67	U	59	R	61	R
Methacrylonitrile	23	U	23	U	21	UJ	21	UJ
Methyl methacrylate	3.6	U	3.6	U	3.2	UJ	3.3	UJ
Methylene Chloride	0.96	U	0.96	U	0.86	U	0.88	U
Pentachloroethane	2.1	U	2.1	U	1.9	UJ	1.9	UJ
Propionitrile	20	UJ	20	U	18	U	19	U
Styrene	0.63	U	0.64	U	0.57	U	0.58	U
Tetrachloroethene	0.7	U	0.7	U	0.63	U	0.64	U
Toluene	0.76	U	0.76	U	0.68	U	0.7	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03	
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB03-00D	
Date	4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	0.0-1.0		0.0-1.0		0.0-1.0		0.0-1.0	
Volatile Organic Compounds (ug/kg)								
trans-1,2-Dichloroethene	0.93	U	0.94	U	0.84	U	0.85	U
trans-1,3-Dichloropropene	0.84	U	0.84	U	0.75	U	0.77	U
trans-1,4-Dichloro-2-butene	3	U	3	U	2.7	UJ	2.7	UJ
Trichloroethene	0.96	U	0.96	U	0.86	U	0.88	U
Trichlorofluoromethane	1.4	U	1.4	U	1.3	U	1.3	U
Vinyl acetate	1.4	UJ	1.4	U	1.3	U	1.3	U
Vinyl chloride	0.56	U	0.56	U	0.5	U	0.51	U
Xylenes, Total	2.2	U	2.2	U	2	U	2	U
Semivolatile Organic Compounds (ug/kg)								
1,1'-Biphenyl	9.6	U	9.5	U	8.9	UJ	8.9	UJ
1,2,4,5-Tetrachlorobenzene	8.2	U	8.1	U	7.6	UJ	7.6	UJ
1,2,4-Trichlorobenzene	9.6	U	9.5	U	8.9	UJ	8.9	UJ
1,2-Dichlorobenzene	9.1	U	9	U	8.4	UJ	8.5	UJ
1,3,5-Trinitrobenzene	22	U	22	U	20	UJ	21	UJ
1,3-Dichlorobenzene	7.8	U	7.7	U	7.2	UJ	7.3	UJ
1,3-Dinitrobenzene	5.1	U	5	U	4.7	UJ	4.7	UJ
1,4-Dichlorobenzene	8.1	U	8	U	7.5	UJ	7.5	UJ
1,4-Dioxane	10	U	10	U	9.6	UJ	9.7	UJ
1,4-Naphthoquinone	5.1	U	5	U	4.7	UJ	4.7	UJ
2,2'-oxybis[1-chloropropane]	8.2	U	8.1	U	7.6	UJ	7.6	UJ
2,3,4,6-Tetrachlorophenol	5.5	U	5.4	U	5.1	UJ	5.1	UJ
2,4,5-Trichlorophenol	8.9	U	8.8	U	8.2	UJ	8.2	UJ
2,4,6-Trichlorophenol	10	U	10	U	9.5	UJ	9.5	UJ
2,4-Dichlorophenol	11	U	10	U	9.8	UJ	9.8	UJ
2,4-Dimethylphenol	22	U	22	U	20	UJ	21	UJ
2,4-Dinitrophenol	110	UJ	110	UJ	100	UJ	100	UJ
2,4-Dinitrotoluene	7.7	U	7.6	UJ	7.1	UJ	7.1	UJ
2,6-Dichlorophenol	8.3	U	8.2	U	7.7	UJ	7.7	UJ
2,6-Dinitrotoluene	8.1	U	8	U	7.5	UJ	7.5	UJ
2-Acetylaminofluorene	6.6	U	6.6	U	6.1	UJ	6.2	UJ
2-Chloronaphthalene	8.1	U	8	U	7.5	UJ	7.5	UJ
2-Chlorophenol	8.6	U	8.5	U	8	UJ	8	UJ
2-Methylnaphthalene	2.2	U	2.2	U	2	UJ	2.1	UJ
2-Methylphenol	11	U	10	U	9.8	UJ	9.8	UJ
2-Naphthylamine	26	UJ	26	U	24	UJ	24	UJ
2-Nitroaniline	8.5	U	8.4	U	7.8	UJ	7.9	UJ
2-Nitrophenol	9.5	U	9.4	U	8.8	UJ	8.8	UJ
2-Picoline	16	U	15	U	14	UJ	15	UJ
2-Toluidine	12	U	12	U	11	UJ	11	UJ
3 & 4 Methylphenol	9.5	U	9.4	U	8.8	UJ	8.8	UJ
3,3'-Dichlorobenzidine	12	U	12	U	11	UJ	11	UJ
3,3'-Dimethylbenzidine	230	UJ	230	U	220	UJ	220	UJ
3-Methylcholanthrene	8	U	7.9	U	7.3	UJ	7.4	UJ
3-Nitroaniline	5.9	U	5.8	U	5.4	UJ	5.4	UJ
4,6-Dinitro-2-methylphenol	7.6	UJ	7.5	UJ	7	UJ	7	UJ
4-Aminobiphenyl	17	U	17	U	16	UJ	16	UJ
4-Bromophenyl phenyl ether	9.3	U	9.1	U	8.6	UJ	8.6	UJ
4-Chloro-3-methylphenol	9.8	U	9.7	U	9	UJ	9.1	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03	
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB03-00D	
Date	4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	0.0-1.0		0.0-1.0		0.0-1.0		0.0-1.0	
Semivolatile Organic Compounds (ug/kg)								
4-Chloroaniline	7.8	U	7.7	U	7.2	UJ	7.3	UJ
4-Chlorophenyl phenyl ether	8.1	U	8	U	7.5	UJ	7.5	UJ
4-Nitroaniline	10	U	9.9	UJ	9.3	UJ	9.3	UJ
4-Nitrophenol	43	U	42	UJ	40	UJ	40	UJ
4-Nitroquinoline-1-oxide	14	R	14	R	13	R	13	R
7,12-Dimethylbenz(a)anthracene	12	U	12	U	11	UJ	11	UJ
Acenaphthene	0.74	U	0.73	U	0.69	UJ	0.69	UJ
Acenaphthylene	2.2	U	2.2	U	2	UJ	2.1	UJ
Acetophenone	11	U	11	U	10	UJ	10	UJ
alpha,alpha-Dimethyl phenethylamine	77	U	76	U	71	UJ	71	UJ
Aniline	8.2	U	8.1	U	7.6	UJ	7.6	UJ
Anthracene	2.2	U	2.2	U	2	UJ	2.1	UJ
Aramite, Total	14	UJ	14	U	13	UJ	13	UJ
Benzo[a]anthracene	2.2	U	2.2	U	3.1	UJ	9.2	J
Benzo[a]pyrene	0.86	U	0.85	U	3.6	J	20	J
Benzo[b]fluoranthene	0.99	U	0.98	U	9.2	J	44	J
Benzo[g,h,i]perylene	2.2	U	2.2	U	2	UJ	17	J
Benzo[k]fluoranthene	1.3	U	1.3	U	1.2	UJ	1.2	UJ
Benzyl alcohol	10	U	10	U	9.6	UJ	9.7	UJ
Bis(2-chloroethoxy)methane	8.9	U	8.8	U	8.2	UJ	8.2	UJ
Bis(2-chloroethyl)ether	7.4	U	7.3	U	6.9	UJ	6.9	UJ
Bis(2-ethylhexyl) phthalate	14	U	9.9	U	47	UJ	80	UJ
Butyl benzyl phthalate	9.4	U	9.3	U	8.7	UJ	10	J
Chrysene	0.8	U	0.79	U	2.9	J	36	J
Diallate	13	U	12	U	12	UJ	12	UJ
Dibenz(a,h)anthracene	0.77	U	0.76	U	0.71	UJ	2.9	J
Dibenzofuran	5.5	U	5.4	U	5.1	UJ	5.1	UJ
Diethyl phthalate	14	U	14	U	13	UJ	13	UJ
Dimethyl phthalate	8.3	U	8.2	U	7.7	UJ	7.7	UJ
Di-n-butyl phthalate	33	U	32	U	30	UJ	30	UJ
Di-n-octyl phthalate	4.3	U	4.2	U	4	UJ	4	UJ
Dinoseb	22	U	22	U	20	UJ	21	UJ
Ethyl methanesulfonate	14	U	14	U	13	UJ	13	UJ
Fluoranthene	2.2	U	2.2	U	2.2	J	9.2	J
Fluorene	1	U	0.99	U	0.93	UJ	0.93	UJ
Hexachlorobenzene	8.9	U	8.8	U	8.2	UJ	8.2	UJ
Hexachlorobutadiene	12	U	12	U	11	UJ	11	UJ
Hexachlorocyclopentadiene	18	U	18	U	17	UJ	17	UJ
Hexachloroethane	9.6	U	9.5	U	8.9	UJ	8.9	UJ
Hexachlorophene	1100	R	1100	R	1000	UJ	1000	UJ
Hexachloropropene	9.4	UJ	9.3	UJ	8.7	UJ	8.7	UJ
Indeno[1,2,3-cd]pyrene	1.6	UJ	1.5	UJ	1.9	UJ	7.5	J
Isophorone	8.1	U	8	U	7.5	UJ	7.5	UJ
Isosafrole	9.3	U	9.1	U	8.6	UJ	8.6	UJ
Methapyrilene	12	UJ	12	UJ	11	UJ	11	UJ
Methyl methanesulfonate	12	U	12	U	11	UJ	11	UJ
Naphthalene	0.78	U	0.77	U	0.72	UJ	0.73	UJ
Nitrobenzene	9	U	8.9	U	8.3	UJ	8.3	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03	
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB03-00D	
Date	4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	0.0-1.0		0.0-1.0		0.0-1.0		0.0-1.0	
Semivolatile Organic Compounds (ug/kg)								
N-Nitro-o-toluidine	7.8	U	7.7	U	7.2	UJ	7.3	UJ
N-Nitrosodiethylamine	16	U	15	U	14	UJ	15	UJ
N-Nitrosodimethylamine	13	U	13	U	12	UJ	12	UJ
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	11	UJ	11	UJ
N-Nitrosodi-n-propylamine	8.5	U	8.4	U	7.8	UJ	7.9	UJ
N-Nitrosodiphenylamine	9.3	U	9.1	U	8.6	UJ	8.6	UJ
N-Nitrosomethylethylamine	7.4	U	7.3	U	6.9	UJ	6.9	UJ
N-Nitrosomorpholine	8.6	UJ	8.5	UJ	8	UJ	8	UJ
N-Nitrosopiperidine	11	UJ	11	U	10	UJ	10	UJ
N-Nitrosopyrrolidine	12	UJ	11	U	11	UJ	11	UJ
p-Dimethylamino azobenzene	9.3	U	9.1	U	8.6	UJ	8.6	UJ
Pentachlorobenzene	8.1	U	8	U	7.5	UJ	7.5	UJ
Pentachloronitrobenzene	7.7	U	7.6	U	7.1	UJ	7.1	UJ
Pentachlorophenol	11	U	11	U	10	UJ	10	UJ
Phenacetin	6.1	U	6.1	U	5.7	UJ	5.7	UJ
Phenanthrene	2.2	UJ	2.2	UJ	2	UJ	2.3	J
Phenol	6.3	U	6.2	U	5.8	UJ	5.8	UJ
p-Phenylene diamine	210	U	210	U	190	UJ	190	UJ
Pronamide	12	U	12	U	11	UJ	11	UJ
Pyrene	2.2	U	2.2	U	3.6	J	16	J
Pyridine	14	U	14	U	13	UJ	13	UJ
Safrole, Total	11	U	11	U	10	UJ	10	UJ
Metals (mg/kg)								
Antimony	2		0.14	U	0.095	UJ	0.11	UJ
Arsenic	2.3		2.4		2.9		2.8	
Barium	39	J	16	J	130	J	130	J
Beryllium	0.14		0.096	J	0.27		0.28	
Cadmium	3.3	J	0.1	J	0.16	J	0.13	J
Chromium	33		21		17	J	19	J
Cobalt	12		4.2		25	J	29	J
Copper	81	J	50	J	67	J	67	J
Lead	210		6.1		8.3	J	10	J
Mercury	0.015	J	0.033		0.043	J	0.046	J
Nickel	12		4.4		8.5	J	8.9	J
Selenium	1.6		2.7		0.59	J	0.61	J
Silver	0.24	J	0.032	J	0.069	UJ	0.042	UJ
Thallium	0.15	U	0.14	U	0.17	J	0.16	J
Tin	5	U	4.8	U	4.4	U	4.7	U
Vanadium	170	J	250	J	190	J	200	J
Zinc	77	J	25	J	48	J	54	J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07	
Sample ID	56SB04-00		56SB05-00		56SB06-00		56SB07-00	
Date	4/28/2008		4/29/2008		4/30/2008		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	0.64	U	0.64	U	0.65	U	0.59	U
1,1,1-Trichloroethane	0.58	U	0.58	U	0.59	U	0.53	U
1,1,2,2-Tetrachloroethane	1.4	U	1.4	U	1.4	U	1.3	U
1,1,2-Trichloroethane	1.2	U	1.2	U	1.2	U	1.1	U
1,1-Dichloroethane	0.5	U	0.5	U	0.5	U	0.46	U
1,1-Dichloroethene	0.54	U	0.54	U	0.54	U	0.5	U
1,2,3-Trichloropropane	1.4	U	1.4	U	1.4	U	1.3	U
1,2-Dibromo-3-Chloropropane	2.8	U	2.8	U	2.8	U	2.6	U
1,2-Dichloroethane	1	U	1	U	1	U	0.92	U
1,2-Dichloropropane	1.1	U	1.1	U	1.1	U	1	U
2-Butanone (MEK)	2.7	U	9.6	U	7.2	U	18	U
2-Chloro-1,3-butadiene	0.57	U	0.57	U	0.57	U	0.52	U
2-Hexanone	2.1	U	2.1	U	2.1	U	1.9	U
3-Chloro-1-propene	1.5	UJ	1.5	UJ	1.5	UJ	1.4	UJ
4-Methyl-2-pentanone (MIBK)	2.9	U	2.9	U	2.9	U	2.7	U
Acetone	23	J	86	U	110	J	260	
Acetonitrile	45	U	45	U	45	U	41	U
Acrolein	19	R	19	R	19	R	17	R
Acrylonitrile	23	U	23	UJ	23	U	21	UJ
Benzene	0.79	U	0.95	J	0.8	U	0.73	U
Bromoform	1.1	U	1.1	U	1.1	U	1	U
Bromomethane	1.6	U	1.6	U	1.6	U	1.5	U
Carbon disulfide	0.51	U	0.51	U	0.51	U	1.9	J
Carbon tetrachloride	1	U	1	U	1	U	0.92	U
Chlorobenzene	0.73	U	0.73	U	0.74	U	0.67	U
Chlorodibromomethane	0.5	U	0.5	U	0.5	U	0.46	U
Chloroethane	1.2	U	1.2	U	1.2	U	1.1	U
Chloroform	0.5	U	0.5	U	0.5	U	0.46	U
Chloromethane	0.71	U	0.71	U	0.72	U	0.65	U
cis-1,3-Dichloropropene	0.87	U	0.87	U	0.88	U	0.8	U
Dibromomethane	1.2	U	1.2	U	1.2	U	1.1	U
Dichlorobromomethane	0.83	U	0.83	U	0.84	U	0.76	U
Dichlorodifluoromethane	0.89	U	0.89	U	0.9	U	0.82	U
Ethyl methacrylate	2.2	U	2.2	U	2.2	U	2	U
Ethylbenzene	0.75	U	0.75	U	0.76	U	0.69	U
Ethylene Dibromide	1.5	U	1.5	U	1.5	U	1.4	U
Iodomethane	1	UJ	1	U	1.7	J	2.4	J
Isobutyl alcohol	69	U	69	R	70	R	63	R
Methacrylonitrile	24	U	24	U	24	UJ	22	U
Methyl methacrylate	3.7	U	3.7	U	3.7	UJ	3.4	U
Methylene Chloride	1	U	1	U	1	U	0.92	U
Pentachloroethane	2.2	U	2.2	UJ	2.2	UJ	2	UJ
Propionitrile	21	U	21	U	21	U	19	U
Styrene	0.66	U	0.66	U	0.67	U	0.61	U
Tetrachloroethene	0.73	U	0.73	U	0.74	U	0.67	U
Toluene	0.79	U	0.79	U	0.8	U	0.73	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07	
Sample ID	56SB04-00		56SB05-00		56SB06-00		56SB07-00	
Date	4/28/2008		4/29/2008		4/30/2008		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	0.97	U	0.97	U	0.98	U	0.89	U
trans-1,3-Dichloropropene	0.87	U	0.87	U	0.88	U	0.8	U
trans-1,4-Dichloro-2-butene	3.1	U	3.1	U	3.1	UJ	2.8	U
Trichloroethene	1	U	1	U	1	U	0.92	U
Trichlorofluoromethane	1.5	U	1.5	U	1.5	U	1.4	U
Vinyl acetate	1.5	U	1.5	U	1.5	U	1.4	U
Vinyl chloride	0.58	U	0.58	U	0.59	U	0.53	U
Xylenes, Total	2.3	U	2.3	U	2.3	U	2.1	U
Semivolatile Organic Compounds (ug/kg)								
1,1'-Biphenyl	9.9	U	9.3	UJ	9.8	UJ	9.4	U
1,2,4,5-Tetrachlorobenzene	8.4	U	7.9	UJ	8.4	UJ	8	U
1,2,4-Trichlorobenzene	9.9	U	9.3	UJ	9.8	UJ	9.4	U
1,2-Dichlorobenzene	9.3	U	8.8	UJ	9.3	UJ	8.8	U
1,3,5-Trinitrobenzene	23	U	21	UJ	23	UJ	21	U
1,3-Dichlorobenzene	8	U	7.5	UJ	8	UJ	7.6	U
1,3-Dinitrobenzene	5.2	U	4.9	UJ	5.2	UJ	4.9	U
1,4-Dichlorobenzene	8.3	U	7.8	UJ	8.2	UJ	7.8	U
1,4-Dioxane	11	U	10	UJ	11	UJ	10	U
1,4-Naphthoquinone	5.2	U	4.9	UJ	5.2	UJ	4.9	U
2,2'-oxybis[1-chloropropane]	8.4	U	7.9	UJ	8.4	UJ	8	U
2,3,4,6-Tetrachlorophenol	5.6	U	5.3	UJ	5.6	UJ	5.3	U
2,4,5-Trichlorophenol	9.1	U	8.5	UJ	9	UJ	8.6	U
2,4,6-Trichlorophenol	11	U	9.9	UJ	10	UJ	10	U
2,4-Dichlorophenol	11	U	10	UJ	11	UJ	10	U
2,4-Dimethylphenol	23	U	21	UJ	23	UJ	21	U
2,4-Dinitrophenol	110	UJ	100	UJ	110	UJ	100	U
2,4-Dinitrotoluene	7.9	UJ	7.4	UJ	7.8	UJ	7.5	UJ
2,6-Dichlorophenol	8.5	U	8	UJ	8.5	UJ	8.1	U
2,6-Dinitrotoluene	8.3	U	7.8	UJ	8.2	UJ	7.8	U
2-Acetylaminofluorene	6.8	U	6.4	UJ	6.8	UJ	6.4	UJ
2-Chloronaphthalene	8.3	U	7.8	UJ	8.2	UJ	7.8	U
2-Chlorophenol	8.8	U	8.3	UJ	8.8	UJ	8.3	U
2-Methylnaphthalene	2.3	U	2.1	UJ	2.3	UJ	2.1	U
2-Methylphenol	11	U	10	UJ	11	UJ	10	U
2-Naphthylamine	27	U	25	UJ	27	UJ	25	U
2-Nitroaniline	8.7	U	8.2	UJ	8.6	UJ	8.2	U
2-Nitrophenol	9.7	U	9.2	UJ	9.7	UJ	9.2	U
2-Picoline	16	U	15	UJ	16	UJ	15	U
2-Toluidine	12	U	12	UJ	12	UJ	12	U
3 & 4 Methylphenol	9.7	U	9.2	UJ	9.7	UJ	9.2	U
3,3'-Dichlorobenzidine	12	U	12	UJ	12	UJ	12	U
3,3'-Dimethylbenzidine	240	U	230	UJ	240	UJ	230	U
3-Methylcholanthrene	8.1	U	7.7	UJ	8.1	UJ	7.7	U
3-Nitroaniline	6	U	5.7	UJ	6	UJ	5.7	U
4,6-Dinitro-2-methylphenol	7.7	UJ	7.3	UJ	7.7	UJ	7.3	UJ
4-Aminobiphenyl	17	U	16	UJ	17	UJ	16	U
4-Bromophenyl phenyl ether	9.5	U	8.9	UJ	9.4	UJ	9	U
4-Chloro-3-methylphenol	10	U	9.4	UJ	10	UJ	9.5	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07	
Sample ID	56SB04-00		56SB05-00		56SB06-00		56SB07-00	
Date	4/28/2008		4/29/2008		4/30/2008		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-Chloroaniline	8	U	7.5	UJ	8	UJ	7.6	U
4-Chlorophenyl phenyl ether	8.3	U	7.8	UJ	8.2	UJ	7.8	U
4-Nitroaniline	10	UJ	9.7	UJ	10	UJ	9.7	U
4-Nitrophenol	44	UJ	41	UJ	44	UJ	42	U
4-Nitroquinoline-1-oxide	15	R	14	R	15	R	14	R
7,12-Dimethylbenz(a)anthracene	12	U	12	UJ	12	UJ	12	U
Acenaphthene	0.76	U	0.72	UJ	0.76	UJ	0.72	U
Acenaphthylene	2.3	U	2.1	UJ	2.3	UJ	2.1	U
Acetophenone	11	U	11	UJ	11	UJ	11	U
alpha,alpha-Dimethyl phenethylamine	79	U	74	UJ	78	UJ	75	UJ
Aniline	8.4	U	7.9	UJ	8.4	UJ	8	U
Anthracene	2.3	U	2.1	UJ	2.3	UJ	2.1	U
Aramite, Total	15	U	14	UJ	15	UJ	14	UJ
Benzo[a]anthracene	2.3	U	2.1	UJ	2.3	UJ	2.4	J
Benzo[a]pyrene	0.88	U	0.83	UJ	0.88	UJ	2.8	J
Benzo[b]fluoranthene	1	U	0.96	UJ	1	UJ	3.1	J
Benzo[g,h,i]perylene	2.3	U	2.1	UJ	2.3	UJ	2.1	U
Benzo[k]fluoranthene	1.3	U	1.3	UJ	1.3	UJ	1.5	J
Benzyl alcohol	11	U	10	UJ	11	UJ	10	U
Bis(2-chloroethoxy)methane	9.1	U	8.5	UJ	9	UJ	8.6	U
Bis(2-chloroethyl)ether	7.6	U	7.2	UJ	7.6	UJ	7.2	U
Bis(2-ethylhexyl) phthalate	25	U	14	UJ	7.9	UJ	61	U
Butyl benzyl phthalate	9.6	U	9	UJ	9.6	UJ	9.1	U
Chrysene	0.81	U	1.4	UJ	0.81	UJ	2.2	J
Diallate	13	U	12	UJ	13	UJ	12	U
Dibenz(a,h)anthracene	0.79	U	0.74	UJ	0.78	UJ	0.75	U
Dibenzofuran	5.6	U	5.3	UJ	5.6	UJ	5.3	U
Diethyl phthalate	15	U	14	UJ	15	UJ	14	U
Dimethyl phthalate	8.5	U	8	UJ	8.5	UJ	8.1	U
Di-n-butyl phthalate	33	U	31	UJ	33	UJ	97	U
Di-n-octyl phthalate	4.4	U	4.1	UJ	4.4	UJ	4.2	U
Dinoseb	23	U	21	UJ	23	UJ	21	U
Ethyl methanesulfonate	15	U	14	UJ	15	UJ	14	U
Fluoranthene	2.3	U	2.1	UJ	2.3	UJ	2.1	U
Fluorene	1	U	0.97	UJ	1	UJ	0.97	U
Hexachlorobenzene	9.1	U	8.5	UJ	9	UJ	8.6	U
Hexachlorobutadiene	12	U	11	UJ	12	UJ	12	U
Hexachlorocyclopentadiene	19	U	18	UJ	19	UJ	18	U
Hexachloroethane	9.9	U	9.3	UJ	9.8	UJ	9.4	U
Hexachlorophene	1100	R	1000	UJ	1100	R	1000	R
Hexachloropropene	9.6	UJ	9	UJ	9.6	UJ	9.1	UJ
Indeno[1,2,3-cd]pyrene	1.6	UJ	1.5	UJ	1.6	UJ	1.9	J
Isophorone	8.3	U	7.8	UJ	8.2	UJ	7.8	U
Isosafrole	9.5	U	8.9	UJ	9.4	UJ	9	U
Methapyrilene	12	UJ	12	UJ	12	UJ	12	U
Methyl methanesulfonate	12	U	12	UJ	12	UJ	12	U
Naphthalene	0.8	U	0.75	UJ	0.8	UJ	1.9	J
Nitrobenzene	9.2	U	8.7	UJ	9.2	UJ	8.7	U

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07	
Sample ID	56SB04-00		56SB05-00		56SB06-00		56SB07-00	
Date	4/28/2008		4/29/2008		4/30/2008		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)								
N-Nitro-o-toluidine	8	U	7.5	UJ	8	UJ	7.6	U
N-Nitrosodiethylamine	16	U	15	UJ	16	UJ	15	U
N-Nitrosodimethylamine	13	U	12	UJ	13	UJ	12	U
N-Nitrosodi-n-butylamine	12	UJ	11	UJ	12	UJ	12	UJ
N-Nitrosodi-n-propylamine	8.7	U	8.2	UJ	8.6	UJ	8.2	U
N-Nitrosodiphenylamine	9.5	U	8.9	UJ	9.4	UJ	9	U
N-Nitrosomethylethylamine	7.6	U	7.2	UJ	7.6	UJ	7.2	U
N-Nitrosomorpholine	8.8	UJ	8.3	UJ	8.8	UJ	8.3	UJ
N-Nitrosopiperidine	11	U	11	UJ	11	UJ	11	UJ
N-Nitrosopyrrolidine	12	U	11	UJ	12	UJ	11	U
p-Dimethylamino azobenzene	9.5	U	8.9	UJ	9.4	UJ	9	U
Pentachlorobenzene	8.3	U	7.8	UJ	8.2	UJ	7.8	U
Pentachloronitrobenzene	7.9	U	7.4	UJ	7.8	UJ	7.5	U
Pentachlorophenol	11	U	10	UJ	11	UJ	10	U
Phenacetin	6.3	U	5.9	UJ	6.2	UJ	5.9	U
Phenanthrene	2.3	UJ	2.1	UJ	2.3	UJ	3.1	U
Phenol	6.4	U	6	UJ	6.4	UJ	6.1	U
p-Phenylene diamine	210	U	200	UJ	210	UJ	200	U
Pronamide	12	U	11	UJ	12	UJ	11	U
Pyrene	2.3	U	2.1	UJ	2.3	UJ	5.4	J
Pyridine	15	U	14	UJ	15	UJ	14	U
Safrole, Total	11	U	10	UJ	11	UJ	10	U
Metals (mg/kg)								
Antimony	0.091	U	0.11	UJ	0.13	UJ	0.16	UJ
Arsenic	0.59	J	3.4		2.2		3	
Barium	15	J	120	J	20	J	190	J
Beryllium	0.053	J	0.24		0.15		0.34	
Cadmium	0.038	UJ	0.18	J	0.055	J	0.16	J
Chromium	6.3		22	J	48	J	54	J
Cobalt	2.6		27	J	6.8	J	50	J
Copper	31	J	72	J	56	J	130	J
Lead	0.88		4.8	J	6.3	J	5.5	J
Mercury	0.018	J	0.041	J	0.0047	U	0.066	J
Nickel	1.1		13	J	7	J	14	J
Selenium	1.4		0.88	J	1.7	J	1.7	J
Silver	0.019	U	0.057	UJ	0.13	UJ	0.078	UJ
Thallium	0.15	U	0.15	J	0.15	U	0.25	J
Tin	4.9	U	4.6	U	4.8	U	4.6	U
Vanadium	170	J	190	J	320	J	360	J
Zinc	7.5	J	49	J	23	J	62	J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SS01	56SS02	56SS03	56SS04
Sample ID	56SB08-00		56SS01	56SS02	56SS03	56SS04
Date	5/5/2008		9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0.0-1.0		0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.75	U	NA	NA	NA	NA
1,1,1-Trichloroethane	0.68	U	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	1.7	U	NA	NA	NA	NA
1,1,2-Trichloroethane	1.4	U	NA	NA	NA	NA
1,1-Dichloroethane	0.59	U	NA	NA	NA	NA
1,1-Dichloroethene	0.64	U	NA	NA	NA	NA
1,2,3-Trichloropropane	1.7	U	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	3.3	U	NA	NA	NA	NA
1,2-Dichloroethane	1.2	U	NA	NA	NA	NA
1,2-Dichloropropane	1.3	U	NA	NA	NA	NA
2-Butanone (MEK)	24	U	NA	NA	NA	NA
2-Chloro-1,3-butadiene	0.67	UJ	NA	NA	NA	NA
2-Hexanone	2.5	U	NA	NA	NA	NA
3-Chloro-1-propene	1.8	U	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	3.4	U	NA	NA	NA	NA
Acetone	280		NA	NA	NA	NA
Acetonitrile	53	R	NA	NA	NA	NA
Acrolein	22	R	NA	NA	NA	NA
Acrylonitrile	27	U	NA	NA	NA	NA
Benzene	0.99	J	NA	NA	NA	NA
Bromoform	1.3	U	NA	NA	NA	NA
Bromomethane	1.9	U	NA	NA	NA	NA
Carbon disulfide	0.6	U	NA	NA	NA	NA
Carbon tetrachloride	1.2	U	NA	NA	NA	NA
Chlorobenzene	0.86	U	NA	NA	NA	NA
Chlorodibromomethane	0.59	U	NA	NA	NA	NA
Chloroethane	1.4	U	NA	NA	NA	NA
Chloroform	0.59	U	NA	NA	NA	NA
Chloromethane	0.84	U	NA	NA	NA	NA
cis-1,3-Dichloropropene	1	U	NA	NA	NA	NA
Dibromomethane	1.4	U	NA	NA	NA	NA
Dichlorobromomethane	0.98	U	NA	NA	NA	NA
Dichlorodifluoromethane	1	U	NA	NA	NA	NA
Ethyl methacrylate	2.6	U	NA	NA	NA	NA
Ethylbenzene	0.88	U	NA	NA	NA	NA
Ethylene Dibromide	1.8	U	NA	NA	NA	NA
Iodomethane	1.2	U	NA	NA	NA	NA
Isobutyl alcohol	81	R	NA	NA	NA	NA
Methacrylonitrile	28	UJ	NA	NA	NA	NA
Methyl methacrylate	4.4	U	NA	NA	NA	NA
Methylene Chloride	1.2	U	NA	NA	NA	NA
Pentachloroethane	2.6	UJ	NA	NA	NA	NA
Propionitrile	25	U	NA	NA	NA	NA
Styrene	0.78	U	NA	NA	NA	NA
Tetrachloroethene	0.86	U	NA	NA	NA	NA
Toluene	0.93	U	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SS01	56SS02	56SS03	56SS04
Sample ID	56SB08-00		56SS01	56SS02	56SS03	56SS04
Date	5/5/2008		9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0.0-1.0		0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)						
trans-1,2-Dichloroethene	1.1	U	NA	NA	NA	NA
trans-1,3-Dichloropropene	1	U	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	3.7	U	NA	NA	NA	NA
Trichloroethene	1.2	U	NA	NA	NA	NA
Trichlorofluoromethane	1.8	U	NA	NA	NA	NA
Vinyl acetate	1.8	U	NA	NA	NA	NA
Vinyl chloride	0.68	U	NA	NA	NA	NA
Xylenes, Total	2.7	U	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	9.9	U	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	8.5	U	NA	NA	NA	NA
1,2,4-Trichlorobenzene	9.9	U	NA	NA	NA	NA
1,2-Dichlorobenzene	9.4	U	NA	NA	NA	NA
1,3,5-Trinitrobenzene	23	U	NA	NA	NA	NA
1,3-Dichlorobenzene	8.1	U	NA	NA	NA	NA
1,3-Dinitrobenzene	5.2	U	NA	NA	NA	NA
1,4-Dichlorobenzene	8.3	U	NA	NA	NA	NA
1,4-Dioxane	11	U	NA	NA	NA	NA
1,4-Naphthoquinone	5.2	U	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	8.5	U	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	5.6	U	NA	NA	NA	NA
2,4,5-Trichlorophenol	9.1	U	NA	NA	NA	NA
2,4,6-Trichlorophenol	11	U	NA	NA	NA	NA
2,4-Dichlorophenol	11	U	NA	NA	NA	NA
2,4-Dimethylphenol	23	U	NA	NA	NA	NA
2,4-Dinitrophenol	110	U	NA	NA	NA	NA
2,4-Dinitrotoluene	7.9	U	NA	NA	NA	NA
2,6-Dichlorophenol	8.6	U	NA	NA	NA	NA
2,6-Dinitrotoluene	8.3	U	NA	NA	NA	NA
2-Acetylaminofluorene	6.8	U	NA	NA	NA	NA
2-Chloronaphthalene	8.3	U	NA	NA	NA	NA
2-Chlorophenol	8.9	U	NA	NA	NA	NA
2-Methylnaphthalene	19		NA	NA	NA	NA
2-Methylphenol	11	U	NA	NA	NA	NA
2-Naphthylamine	27	U	NA	NA	NA	NA
2-Nitroaniline	8.7	U	NA	NA	NA	NA
2-Nitrophenol	9.8	U	NA	NA	NA	NA
2-Picoline	16	U	NA	NA	NA	NA
2-Toluidine	12	U	NA	NA	NA	NA
3 & 4 Methylphenol	9.8	U	NA	NA	NA	NA
3,3'-Dichlorobenzidine	12	UJ	NA	NA	NA	NA
3,3'-Dimethylbenzidine	240	UJ	NA	NA	NA	NA
3-Methylcholanthrene	8.2	U	NA	NA	NA	NA
3-Nitroaniline	6	U	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	7.8	UJ	NA	NA	NA	NA
4-Aminobiphenyl	17	U	NA	NA	NA	NA
4-Bromophenyl phenyl ether	9.5	U	NA	NA	NA	NA
4-Chloro-3-methylphenol	10	U	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08	56SS01	56SS02	56SS03	56SS04
Sample ID	56SB08-00	56SS01	56SS02	56SS03	56SS04
Date	5/5/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0.0-1.0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)					
4-Chloroaniline	8.1 U	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	8.3 U	NA	NA	NA	NA
4-Nitroaniline	10 UJ	NA	NA	NA	NA
4-Nitrophenol	44 U	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	15 R	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	12 U	NA	NA	NA	NA
Acenaphthene	0.76 U	NA	NA	NA	NA
Acenaphthylene	2.3 U	NA	NA	NA	NA
Acetophenone	12 U	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	79 U	NA	NA	NA	NA
Aniline	8.5 U	NA	NA	NA	NA
Anthracene	2.3 U	NA	NA	NA	NA
Aramite, Total	15 U	NA	NA	NA	NA
Benzo[a]anthracene	2.9 J	NA	NA	NA	NA
Benzo[a]pyrene	3 J	NA	NA	NA	NA
Benzo[b]fluoranthene	8 J	NA	NA	NA	NA
Benzo[g,h,i]perylene	3.1 J	NA	NA	NA	NA
Benzo[k]fluoranthene	1.3 U	NA	NA	NA	NA
Benzyl alcohol	11 U	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	9.1 U	NA	NA	NA	NA
Bis(2-chloroethyl)ether	7.6 U	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	24 U	NA	NA	NA	NA
Butyl benzyl phthalate	9.7 U	NA	NA	NA	NA
Chrysene	3.9 J	NA	NA	NA	NA
Diallate	13 U	NA	NA	NA	NA
Dibenz(a,h)anthracene	0.79 U	NA	NA	NA	NA
Dibenzofuran	5.6 U	NA	NA	NA	NA
Diethyl phthalate	15 U	NA	NA	NA	NA
Dimethyl phthalate	8.6 U	NA	NA	NA	NA
Di-n-butyl phthalate	34 U	NA	NA	NA	NA
Di-n-octyl phthalate	4.4 U	NA	NA	NA	NA
Dinoseb	23 UJ	NA	NA	NA	NA
Ethyl methanesulfonate	15 U	NA	NA	NA	NA
Fluoranthene	5 J	NA	NA	NA	NA
Fluorene	1 U	NA	NA	NA	NA
Hexachlorobenzene	9.1 U	NA	NA	NA	NA
Hexachlorobutadiene	12 U	NA	NA	NA	NA
Hexachlorocyclopentadiene	19 U	NA	NA	NA	NA
Hexachloroethane	9.9 U	NA	NA	NA	NA
Hexachlorophene	1100 R	NA	NA	NA	NA
Hexachloropropene	9.7 U	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	1.6 UJ	NA	NA	NA	NA
Isophorone	8.3 U	NA	NA	NA	NA
Isosafrole	9.5 U	NA	NA	NA	NA
Methapyrilene	12 U	NA	NA	NA	NA
Methyl methanesulfonate	12 U	NA	NA	NA	NA
Naphthalene	4.3 J	NA	NA	NA	NA
Nitrobenzene	9.3 U	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SS01	56SS02	56SS03	56SS04
Sample ID	56SB08-00		56SS01	56SS02	56SS03	56SS04
Date	5/5/2008		9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0.0-1.0		0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)						
N-Nitro-o-toluidine	8.1	U	NA	NA	NA	NA
N-Nitrosodiethylamine	16	U	NA	NA	NA	NA
N-Nitrosodimethylamine	13	U	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	12	U	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	8.7	U	NA	NA	NA	NA
N-Nitrosodiphenylamine	9.5	U	NA	NA	NA	NA
N-Nitrosomethylethylamine	7.6	U	NA	NA	NA	NA
N-Nitrosomorpholine	8.9	U	NA	NA	NA	NA
N-Nitrosopiperidine	11	U	NA	NA	NA	NA
N-Nitrosopyrrolidine	12	U	NA	NA	NA	NA
p-Dimethylamino azobenzene	9.5	U	NA	NA	NA	NA
Pentachlorobenzene	8.3	U	NA	NA	NA	NA
Pentachloronitrobenzene	7.9	U	NA	NA	NA	NA
Pentachlorophenol	11	U	NA	NA	NA	NA
Phenacetin	6.3	U	NA	NA	NA	NA
Phenanthrene	2.5	J	NA	NA	NA	NA
Phenol	6.4	U	NA	NA	NA	NA
p-Phenylene diamine	210	U	NA	NA	NA	NA
Pronamide	12	U	NA	NA	NA	NA
Pyrene	5.1	J	NA	NA	NA	NA
Pyridine	15	U	NA	NA	NA	NA
Safrole, Total	11	U	NA	NA	NA	NA
Metals (mg/kg)						
Antimony	0.11	UJ	NA	NA	NA	NA
Arsenic	1.4		NA	NA	NA	NA
Barium	71		NA	NA	NA	NA
Beryllium	0.24		NA	NA	NA	NA
Cadmium	0.15		NA	NA	NA	NA
Chromium	24		NA	NA	NA	NA
Cobalt	24	J	NA	NA	NA	NA
Copper	100		NA	NA	NA	NA
Lead	5.3		83	5	8	5.9
Mercury	0.028		NA	NA	NA	NA
Nickel	8.7		NA	NA	NA	NA
Selenium	0.64		0.51	2	2.2	3.5
Silver	0.069	U	NA	NA	NA	NA
Thallium	0.15	U	NA	NA	NA	NA
Tin	4.8	U	NA	NA	NA	NA
Vanadium	180		NA	NA	NA	NA
Zinc	58		NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS05	56SS06	56SS07	56SS08	56SS09
Sample ID	56SS05	56SS06	56SS07	56SS08	56SS09
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)					
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS05	56SS06	56SS07	56SS08	56SS09
Sample ID	56SS05	56SS06	56SS07	56SS08	56SS09
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)					
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/kg)					
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
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

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS05	56SS06	56SS07	56SS08	56SS09
Sample ID	56SS05	56SS06	56SS07	56SS08	56SS09
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)					
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
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
Ethyl methanesulfonate	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
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
Naphthalene	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS05	56SS06	56SS07	56SS08	56SS09
Sample ID	56SS05	56SS06	56SS07	56SS08	56SS09
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)					
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
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
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
Metals (mg/kg)					
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	7.2	3	NA	NA	NA
Mercury	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA
Selenium	0.86	1.4	0.86	0.62	2.3
Silver	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA
Vanadium	NA	NA	160	55	430
Zinc	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS10	56SS11D	56SS11	56SS12
Sample ID	56SS10	56SS11D	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)				
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA
Acetone	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA
Benzene	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA
Styrene	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA
Toluene	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS10	56SS11D	56SS11	56SS12
Sample ID	56SS10	56SS11D	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)				
trans-1,2-Dichloroethene	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/kg)				
1,1'-Biphenyl	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA
1,3,5-Trinitrobenzene	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA
2-Picoline	NA	NA	NA	NA
2-Toluidine	NA	NA	NA	NA
3 & 4 Methylphenol	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS10	56SS11D	56SS11	56SS12
Sample ID	56SS10	56SS11D	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)				
4-Chloroaniline	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	NA	NA	NA	NA
Aniline	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA
Aramite, Total	NA	NA	NA	NA
Benzo[a]anthracene	NA	NA	NA	NA
Benzo[a]pyrene	NA	NA	NA	NA
Benzo[b]fluoranthene	NA	NA	NA	NA
Benzo[g,h,i]perylene	NA	NA	NA	NA
Benzo[k]fluoranthene	NA	NA	NA	NA
Benzyl alcohol	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	NA	NA	NA	NA
Bis(2-chloroethyl)ether	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA
Diallate	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA
Ethyl methanesulfonate	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA
Methapyrilene	NA	NA	NA	NA
Methyl methanesulfonate	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS10	56SS11D	56SS11	56SS12
Sample ID	56SS10	56SS11D	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)				
N-Nitro-o-toluidine	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA
Phenol	NA	NA	NA	NA
p-Phenylene diamine	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA
Safrole, Total	NA	NA	NA	NA
Metals (mg/kg)				
Antimony	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA
Barium	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA
Chromium	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA
Copper	NA	NA	NA	NA
Lead	NA	NA	NA	NA
Mercury	NA	NA	NA	NA
Nickel	NA	NA	NA	NA
Selenium	1.2	0.89	1.7	0.33
Silver	NA	NA	NA	NA
Thallium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Vanadium	190	190	280	140
Zinc	NA	NA	NA	NA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0	
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	0.64	U	0.66	U	0.58	U	0.65	U	0.67	U
1,1,1-Trichloroethane	0.58	U	0.6	U	0.52	U	0.59	U	0.61	U
1,1,2,2-Tetrachloroethane	1.4	U	1.5	U	1.3	U	1.4	U	1.5	U
1,1,2-Trichloroethane	1.2	U	1.2	U	1.1	U	1.2	U	1.3	U
1,1-Dichloroethane	0.5	U	0.52	U	0.45	U	0.51	U	0.52	U
1,1-Dichloroethene	0.54	U	0.56	U	0.49	U	0.55	U	0.57	U
1,2,3-Trichloropropane	1.4	U	1.5	U	1.3	U	1.4	U	1.5	U
1,2-Dibromo-3-Chloropropane	2.8	U	2.9	U	2.5	U	2.8	U	2.9	U
1,2-Dichloroethane	1	U	1	U	0.9	U	1	U	1	U
1,2-Dichloropropane	1.1	U	1.1	U	0.99	U	1.1	U	1.2	U
2-Butanone (MEK)	2.7	U	2.8	U	2.4	U	2.7	U	7	U
2-Chloro-1,3-butadiene	0.57	U	0.59	U	0.51	UJ	0.58	U	0.6	U
2-Hexanone	2.1	U	2.2	U	1.9	U	2.1	U	2.2	U
3-Chloro-1-propene	1.5	UJ	1.6	UJ	1.4	R	1.5	UJ	1.6	UJ
4-Methyl-2-pentanone (MIBK)	2.9	U	3	U	2.6	U	2.9	U	3	U
Acetone	8.3	J	9.7	J	22	J	25	J	120	J
Acetonitrile	45	U	47	U	41	UJ	46	U	47	U
Acrolein	19	R	20	R	17	R	19	R	20	R
Acrylonitrile	23	U	24	U	21	UJ	23	U	24	U
Benzene	0.79	U	0.82	U	0.71	U	0.8	U	0.83	U
Bromoform	1.1	U	1.1	U	0.99	U	1.1	U	1.2	U
Bromomethane	1.6	U	1.7	U	1.4	UJ	1.6	U	1.7	U
Carbon disulfide	0.51	U	0.53	U	0.46	U	0.52	U	0.53	U
Carbon tetrachloride	1	U	1	U	0.9	U	1	U	1	U
Chlorobenzene	0.73	U	0.76	U	0.66	U	0.74	U	0.76	U
Chlorodibromomethane	0.5	U	0.52	U	0.45	U	0.51	U	0.52	U
Chloroethane	1.2	U	1.2	U	1.1	U	1.2	U	1.3	U
Chloroform	0.5	U	0.52	U	0.45	U	0.51	U	0.52	U
Chloromethane	0.71	U	0.74	U	0.64	U	0.72	U	0.74	U
cis-1,3-Dichloropropene	0.87	U	0.9	U	0.79	U	0.88	U	0.91	U
Dibromomethane	1.2	U	1.2	U	1.1	U	1.2	U	1.3	U
Dichlorobromomethane	0.83	U	0.86	U	0.75	U	0.84	U	0.87	U
Dichlorodifluoromethane	0.89	U	0.92	U	0.8	U	0.9	U	0.93	U
Ethyl methacrylate	2.2	U	2.3	U	2	U	2.2	U	2.3	U
Ethylbenzene	0.75	U	0.78	U	0.68	U	0.76	U	0.79	U
Ethylene Dibromide	1.5	U	1.6	U	1.4	U	1.5	U	1.6	U
Iodomethane	1	UJ	1	UJ	0.9	U	1	UJ	1	UJ
Isobutyl alcohol	69	U	72	U	62	U	70	U	72	R
Methacrylonitrile	24	U	25	U	22	U	24	U	25	UJ
Methyl methacrylate	3.7	U	3.8	U	3.3	U	3.7	U	3.9	UJ
Methylene Chloride	1	U	1	U	0.9	U	1	U	1	U
Pentachloroethane	2.2	U	2.3	U	2	U	2.2	U	2.3	UJ
Propionitrile	21	U	22	U	19	UJ	21	U	22	U
Styrene	0.66	U	0.69	U	0.6	U	0.67	U	0.69	U
Tetrachloroethene	0.73	U	0.76	U	0.66	U	0.74	U	0.76	U
Toluene	0.79	U	0.82	U	0.71	U	0.8	U	0.83	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0	
Volatile Organic Compounds (ug/kg)										
trans-1,2-Dichloroethene	0.97	U	1	U	0.88	U	0.98	U	1	U
trans-1,3-Dichloropropene	0.87	U	0.9	U	0.79	U	0.88	U	0.91	U
trans-1,4-Dichloro-2-butene	3.1	U	3.2	U	2.8	U	3.1	U	3.2	UJ
Trichloroethene	1	U	1	U	0.9	U	1	U	1	U
Trichlorofluoromethane	1.5	U	1.6	U	1.4	U	1.5	U	1.6	U
Vinyl acetate	1.5	U	1.6	U	1.4	UJ	1.5	U	1.6	U
Vinyl chloride	0.58	U	0.6	U	0.52	U	0.59	U	0.61	U
Xylenes, Total	2.3	U	2.4	U	2.1	U	2.3	U	2.4	U
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	9.9	U	10	U	9.2	U	9.6	U	10	UJ
1,2,4,5-Tetrachlorobenzene	8.5	U	8.6	U	7.8	U	8.2	U	8.5	UJ
1,2,4-Trichlorobenzene	9.9	U	10	U	9.2	U	9.6	U	10	UJ
1,2-Dichlorobenzene	9.4	U	9.6	U	8.7	U	9.1	U	9.4	UJ
1,3,5-Trinitrobenzene	23	U	23	U	21	U	22	U	23	UJ
1,3-Dichlorobenzene	8.1	U	8.2	U	7.5	U	7.8	U	8.1	UJ
1,3-Dinitrobenzene	5.2	U	5.3	U	4.9	U	5.1	U	5.3	UJ
1,4-Dichlorobenzene	8.3	U	8.5	U	7.7	U	8.1	U	8.4	UJ
1,4-Dioxane	11	U	11	U	10	U	10	U	11	UJ
1,4-Naphthoquinone	5.2	U	5.3	U	4.9	U	5.1	U	5.3	UJ
2,2'-oxybis[1-chloropropane]	8.5	U	8.6	U	7.8	U	8.2	U	8.5	UJ
2,3,4,6-Tetrachlorophenol	5.6	U	5.7	U	5.2	U	5.4	UJ	5.7	UJ
2,4,5-Trichlorophenol	9.1	U	9.3	U	8.5	U	8.8	UJ	9.2	UJ
2,4,6-Trichlorophenol	11	U	11	U	9.8	U	10	UJ	11	UJ
2,4-Dichlorophenol	11	U	11	U	10	U	10	UJ	11	UJ
2,4-Dimethylphenol	23	U	23	U	21	U	22	UJ	23	UJ
2,4-Dinitrophenol	110	UJ	110	UJ	100	R	110	UJ	110	UJ
2,4-Dinitrotoluene	7.9	UJ	8.1	UJ	7.4	UJ	7.7	U	7.9	UJ
2,6-Dichlorophenol	8.6	U	8.7	U	8	U	8.3	UJ	8.6	UJ
2,6-Dinitrotoluene	8.3	U	8.5	U	7.7	U	8.1	U	8.4	UJ
2-Acetylaminofluorene	6.8	U	7	U	6.4	U	6.6	U	6.9	UJ
2-Chloronaphthalene	8.3	U	8.5	U	7.7	U	8.1	U	8.4	UJ
2-Chlorophenol	8.9	U	9	U	8.2	U	8.6	U	8.9	UJ
2-Methylnaphthalene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ
2-Methylphenol	11	U	11	U	10	U	10	UJ	11	UJ
2-Naphthylamine	27	U	27	U	25	U	26	UJ	27	UJ
2-Nitroaniline	8.7	U	8.9	U	8.1	U	8.5	U	8.8	UJ
2-Nitrophenol	9.8	U	10	U	9.1	U	9.5	UJ	9.8	UJ
2-Picoline	16	U	16	U	15	U	16	U	16	UJ
2-Toluidine	12	U	13	U	12	U	12	U	13	UJ
3 & 4 Methylphenol	9.8	U	10	U	9.1	U	9.5	UJ	9.8	UJ
3,3'-Dichlorobenzidine	12	U	13	U	11	U	12	U	12	UJ
3,3'-Dimethylbenzidine	240	U	250	U	220	U	230	UJ	240	UJ
3-Methylcholanthrene	8.2	U	8.3	U	7.6	U	7.9	U	8.2	UJ
3-Nitroaniline	6	U	6.1	U	5.6	U	5.9	U	6.1	UJ
4,6-Dinitro-2-methylphenol	7.8	UJ	7.9	UJ	7.2	UJ	7.5	UJ	7.8	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0	
Semivolatile Organic Compounds (ug/kg)										
4-Aminobiphenyl	17	U	18	U	16	U	17	U	18	UJ
4-Bromophenyl phenyl ether	9.5	U	9.7	U	8.8	U	9.2	U	9.6	UJ
4-Chloro-3-methylphenol	10	U	10	U	9.3	U	9.7	UJ	10	UJ
4-Chloroaniline	8.1	U	8.2	U	7.5	U	7.8	U	8.1	UJ
4-Chlorophenyl phenyl ether	8.3	U	8.5	U	7.7	U	8.1	U	8.4	UJ
4-Nitroaniline	10	UJ	11	UJ	9.6	UJ	10	U	10	UJ
4-Nitrophenol	44	UJ	45	UJ	41	UJ	43	UJ	44	UJ
4-Nitroquinoline-1-oxide	15	R	15	R	14	R	14	R	15	R
7,12-Dimethylbenz(a)anthracene	12	U	13	U	12	U	12	U	13	UJ
Acenaphthene	0.77	U	0.78	U	0.71	U	0.74	U	0.77	UJ
Acenaphthylene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ
Acetophenone	12	U	12	U	11	U	11	U	12	UJ
alpha,alpha-Dimethyl phenethylamine	79	U	81	U	74	U	77	U	79	UJ
Aniline	8.5	U	8.6	U	7.8	U	8.2	U	8.5	UJ
Anthracene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ
Aramite, Total	15	U	15	U	14	U	14	UJ	15	UJ
Benzo[a]anthracene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ
Benzo[a]pyrene	0.89	U	0.9	U	0.82	U	0.86	U	0.89	UJ
Benzo[b]fluoranthene	1	U	1	U	0.95	U	0.99	U	1	UJ
Benzo[g,h,i]perylene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ
Benzo[k]fluoranthene	1.3	U	1.4	U	1.2	U	1.3	U	1.3	UJ
Benzyl alcohol	11	U	11	U	10	U	10	UJ	11	UJ
Bis(2-chloroethoxy)methane	9.1	U	9.3	U	8.5	U	8.9	U	9.2	UJ
Bis(2-chloroethyl)ether	7.7	U	7.8	U	7.1	U	7.4	U	7.7	UJ
Bis(2-ethylhexyl) phthalate	8.6	U	8.9	U	11	U	36	U	20	UJ
Butyl benzyl phthalate	9.7	U	9.8	U	9	U	9.4	U	9.7	UJ
Chrysene	0.82	U	0.83	U	0.76	U	0.79	U	0.82	UJ
Diallate	13	U	13	U	12	U	13	U	13	UJ
Dibenz(a,h)anthracene	0.79	U	0.81	U	0.74	U	0.77	U	0.79	UJ
Dibenzofuran	5.6	U	5.7	U	5.2	U	5.5	U	5.7	UJ
Diethyl phthalate	15	U	15	U	14	U	14	U	15	UJ
Dimethyl phthalate	8.6	U	8.7	U	8	U	8.3	U	8.6	UJ
Di-n-butyl phthalate	34	U	34	U	31	U	33	U	34	UJ
Di-n-octyl phthalate	4.4	U	4.5	U	4.1	U	4.3	U	4.4	UJ
Dinoseb	23	U	23	U	21	U	22	U	23	UJ
Ethyl methanesulfonate	15	U	15	U	14	U	14	U	15	UJ
Fluoranthene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ
Fluorene	1	U	1.1	U	0.96	U	1	U	1	UJ
Hexachlorobenzene	9.1	U	9.3	U	8.5	U	8.9	U	9.2	UJ
Hexachlorobutadiene	12	U	12	U	11	U	12	U	12	UJ
Hexachlorocyclopentadiene	19	U	19	U	17	U	18	U	19	UJ
Hexachloroethane	9.9	U	10	U	9.2	U	9.6	U	10	UJ
Hexachlorophene	1100	R	1100	R	1000	R	1100	R	1100	UJ
Hexachloropropene	9.7	UJ	9.8	UJ	9	UJ	9.4	U	9.7	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB01	56SB02	56SB02	56SB03
Sample ID	56SB01-01	56SB01-04	56SB02-02	56SB02-04	56SB03-02
Date	4/28/2008	4/28/2008	4/28/2008	4/28/2008	4/29/2008
Depth Range	1.0-3.0	7.0-9.0	3.0-5.0	7.0-9.0	3.0-5.0
Semivolatile Organic Compounds (ug/kg)					
Indeno[1,2,3-cd]pyrene	1.6 UJ	1.6 UJ	1.5 UJ	1.6 UJ	1.6 UJ
Isophorone	8.3 U	8.5 U	7.7 U	8.1 U	8.4 UJ
Isosafrole	9.5 U	9.7 U	8.8 U	9.2 U	9.6 UJ
Methapyrilene	12 UJ	13 UJ	12 UJ	12 UJ	13 UJ
Methyl methanesulfonate	12 U	13 U	12 U	12 U	13 UJ
Naphthalene	0.81 U	0.82 U	0.75 U	0.78 U	0.81 UJ
Nitrobenzene	9.3 U	9.4 U	8.6 U	9 U	9.3 UJ
N-Nitro-o-toluidine	8.1 U	8.2 U	7.5 U	7.8 U	8.1 UJ
N-Nitrosodiethylamine	16 U	16 U	15 U	16 U	16 UJ
N-Nitrosodimethylamine	13 U	13 U	12 U	13 U	13 UJ
N-Nitrosodi-n-butylamine	12 UJ	12 UJ	11 UJ	12 U	12 UJ
N-Nitrosodi-n-propylamine	8.7 U	8.9 U	8.1 U	8.5 U	8.8 UJ
N-Nitrosodiphenylamine	9.5 U	9.7 U	8.8 U	9.2 U	9.6 UJ
N-Nitrosomethylethylamine	7.7 U	7.8 U	7.1 U	7.4 U	7.7 UJ
N-Nitrosomorpholine	8.9 UJ	9 UJ	8.2 UJ	8.5 UJ	8.9 UJ
N-Nitrosopiperidine	11 U	12 U	11 U	11 UJ	11 UJ
N-Nitrosopyrrolidine	12 U	12 U	11 U	12 UJ	12 UJ
p-Dimethylamino azobenzene	9.5 U	9.7 U	8.8 U	9.2 U	9.6 UJ
Pentachlorobenzene	8.3 U	8.5 U	7.7 U	8.1 U	8.4 UJ
Pentachloronitrobenzene	7.9 U	8.1 U	7.4 U	7.7 U	7.9 UJ
Pentachlorophenol	11 U	11 U	10 U	11 UJ	11 UJ
Phenacetin	6.3 U	6.4 U	5.9 U	6.1 U	6.3 UJ
Phenanthrene	2.3 UJ	2.3 UJ	2.1 UJ	2.2 UJ	2.3 UJ
Phenol	6.4 U	6.6 U	6 U	6.3 U	6.5 UJ
p-Phenylene diamine	210 U	220 U	200 U	210 U	220 UJ
Pronamide	12 U	12 U	11 U	12 U	12 UJ
Pyrene	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ
Pyridine	15 U	15 U	14 U	14 U	15 UJ
Safrole, Total	11 U	11 U	10 U	11 U	11 UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0	
Metals (mg/kg)										
Antimony	0.094	U	0.14	U	0.084	U	0.096	U	0.096	UJ
Arsenic	1.1		1.2		0.5	J	0.48	J	0.47	U
Barium	13	J	16	J	12	J	55	J	34	J
Beryllium	0.046	J	0.096	J	0.089	J	0.21		0.064	U
Cadmium	0.039	UJ	0.04	UJ	0.035	UJ	0.04	UJ	0.04	UJ
Chromium	15		19		3.6		4		17	J
Cobalt	2.3		1.6		2.7		8		0.5	J
Copper	45	J	55	J	94	J	130	J	18	J
Lead	1.4		3		1.3		0.54		0.39	J
Mercury	0.042		0.0054	U	0.0049	U	0.0056	J	0.0047	U
Nickel	2.9		3.6		1.3		2.5		2.3	J
Selenium	2.9		0.64	J	0.76		0.4	J	0.59	J
Silver	0.091	J	0.051	J	0.018	U	0.035	J	0.034	UJ
Thallium	0.15	U	0.16	U	0.13	U	0.15	U	0.15	U
Tin	5	U	5.2	U	4.5	U	5.1	U	5.1	U
Vanadium	110	J	140	J	230	J	200	J	29	J
Zinc	8.7	J	16	J	14	J	33	J	8.1	J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	0.71	U	0.63	U	0.63	U	0.65	U	0.71	U
1,1,1-Trichloroethane	0.65	U	0.57	U	0.57	U	0.58	U	0.65	U
1,1,2,2-Tetrachloroethane	1.6	U	1.4	U	1.4	U	1.4	U	1.6	U
1,1,2-Trichloroethane	1.3	U	1.2	U	1.2	U	1.2	U	1.3	U
1,1-Dichloroethane	0.56	U	0.49	U	0.5	U	0.5	U	0.56	U
1,1-Dichloroethene	0.6	U	0.53	U	0.53	U	0.54	U	0.6	U
1,2,3-Trichloropropane	1.6	U	1.4	U	1.4	U	1.4	U	1.6	U
1,2-Dibromo-3-Chloropropane	3.1	U	2.7	U	2.8	U	2.8	U	3.1	U
1,2-Dichloroethane	1.1	U	0.98	U	0.99	U	1	U	1.1	U
1,2-Dichloropropane	1.2	U	1.1	U	1.1	U	1.1	U	1.2	U
2-Butanone (MEK)	5.4	U	2.6	U	2.7	U	5	U	10	U
2-Chloro-1,3-butadiene	0.64	U	0.56	U	0.56	U	0.57	U	0.63	U
2-Hexanone	2.3	U	2.1	U	2.1	U	2.1	U	2.3	U
3-Chloro-1-propene	1.7	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.7	UJ
4-Methyl-2-pentanone (MIBK)	3.2	U	2.8	U	2.9	U	2.9	U	3.2	U
Acetone	49	J	17	J	11	J	99	J	95	J
Acetonitrile	50	U	44	U	45	U	45	U	50	U
Acrolein	21	R	19	R	19	R	19	R	21	R
Acrylonitrile	26	U	22	U	23	U	23	U	26	U
Benzene	0.88	U	0.77	U	0.78	U	0.8	U	0.88	U
Bromoform	1.2	U	1.1	U	1.1	U	1.1	U	1.2	U
Bromomethane	1.8	U	1.6	U	1.6	U	1.6	U	1.8	U
Carbon disulfide	0.57	U	0.5	U	0.51	U	0.51	U	0.57	U
Carbon tetrachloride	1.1	U	0.98	U	0.99	U	1	U	1.1	U
Chlorobenzene	0.82	U	0.71	U	0.72	U	0.74	U	0.81	U
Chlorodibromomethane	0.56	U	0.49	U	0.5	U	0.5	U	0.56	U
Chloroethane	1.3	U	1.2	U	1.2	U	1.2	U	1.3	U
Chloroform	0.56	U	0.49	U	0.5	U	0.5	U	0.56	U
Chloromethane	0.79	U	0.69	U	0.7	U	0.72	U	0.79	U
cis-1,3-Dichloropropene	0.97	U	0.85	U	0.86	U	0.88	U	0.97	U
Dibromomethane	1.3	U	1.2	U	1.2	U	1.2	U	1.3	U
Dichlorobromomethane	0.93	U	0.81	U	0.82	U	0.84	U	0.92	U
Dichlorodifluoromethane	0.99	U	0.87	U	0.88	U	0.9	U	0.99	U
Ethyl methacrylate	2.5	U	2.2	U	2.2	U	2.2	U	2.4	U
Ethylbenzene	0.84	U	0.73	U	0.74	U	0.76	U	0.83	U
Ethylene Dibromide	1.7	U	1.5	U	1.5	U	1.5	U	1.7	U
Iodomethane	1.1	UJ	0.98	UJ	0.99	UJ	1	UJ	1.1	UJ
Isobutyl alcohol	77	U	67	U	68	U	70	R	77	R
Methacrylonitrile	27	UJ	23	U	24	U	24	UJ	27	UJ
Methyl methacrylate	4.1	UJ	3.6	U	3.7	U	3.7	UJ	4.1	UJ
Methylene Chloride	1.1	U	0.98	U	0.99	U	1	U	1.1	U
Pentachloroethane	2.5	UJ	2.2	U	2.2	U	2.2	UJ	2.4	UJ
Propionitrile	23	U	21	U	21	U	21	U	23	U
Styrene	0.74	U	0.65	U	0.65	U	0.67	U	0.73	U
Tetrachloroethene	0.82	U	0.71	U	0.72	U	0.74	U	0.81	U
Toluene	0.88	U	0.77	U	0.78	U	0.8	U	0.88	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Volatile Organic Compounds (ug/kg)										
trans-1,2-Dichloroethene	1.1	U	0.95	U	0.96	U	0.98	U	1.1	U
trans-1,3-Dichloropropene	0.97	U	0.85	U	0.86	U	0.88	U	0.97	U
trans-1,4-Dichloro-2-butene	3.5	UJ	3	U	3.1	U	3.1	UJ	3.4	UJ
Trichloroethene	1.1	U	0.98	U	0.99	U	1	U	1.1	U
Trichlorofluoromethane	1.7	U	1.5	U	1.5	U	1.5	U	1.7	U
Vinyl acetate	1.7	U	1.5	U	1.5	U	1.5	U	1.7	U
Vinyl chloride	0.65	U	0.57	U	0.57	U	0.58	U	0.65	U
Xylenes, Total	2.6	U	2.2	U	2.3	U	2.3	U	2.6	U
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	9.9	UJ	9.7	U	9.5	U	9.7	UJ	10	UJ
1,2,4,5-Tetrachlorobenzene	8.4	UJ	8.2	U	8.1	U	8.2	UJ	8.6	UJ
1,2,4-Trichlorobenzene	9.9	UJ	9.7	U	9.5	U	9.7	UJ	10	UJ
1,2-Dichlorobenzene	9.3	UJ	9.2	U	9	U	9.2	UJ	9.6	UJ
1,3,5-Trinitrobenzene	23	UJ	22	U	22	U	22	UJ	23	UJ
1,3-Dichlorobenzene	8	UJ	7.8	U	7.7	U	7.8	UJ	8.2	UJ
1,3-Dinitrobenzene	5.2	UJ	5.1	U	5	U	5.1	UJ	5.3	UJ
1,4-Dichlorobenzene	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
1,4-Dioxane	11	UJ	10	U	10	U	10	UJ	11	UJ
1,4-Naphthoquinone	5.2	UJ	5.1	U	5	U	5.1	UJ	5.3	UJ
2,2'-oxybis[1-chloropropane]	8.4	UJ	8.2	U	8.1	UJ	8.2	UJ	8.6	UJ
2,3,4,6-Tetrachlorophenol	5.6	UJ	5.5	U	5.4	UJ	5.5	UJ	5.8	UJ
2,4,5-Trichlorophenol	9.1	UJ	8.9	U	8.7	UJ	8.9	UJ	9.3	UJ
2,4,6-Trichlorophenol	11	UJ	10	U	10	UJ	10	UJ	11	UJ
2,4-Dichlorophenol	11	UJ	11	U	10	UJ	11	UJ	11	UJ
2,4-Dimethylphenol	23	UJ	22	U	22	UJ	22	UJ	23	UJ
2,4-Dinitrophenol	110	UJ	110	UJ	110	UJ	110	UJ	110	UJ
2,4-Dinitrotoluene	7.9	UJ	7.7	UJ	7.6	U	7.7	UJ	8.1	UJ
2,6-Dichlorophenol	8.5	UJ	8.4	U	8.2	UJ	8.4	UJ	8.8	UJ
2,6-Dinitrotoluene	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
2-Acetylaminofluorene	6.8	UJ	6.7	U	6.6	U	6.7	UJ	7	UJ
2-Chloronaphthalene	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
2-Chlorophenol	8.8	UJ	8.6	U	8.5	UJ	8.6	UJ	9	UJ
2-Methylnaphthalene	2.3	UJ	2.2	U	2.2	U	2.2	UJ	2.3	UJ
2-Methylphenol	11	UJ	11	U	10	UJ	11	UJ	11	UJ
2-Naphthylamine	27	UJ	26	U	26	UJ	26	UJ	27	UJ
2-Nitroaniline	8.7	UJ	8.5	U	8.4	U	8.5	UJ	8.9	UJ
2-Nitrophenol	9.7	UJ	9.5	U	9.4	UJ	9.5	UJ	10	UJ
2-Picoline	16	UJ	16	U	15	U	16	UJ	16	UJ
2-Toluidine	12	UJ	12	U	12	U	12	UJ	13	UJ
3 & 4 Methylphenol	9.7	UJ	9.5	U	9.4	UJ	9.5	UJ	10	UJ
3,3'-Dichlorobenzidine	12	UJ	12	U	12	U	12	UJ	13	UJ
3,3'-Dimethylbenzidine	240	UJ	240	U	230	UJ	240	UJ	250	UJ
3-Methylcholanthrene	8.1	UJ	8	U	7.8	U	8	UJ	8.4	UJ
3-Nitroaniline	6	UJ	5.9	U	5.8	U	5.9	UJ	6.2	UJ
4,6-Dinitro-2-methylphenol	7.7	UJ	7.6	UJ	7.4	UJ	7.6	UJ	7.9	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Semivolatile Organic Compounds (ug/kg)										
4-Aminobiphenyl	17	UJ	17	U	17	U	17	UJ	18	UJ
4-Bromophenyl phenyl ether	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ
4-Chloro-3-methylphenol	10	UJ	9.8	U	9.6	UJ	9.8	UJ	10	UJ
4-Chloroaniline	8	UJ	7.8	U	7.7	U	7.8	UJ	8.2	UJ
4-Chlorophenyl phenyl ether	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
4-Nitroaniline	10	UJ	10	UJ	9.9	U	10	UJ	11	UJ
4-Nitrophenol	44	UJ	43	UJ	42	UJ	43	UJ	45	UJ
4-Nitroquinoline-1-oxide	15	R	14	R	14	R	14	R	15	R
7,12-Dimethylbenz(a)anthracene	12	UJ	12	U	12	U	12	UJ	13	UJ
Acenaphthene	0.76	UJ	0.75	U	0.73	U	0.75	UJ	0.78	UJ
Acenaphthylene	2.3	UJ	2.2	U	2.2	U	2.2	UJ	2.3	UJ
Acetophenone	11	UJ	11	U	11	U	11	UJ	12	UJ
alpha,alpha-Dimethyl phenethylamine	79	UJ	77	U	76	U	77	UJ	81	UJ
Aniline	8.4	UJ	8.2	U	8.1	U	8.2	UJ	8.6	UJ
Anthracene	2.3	UJ	2.2	U	2.2	U	2.2	UJ	2.3	UJ
Aramite, Total	15	UJ	14	U	14	UJ	14	UJ	15	UJ
Benzo[a]anthracene	2.3	UJ	4	J	2.2	U	2.2	UJ	2.3	UJ
Benzo[a]pyrene	0.88	UJ	4.2	J	0.85	U	0.86	UJ	0.9	UJ
Benzo[b]fluoranthene	1	UJ	0.99	U	0.98	U	0.99	UJ	1	UJ
Benzo[g,h,i]perylene	2.3	UJ	2.2	U	2.2	U	2.2	UJ	2.3	UJ
Benzo[k]fluoranthene	1.3	UJ	8.6	J	1.3	U	1.3	UJ	1.4	UJ
Benzyl alcohol	11	UJ	10	U	10	UJ	10	UJ	11	UJ
Bis(2-chloroethoxy)methane	9.1	UJ	8.9	U	8.7	U	8.9	UJ	9.3	UJ
Bis(2-chloroethyl)ether	7.6	UJ	7.5	U	7.3	U	7.5	UJ	7.8	UJ
Bis(2-ethylhexyl) phthalate	16	UJ	19	U	8.8	U	14	UJ	42	UJ
Butyl benzyl phthalate	9.6	UJ	9.4	U	9.3	U	9.4	UJ	9.9	UJ
Chrysene	0.81	UJ	6.9	J	0.78	U	0.8	UJ	0.84	UJ
Diallate	13	UJ	13	U	12	U	13	UJ	13	UJ
Dibenz(a,h)anthracene	0.79	UJ	0.77	U	0.76	U	0.77	UJ	0.81	UJ
Dibenzofuran	5.6	UJ	5.5	U	5.4	U	5.5	UJ	5.8	UJ
Diethyl phthalate	15	UJ	14	U	14	U	14	UJ	15	UJ
Dimethyl phthalate	8.5	UJ	8.4	U	8.2	U	8.4	UJ	8.8	UJ
Di-n-butyl phthalate	33	UJ	35	U	32	U	33	UJ	41	J
Di-n-octyl phthalate	4.4	UJ	4.3	U	4.2	U	4.3	UJ	4.5	UJ
Dinoseb	23	UJ	22	U	22	U	22	UJ	23	UJ
Ethyl methanesulfonate	15	UJ	14	U	14	U	14	UJ	15	UJ
Fluoranthene	2.3	UJ	5.7	J	2.2	U	2.2	UJ	2.3	UJ
Fluorene	1	UJ	1	U	0.99	U	1	UJ	1.1	UJ
Hexachlorobenzene	9.1	UJ	8.9	U	8.7	U	8.9	UJ	9.3	UJ
Hexachlorobutadiene	12	UJ	12	U	12	U	12	UJ	12	UJ
Hexachlorocyclopentadiene	19	UJ	18	U	18	U	18	UJ	19	UJ
Hexachloroethane	9.9	UJ	9.7	U	9.5	U	9.7	UJ	10	UJ
Hexachlorophene	1100	UJ	1100	R	1100	R	1100	UJ	1100	R
Hexachloropropene	9.6	UJ	9.4	UJ	9.3	U	9.4	UJ	9.9	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Semivolatile Organic Compounds (ug/kg)										
Indeno[1,2,3-cd]pyrene	1.6	UJ	1.6	UJ	1.5	UJ	1.6	UJ	1.6	UJ
Isophorone	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
Isosafrole	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ
Methapyrilene	12	UJ	12	UJ	12	UJ	12	UJ	13	UJ
Methyl methanesulfonate	12	UJ	12	U	12	U	12	UJ	13	UJ
Naphthalene	0.8	UJ	0.78	U	0.77	U	0.78	UJ	0.82	UJ
Nitrobenzene	9.2	UJ	9	U	8.9	U	9	UJ	9.5	UJ
N-Nitro-o-toluidine	8	UJ	7.8	U	7.7	U	7.8	UJ	8.2	UJ
N-Nitrosodiethylamine	16	UJ	16	U	15	U	16	UJ	16	UJ
N-Nitrosodimethylamine	13	UJ	13	U	13	U	13	UJ	13	UJ
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	12	UJ	12	UJ	12	UJ
N-Nitrosodi-n-propylamine	8.7	UJ	8.5	U	8.4	U	8.5	UJ	8.9	UJ
N-Nitrosodiphenylamine	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ
N-Nitrosomethylethylamine	7.6	UJ	7.5	U	7.3	U	7.5	UJ	7.8	UJ
N-Nitrosomorpholine	8.8	UJ	8.6	UJ	8.5	UJ	8.6	UJ	9	UJ
N-Nitrosopiperidine	11	UJ	11	U	11	UJ	11	UJ	12	UJ
N-Nitrosopyrrolidine	12	UJ	12	U	11	UJ	12	UJ	12	UJ
p-Dimethylamino azobenzene	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ
Pentachlorobenzene	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
Pentachloronitrobenzene	7.9	UJ	7.7	U	7.6	U	7.7	UJ	8.1	UJ
Pentachlorophenol	11	UJ	11	U	11	UJ	11	UJ	11	UJ
Phenacetin	6.3	UJ	6.1	U	6	U	6.1	UJ	6.4	UJ
Phenanthrene	2.3	UJ	2.2	UJ	2.2	UJ	2.2	UJ	2.3	UJ
Phenol	6.4	UJ	6.3	U	6.2	U	6.3	UJ	6.6	UJ
p-Phenylene diamine	210	UJ	210	U	210	U	210	UJ	220	UJ
Pronamide	12	UJ	12	U	12	U	12	UJ	12	UJ
Pyrene	2.3	UJ	8.1	J	2.2	U	2.2	UJ	2.3	UJ
Pyridine	15	UJ	14	U	14	U	14	UJ	15	UJ
Safrole, Total	11	UJ	11	U	11	U	11	UJ	11	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Metals (mg/kg)										
Antimony	0.15	UJ	0.088	U	0.26	U	0.089	UJ	0.12	UJ
Arsenic	3.4		0.8		1.5		1.2		1.7	
Barium	42	J	14	J	7.9	J	10	J	470	J
Beryllium	0.18		0.098	J	0.18		0.15		0.43	
Cadmium	0.064	J	0.036	UJ	0.036	UJ	0.037	UJ	0.061	J
Chromium	25	J	7.2		12		56	J	120	J
Cobalt	9.9	J	5.4		12		5.6	J	21	J
Copper	85	J	42	J	84	J	59	J	98	J
Lead	4.7	J	0.8		1.5		0.76	J	0.99	J
Mercury	0.74	J	0.015	J	0.0048	U	0.017	J	0.0051	U
Nickel	6.7	J	2.2		4.9		5.8	J	16	J
Selenium	2.2	J	0.57	J	1.2		0.49	J	0.62	J
Silver	0.052	UJ	0.04	J	0.036	J	0.035	UJ	0.061	UJ
Thallium	0.14	U	0.14	U	0.14	U	0.14	U	0.65	
Tin	4.8	U	4.7	U	4.6	U	4.8	U	4.9	U
Vanadium	470	J	170	J	380	J	170	J	220	J
Zinc	31	J	16	J	47	J	26	J	62	J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB06		56SB07		56SB07	
Sample ID	56SB06-01D		56SB06-01		56SB06-03		56SB07-02		56SB07-03	
Date	4/30/2008		4/30/2008		4/30/2008		5/1/2008		5/1/2008	
Depth Range	1.0-3.0		1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0	
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	0.59	U	0.62	U	0.66	U	0.69	U	0.57	U
1,1,1-Trichloroethane	0.53	U	0.57	U	0.6	U	0.63	U	0.52	U
1,1,2,2-Tetrachloroethane	1.3	U	1.4	U	1.4	U	1.5	U	1.2	U
1,1,2-Trichloroethane	1.1	U	1.2	U	1.2	U	1.3	U	1.1	U
1,1-Dichloroethane	0.46	U	0.49	U	0.52	U	0.54	U	0.45	U
1,1-Dichloroethene	0.5	U	0.53	U	0.56	U	0.59	U	0.48	U
1,2,3-Trichloropropane	1.3	U	1.4	U	1.4	U	1.5	U	1.2	U
1,2-Dibromo-3-Chloropropane	2.6	U	2.7	U	2.9	U	3	U	2.5	U
1,2-Dichloroethane	0.92	U	0.97	U	1	U	1.1	U	0.89	U
1,2-Dichloropropane	1	U	1.1	U	1.1	U	1.2	U	0.98	U
2-Butanone (MEK)	3.9	U	3.5	U	2.8	U	16	U	4.4	U
2-Chloro-1,3-butadiene	0.52	U	0.56	U	0.59	U	0.62	U	0.51	U
2-Hexanone	1.9	U	2	U	2.2	U	2.3	U	1.9	U
3-Chloro-1-propene	1.4	UJ	1.5	UJ	1.6	UJ	1.6	UJ	1.3	UJ
4-Methyl-2-pentanone (MIBK)	2.7	U	2.8	U	3	U	3.1	U	2.6	U
Acetone	55	UJ	50	J	25	U	260		54	U
Acetonitrile	41	U	44	U	47	U	49	U	40	U
Acrolein	17	R	19	R	20	R	21	R	17	R
Acrylonitrile	21	UJ	22	U	24	UJ	25	UJ	21	UJ
Benzene	0.73	U	0.77	U	0.82	U	0.86	U	0.71	U
Bromoform	1	U	1.1	U	1.1	U	1.2	U	0.98	U
Bromomethane	1.5	U	1.6	U	1.7	U	1.7	U	1.4	U
Carbon disulfide	0.47	U	0.5	U	0.53	U	1.9	J	0.46	U
Carbon tetrachloride	0.92	U	0.97	U	1	U	1.1	U	0.89	U
Chlorobenzene	0.67	U	0.71	U	0.75	U	0.79	U	0.65	U
Chlorodibromomethane	0.46	U	0.49	U	0.52	U	0.54	U	0.45	U
Chloroethane	1.1	U	1.2	U	1.2	U	1.3	U	1.1	U
Chloroform	0.46	U	0.49	U	0.52	U	0.54	U	0.45	U
Chloromethane	0.65	U	0.69	U	0.73	U	0.77	U	0.63	U
cis-1,3-Dichloropropene	0.8	U	0.85	U	0.9	U	0.94	U	0.78	U
Dibromomethane	1.1	U	1.2	U	1.2	U	1.3	U	1.1	U
Dichlorobromomethane	0.76	U	0.81	U	0.86	U	0.9	U	0.74	U
Dichlorodifluoromethane	0.82	U	0.87	U	0.92	U	0.96	U	0.79	U
Ethyl methacrylate	2	U	2.1	U	2.3	U	2.4	U	2	U
Ethylbenzene	0.69	U	0.73	U	0.78	U	0.81	U	0.67	U
Ethylene Dibromide	1.4	U	1.5	U	1.6	U	1.6	U	1.3	U
Iodomethane	0.92	U	0.97	UJ	1	U	1.7	J	0.89	U
Isobutyl alcohol	63	R	67	R	71	R	75	R	62	R
Methacrylonitrile	22	U	23	UJ	25	U	26	U	21	U
Methyl methacrylate	3.4	U	3.6	UJ	3.8	U	4	U	3.3	U
Methylene Chloride	0.92	U	0.97	U	1	U	1.1	U	0.89	U
Pentachloroethane	2	UJ	2.1	UJ	2.3	UJ	2.4	UJ	2	UJ
Propionitrile	19	U	20	U	22	U	23	U	19	U
Styrene	0.61	U	0.64	U	0.68	U	0.72	U	0.59	U
Tetrachloroethene	0.67	U	0.71	U	0.75	U	0.79	U	0.65	U
Toluene	0.73	U	0.77	U	0.82	U	0.86	U	0.71	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06	56SB06	56SB06	56SB07	56SB07
Sample ID	56SB06-01D	56SB06-01	56SB06-03	56SB07-02	56SB07-03
Date	4/30/2008	4/30/2008	4/30/2008	5/1/2008	5/1/2008
Depth Range	1.0-3.0	1.0-3.0	5.0-7.0	3.0-5.0	5.0-7.0
Volatile Organic Compounds (ug/kg)					
trans-1,2-Dichloroethene	0.89 U	0.95 U	1 U	1.1 U	0.87 U
trans-1,3-Dichloropropene	0.8 U	0.85 U	0.9 U	0.94 U	0.78 U
trans-1,4-Dichloro-2-butene	2.8 U	3 UJ	3.2 U	3.4 U	2.8 U
Trichloroethene	0.92 U	0.97 U	1 U	1.1 U	0.89 U
Trichlorofluoromethane	1.4 U	1.5 U	1.6 U	1.6 U	1.3 U
Vinyl acetate	1.4 U	1.5 U	1.6 U	1.6 U	1.3 U
Vinyl chloride	0.53 U	0.57 U	0.6 U	0.63 U	0.52 U
Xylenes, Total	2.1 U	2.2 U	2.4 U	2.5 U	2.1 U
Semivolatile Organic Compounds (ug/kg)					
1,1'-Biphenyl	9.4 UJ	9.4 UJ	10 UJ	9.6 U	9.3 U
1,2,4,5-Tetrachlorobenzene	8 UJ	8 UJ	8.6 UJ	8.2 U	7.9 U
1,2,4-Trichlorobenzene	9.4 UJ	9.4 UJ	10 UJ	9.6 U	9.4 U
1,2-Dichlorobenzene	8.9 UJ	8.9 UJ	9.5 UJ	9.1 U	8.8 U
1,3,5-Trinitrobenzene	22 UJ	22 UJ	23 UJ	22 U	21 U
1,3-Dichlorobenzene	7.6 UJ	7.6 UJ	8.2 UJ	7.8 U	7.6 U
1,3-Dinitrobenzene	5 UJ	4.9 UJ	5.3 UJ	5.1 U	4.9 U
1,4-Dichlorobenzene	7.9 UJ	7.9 UJ	8.4 UJ	8.1 U	7.8 U
1,4-Dioxane	10 UJ	10 UJ	11 UJ	10 U	10 U
1,4-Naphthoquinone	5 UJ	4.9 UJ	5.3 UJ	5.1 U	4.9 U
2,2'-oxybis[1-chloropropane]	8 UJ	8 UJ	8.6 UJ	8.3 U	8 U
2,3,4,6-Tetrachlorophenol	5.3 UJ	5.3 UJ	5.7 UJ	5.5 U	5.3 U
2,4,5-Trichlorophenol	8.6 UJ	8.6 UJ	9.2 UJ	8.9 U	8.6 U
2,4,6-Trichlorophenol	10 UJ	10 UJ	11 UJ	10 U	10 U
2,4-Dichlorophenol	10 UJ	10 UJ	11 UJ	11 U	10 U
2,4-Dimethylphenol	22 UJ	22 UJ	23 UJ	22 U	21 U
2,4-Dinitrophenol	110 UJ	110 UJ	110 UJ	110 U	100 U
2,4-Dinitrotoluene	7.5 UJ	7.5 UJ	8 UJ	7.7 UJ	7.4 UJ
2,6-Dichlorophenol	8.1 UJ	8.1 UJ	8.7 UJ	8.3 U	8.1 U
2,6-Dinitrotoluene	7.9 UJ	7.9 UJ	8.4 UJ	8.1 U	7.8 U
2-Acetylaminofluorene	6.5 UJ	6.5 UJ	6.9 UJ	6.6 U	6.4 UJ
2-Chloronaphthalene	7.9 UJ	7.9 UJ	8.4 UJ	8.1 U	7.8 U
2-Chlorophenol	8.4 UJ	8.4 UJ	9 UJ	8.6 U	8.3 U
2-Methylnaphthalene	2.2 UJ	2.2 UJ	2.3 UJ	2.2 U	2.1 U
2-Methylphenol	10 UJ	10 UJ	11 UJ	11 U	10 U
2-Naphthylamine	25 UJ	25 UJ	27 UJ	26 U	25 U
2-Nitroaniline	8.3 UJ	8.2 UJ	8.8 UJ	8.5 U	8.2 U
2-Nitrophenol	9.3 UJ	9.2 UJ	9.9 UJ	9.5 U	9.2 U
2-Picoline	15 UJ	15 UJ	16 UJ	16 U	15 U
2-Toluidine	12 UJ	12 UJ	13 UJ	12 U	12 U
3 & 4 Methylphenol	9.3 UJ	9.2 UJ	9.9 UJ	9.5 U	9.2 U
3,3'-Dichlorobenzidine	12 UJ	12 UJ	13 UJ	12 U	12 U
3,3'-Dimethylbenzidine	230 UJ	230 UJ	240 UJ	230 U	230 U
3-Methylcholanthrene	7.7 UJ	7.7 UJ	8.3 UJ	7.9 U	7.7 U
3-Nitroaniline	5.7 UJ	5.7 UJ	6.1 UJ	5.9 U	5.7 U
4,6-Dinitro-2-methylphenol	7.4 UJ	7.3 UJ	7.9 UJ	7.5 UJ	7.3 UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB06		56SB07		56SB07	
Sample ID	56SB06-01D		56SB06-01		56SB06-03		56SB07-02		56SB07-03	
Date	4/30/2008		4/30/2008		4/30/2008		5/1/2008		5/1/2008	
Depth Range	1.0-3.0		1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0	
Semivolatile Organic Compounds (ug/kg)										
4-Aminobiphenyl	17	UJ	16	UJ	18	UJ	17	U	16	U
4-Bromophenyl phenyl ether	9	UJ	9	UJ	9.7	UJ	9.2	U	9	U
4-Chloro-3-methylphenol	9.5	UJ	9.5	UJ	10	UJ	9.8	U	9.5	U
4-Chloroaniline	7.6	UJ	7.6	UJ	8.2	UJ	7.8	U	7.6	U
4-Chlorophenyl phenyl ether	7.9	UJ	7.9	UJ	8.4	UJ	8.1	U	7.8	U
4-Nitroaniline	9.8	UJ	9.8	UJ	10	UJ	10	U	9.7	U
4-Nitrophenol	42	UJ	42	UJ	45	UJ	43	U	42	U
4-Nitroquinoline-1-oxide	14	R	14	R	15	R	14	R	14	R
7,12-Dimethylbenz(a)anthracene	12	UJ	12	UJ	13	UJ	12	U	12	U
Acenaphthene	0.72	UJ	0.72	UJ	0.78	UJ	0.74	U	0.72	U
Acenaphthylene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Acetophenone	11	UJ	11	UJ	12	UJ	11	U	11	U
alpha,alpha-Dimethyl phenethylamine	75	UJ	75	UJ	80	UJ	77	UJ	74	UJ
Aniline	8	UJ	8	UJ	8.6	UJ	8.3	U	7.9	U
Anthracene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Aramite, Total	14	UJ	14	UJ	15	UJ	14	UJ	14	UJ
Benzo[a]anthracene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Benzo[a]pyrene	0.84	UJ	0.84	UJ	0.9	UJ	1.2	J	0.83	U
Benzo[b]fluoranthene	0.97	UJ	0.96	UJ	1	UJ	1	J	0.96	U
Benzo[g,h,i]perylene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Benzo[k]fluoranthene	1.3	UJ	1.3	UJ	1.4	UJ	1.3	U	1.3	U
Benzyl alcohol	10	UJ	10	UJ	11	UJ	10	U	10	U
Bis(2-chloroethoxy)methane	8.6	UJ	8.6	UJ	9.2	UJ	8.9	U	8.6	U
Bis(2-chloroethyl)ether	7.2	UJ	7.2	UJ	7.8	UJ	7.4	U	7.2	U
Bis(2-ethylhexyl) phthalate	8.5	UJ	6.1	UJ	13	UJ	61	U	32	U
Butyl benzyl phthalate	9.1	UJ	9.1	UJ	9.8	UJ	9.5	U	9.1	U
Chrysene	0.77	UJ	0.77	UJ	0.83	UJ	1.0	J	0.77	U
Diallate	12	UJ	12	UJ	13	UJ	12	U	12	U
Dibenz(a,h)anthracene	0.75	UJ	0.75	UJ	0.8	UJ	0.77	U	0.74	U
Dibenzofuran	5.3	UJ	5.3	UJ	5.7	UJ	5.5	U	5.3	U
Diethyl phthalate	14	UJ	14	UJ	15	UJ	14	U	14	U
Dimethyl phthalate	8.1	UJ	8.1	UJ	8.7	UJ	8.3	U	8.1	U
Di-n-butyl phthalate	32	UJ	32	UJ	34	UJ	33	U	32	U
Di-n-octyl phthalate	4.2	UJ	4.2	UJ	4.5	UJ	4.3	U	4.2	U
Dinoseb	22	UJ	22	UJ	23	UJ	22	U	21	U
Ethyl methanesulfonate	14	UJ	14	UJ	15	UJ	14	U	14	U
Fluoranthene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Fluorene	0.98	UJ	0.98	UJ	1	UJ	1	U	0.97	U
Hexachlorobenzene	8.6	UJ	8.6	UJ	9.2	UJ	8.9	U	8.6	U
Hexachlorobutadiene	12	UJ	12	UJ	12	UJ	12	U	11	U
Hexachlorocyclopentadiene	18	UJ	18	UJ	19	UJ	18	U	18	U
Hexachloroethane	9.4	UJ	9.4	UJ	10	UJ	9.6	U	9.3	U
Hexachlorophene	1100	R	1100	R	1100	R	1100	R	1000	R
Hexachloropropene	9.1	UJ	9.1	UJ	9.8	UJ	9.4	UJ	9.1	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB06		56SB07		56SB07	
Sample ID	56SB06-01D		56SB06-01		56SB06-03		56SB07-02		56SB07-03	
Date	4/30/2008		4/30/2008		4/30/2008		5/1/2008		5/1/2008	
Depth Range	1.0-3.0		1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0	
Semivolatile Organic Compounds (ug/kg)										
Indeno[1,2,3-cd]pyrene	1.5	UJ	1.5	UJ	1.6	UJ	1.6	U	1.5	U
Isophorone	7.9	UJ	7.9	UJ	8.4	UJ	8.1	U	7.8	U
Isosafrole	9	UJ	9	UJ	9.7	UJ	9.2	U	9	U
Methapyrilene	12	UJ	12	UJ	13	UJ	12	U	12	U
Methyl methanesulfonate	12	UJ	12	UJ	13	UJ	12	U	12	U
Naphthalene	0.76	UJ	0.76	UJ	0.82	UJ	0.78	U	0.76	U
Nitrobenzene	8.8	UJ	8.7	UJ	9.4	UJ	9.0	U	8.7	U
N-Nitro-o-toluidine	7.6	UJ	7.6	UJ	8.2	UJ	7.9	U	7.6	U
N-Nitrosodiethylamine	15	UJ	15	UJ	16	UJ	16	U	15	U
N-Nitrosodimethylamine	12	UJ	12	UJ	13	UJ	13	U	12	U
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	12	UJ	12	U	11	U
N-Nitrosodi-n-propylamine	8.3	UJ	8.2	UJ	8.8	UJ	8.5	U	8.2	U
N-Nitrosodiphenylamine	9	UJ	9	UJ	9.7	UJ	9.2	U	9	U
N-Nitrosomethylethylamine	7.2	UJ	7.2	UJ	7.8	UJ	7.5	U	7.2	U
N-Nitrosomorpholine	8.4	UJ	8.4	UJ	9	UJ	8.6	UJ	8.3	UJ
N-Nitrosopiperidine	11	UJ	11	UJ	12	UJ	11	UJ	11	UJ
N-Nitrosopyrrolidine	11	UJ	11	UJ	12	UJ	12	U	11	U
p-Dimethylamino azobenzene	9	UJ	9	UJ	9.7	UJ	9.3	U	9	U
Pentachlorobenzene	7.9	UJ	7.9	UJ	8.4	UJ	8.2	U	7.8	U
Pentachloronitrobenzene	7.5	UJ	7.5	UJ	8	UJ	7.8	U	7.4	U
Pentachlorophenol	11	UJ	11	UJ	11	UJ	11	U	11	U
Phenacetin	6	UJ	6	UJ	6.4	UJ	6.1	U	5.9	U
Phenanthrene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Phenol	6.1	UJ	6.1	UJ	6.5	UJ	6.2	U	6.1	U
p-Phenylene diamine	200	UJ	200	UJ	220	UJ	210	U	200	U
Pronamide	11	UJ	11	UJ	12	UJ	12	U	11	U
Pyrene	2.2	UJ	2.2	UJ	2.3	UJ	2.2	U	2.1	U
Pyridine	14	UJ	14	UJ	15	UJ	14	U	14	U
Safrole, Total	11	UJ	11	UJ	11	UJ	11	U	10	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB06		56SB07		56SB07	
Sample ID	56SB06-01D		56SB06-01		56SB06-03		56SB07-02		56SB07-03	
Date	4/30/2008		4/30/2008		4/30/2008		5/1/2008		5/1/2008	
Depth Range	1.0-3.0		1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0	
Metals (mg/kg)										
Antimony	0.092	UJ	0.33	UJ	0.12	UJ	0.18	UJ	0.13	UJ
Arsenic	0.86	R	4.9	R	2.6		2.4		2.1	
Barium	28	J	18	J	18	J	130	J	49	J
Beryllium	0.13		0.17		0.3		0.3		0.3	
Cadmium	0.038	UJ	0.037	UJ	0.038	UJ	0.14	J	0.16	J
Chromium	19	R	90	R	70	J	60	J	67	J
Cobalt	1.1	J	2.1	J	7.3	J	34	J	29	J
Copper	30	J	75	J	140	J	120	J	130	J
Lead	2.4	R	19	R	11	J	8.5	J	5.8	J
Mercury	0.078	J	0.025	J	0.11	J	0.13	J	0.081	J
Nickel	4.1	J	2.8	J	6.5	J	17	J	11	J
Selenium	2.3	J	2.3	J	1	J	1.4	J	0.85	J
Silver	0.027	UJ	0.056	UJ	0.044	UJ	0.089	J	0.11	J
Thallium	0.15	U	0.14	U	0.15	U	0.19	J	0.19	J
Tin	4.9	U	4.8	U	4.9	U	4.9	U	4.7	U
Vanadium	83	R	940	R	410	J	290	J	360	J
Zinc	8.8	J	8.7	J	20	J	72	J	35	J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SB08	
Sample ID	56SB08-01		56SB08-02	
Date	5/5/2008		5/5/2008	
Depth Range	1.0-3.0		3.0-5.0	
Volatile Organic Compounds (ug/kg)				
1,1,1,2-Tetrachloroethane	0.62	U	0.62	U
1,1,1-Trichloroethane	0.56	U	0.56	U
1,1,2,2-Tetrachloroethane	1.3	U	1.3	U
1,1,2-Trichloroethane	1.2	U	1.2	U
1,1-Dichloroethane	0.48	U	0.48	U
1,1-Dichloroethene	0.52	U	0.52	U
1,2,3-Trichloropropane	1.3	U	1.3	U
1,2-Dibromo-3-Chloropropane	2.7	U	2.7	U
1,2-Dichloroethane	0.96	U	0.96	U
1,2-Dichloropropane	1.1	U	1.1	U
2-Butanone (MEK)	2.6	U	11	U
2-Chloro-1,3-butadiene	0.55	U	0.55	U
2-Hexanone	2	U	2	U
3-Chloro-1-propene	1.4	U	1.4	U
4-Methyl-2-pentanone (MIBK)	2.8	U	2.8	U
Acetone	110		140	
Acetonitrile	43	R	43	R
Acrolein	18	U	18	U
Acrylonitrile	22	U	22	U
Benzene	0.76	U	0.76	U
Bromoform	1.1	U	1.1	U
Bromomethane	1.5	U	1.5	U
Carbon disulfide	0.49	U	0.49	U
Carbon tetrachloride	0.96	U	0.96	U
Chlorobenzene	0.7	U	0.7	U
Chlorodibromomethane	0.48	U	0.48	U
Chloroethane	1.2	U	1.2	U
Chloroform	0.48	U	0.48	U
Chloromethane	0.68	U	0.68	U
cis-1,3-Dichloropropene	0.84	U	0.84	U
Dibromomethane	1.2	U	1.2	U
Dichlorobromomethane	0.8	U	0.8	U
Dichlorodifluoromethane	0.86	U	0.86	U
Ethyl methacrylate	2.1	U	2.1	U
Ethylbenzene	0.72	U	0.72	U
Ethylene Dibromide	1.4	U	1.4	U
Iodomethane	2.6	J	1.2	J
Isobutyl alcohol	66	R	66	R
Methacrylonitrile	23	UJ	23	UJ
Methyl methacrylate	3.6	U	3.6	U
Methylene Chloride	0.96	U	0.96	U
Pentachloroethane	2.1	UJ	2.1	UJ
Propionitrile	20	U	20	U
Styrene	0.63	U	0.63	U
Tetrachloroethene	0.7	U	0.7	U
Toluene	0.76	U	0.76	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SB08	
Sample ID	56SB08-01		56SB08-02	
Date	5/5/2008		5/5/2008	
Depth Range	1.0-3.0		3.0-5.0	
Volatile Organic Compounds (ug/kg)				
trans-1,2-Dichloroethene	0.93	U	0.93	U
trans-1,3-Dichloropropene	0.84	U	0.84	U
trans-1,4-Dichloro-2-butene	3	U	3	U
Trichloroethene	0.96	U	0.96	U
Trichlorofluoromethane	1.4	U	1.4	U
Vinyl acetate	1.4	U	1.4	U
Vinyl chloride	0.56	U	0.56	U
Xylenes, Total	2.2	U	2.2	U
Semivolatile Organic Compounds (ug/kg)				
1,1'-Biphenyl	9.6	UJ	10	UJ
1,2,4,5-Tetrachlorobenzene	8.1	UJ	8.5	UJ
1,2,4-Trichlorobenzene	9.6	UJ	10	UJ
1,2-Dichlorobenzene	9.0	UJ	9.4	UJ
1,3,5-Trinitrobenzene	22	UJ	23	UJ
1,3-Dichlorobenzene	7.8	UJ	8.1	UJ
1,3-Dinitrobenzene	5.1	UJ	5.3	UJ
1,4-Dichlorobenzene	8.0	UJ	8.4	UJ
1,4-Dioxane	10	UJ	11	UJ
1,4-Naphthoquinone	5.0	UJ	5.3	UJ
2,2'-oxybis[1-chloropropane]	8.3	UJ	8.5	UJ
2,3,4,6-Tetrachlorophenol	5.4	UJ	5.7	UJ
2,4,5-Trichlorophenol	8.8	UJ	9.2	UJ
2,4,6-Trichlorophenol	10	UJ	11	UJ
2,4-Dichlorophenol	10	UJ	11	UJ
2,4-Dimethylphenol	22	UJ	23	UJ
2,4-Dinitrophenol	110	UJ	110	UJ
2,4-Dinitrotoluene	7.6	UJ	7.9	UJ
2,6-Dichlorophenol	8.3	UJ	8.6	UJ
2,6-Dinitrotoluene	8.0	UJ	8.4	UJ
2-Acetylaminofluorene	6.6	UJ	6.9	UJ
2-Chloronaphthalene	8.0	UJ	8.4	UJ
2-Chlorophenol	8.5	UJ	8.9	UJ
2-Methylnaphthalene	6.2	J	2.3	UJ
2-Methylphenol	10	UJ	11	UJ
2-Naphthylamine	26	UJ	27	UJ
2-Nitroaniline	8.4	UJ	8.8	UJ
2-Nitrophenol	9.4	UJ	9.8	UJ
2-Picoline	16	UJ	16	UJ
2-Toluidine	12	UJ	13	UJ
3 & 4 Methylphenol	9.4	UJ	9.8	UJ
3,3'-Dichlorobenzidine	12	UJ	12	UJ
3,3'-Dimethylbenzidine	230	UJ	240	UJ
3-Methylcholanthrene	7.9	UJ	8.2	UJ
3-Nitroaniline	5.8	UJ	6.1	UJ
4,6-Dinitro-2-methylphenol	7.5	UJ	7.8	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SB08	
Sample ID	56SB08-01		56SB08-02	
Date	5/5/2008		5/5/2008	
Depth Range	1.0-3.0		3.0-5.0	
Semivolatile Organic Compounds (ug/kg)				
4-Aminobiphenyl	17	UJ	18	UJ
4-Bromophenyl phenyl ether	9.2	UJ	9.6	UJ
4-Chloro-3-methylphenol	9.7	UJ	10	UJ
4-Chloroaniline	7.8	UJ	8.1	UJ
4-Chlorophenyl phenyl ether	8	UJ	8.4	UJ
4-Nitroaniline	9.9	UJ	10	UJ
4-Nitrophenol	43	UJ	44	UJ
4-Nitroquinoline-1-oxide	14	R	15	R
7,12-Dimethylbenz(a)anthracene	12	UJ	13	UJ
Acenaphthene	0.74	UJ	0.77	UJ
Acenaphthylene	2.2	UJ	2.3	UJ
Acetophenone	11	UJ	12	UJ
alpha,alpha-Dimethyl phenethylamine	76	UJ	79	UJ
Aniline	8.1	UJ	8.5	UJ
Anthracene	2.2	UJ	2.3	UJ
Aramite, Total	14	UJ	15	UJ
Benzo[a]anthracene	2.2	UJ	2.3	UJ
Benzo[a]pyrene	0.85	UJ	0.89	UJ
Benzo[b]fluoranthene	0.98	UJ	1	UJ
Benzo[g,h,i]perylene	2.2	UJ	2.3	UJ
Benzo[k]fluoranthene	1.3	UJ	1.3	UJ
Benzyl alcohol	10	UJ	11	UJ
Bis(2-chloroethoxy)methane	8.8	UJ	9.2	UJ
Bis(2-chloroethyl)ether	7.4	UJ	7.7	UJ
Bis(2-ethylhexyl) phthalate	16	UJ	44	UJ
Butyl benzyl phthalate	9.5	UJ	9.7	UJ
Chrysene	0.79	UJ	0.82	UJ
Diallate	12	UJ	13	UJ
Dibenz(a,h)anthracene	0.76	UJ	0.79	UJ
Dibenzofuran	5.4	UJ	5.7	UJ
Diethyl phthalate	14	UJ	15	UJ
Dimethyl phthalate	8.4	UJ	8.6	UJ
Di-n-butyl phthalate	32	UJ	69	UJ
Di-n-octyl phthalate	4.3	UJ	4.4	UJ
Dinoseb	22	UJ	23	UJ
Ethyl methanesulfonate	14	UJ	15	UJ
Fluoranthene	2.2	UJ	2.3	UJ
Fluorene	0.99	UJ	1	UJ
Hexachlorobenzene	8.8	UJ	9.2	UJ
Hexachlorobutadiene	12	UJ	12	UJ
Hexachlorocyclopentadiene	18	UJ	19	UJ
Hexachloroethane	9.6	UJ	10	UJ
Hexachlorophene	1100	R	1100	R
Hexachloropropene	9.3	UJ	9.7	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Site ID	56SB08		56SB08	
	Sample ID	56SB08-01		56SB08-02	
	Date	5/5/2008		5/5/2008	
	Depth Range	1.0-3.0		3.0-5.0	
Semivolatile Organic Compounds (ug/kg)					
Indeno[1,2,3-cd]pyrene		1.6	UJ	1.6	UJ
Isophorone		8.0	UJ	8.4	UJ
Isosafrole		9.2	UJ	9.6	UJ
Methapyrilene		12	UJ	13	UJ
Methyl methanesulfonate		12	UJ	13	UJ
Naphthalene		0.78	UJ	0.81	UJ
Nitrobenzene		9.1	UJ	9.3	UJ
N-Nitro-o-toluidine		8.9	UJ	8.1	UJ
N-Nitrosodiethylamine		16	UJ	16	UJ
N-Nitrosodimethylamine		13	UJ	13	UJ
N-Nitrosodi-n-butylamine		12	UJ	12	UJ
N-Nitrosodi-n-propylamine		8.4	UJ	8.8	UJ
N-Nitrosodiphenylamine		9.2	UJ	9.6	UJ
N-Nitrosomethylethylamine		7.4	UJ	7.7	UJ
N-Nitrosomorpholine		8.5	UJ	8.9	UJ
N-Nitrosopiperidine		11	UJ	11	UJ
N-Nitrosopyrrolidine		12	UJ	12	UJ
p-Dimethylamino azobenzene		9.3	UJ	9.6	UJ
Pentachlorobenzene		8.0	UJ	8.4	UJ
Pentachloronitrobenzene		7.6	UJ	7.9	UJ
Pentachlorophenol		11	UJ	11	UJ
Phenacetin		6.1	UJ	6.3	UJ
Phenanthrene		2.2	UJ	2.3	UJ
Phenol		6.2	UJ	6.5	UJ
p-Phenylene diamine		210	UJ	220	UJ
Pronamide		12	UJ	12	UJ
Pyrene		2.2	UJ	2.3	UJ
Pyridine		14	UJ	15	UJ
Safrole, Total		11	UJ	11	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - SUBSURFACE SOIL
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB08		56SB08	
Sample ID	56SB08-01		56SB08-02	
Date	5/5/2008		5/5/2008	
Depth Range	1.0-3.0		3.0-5.0	
Metals (mg/kg)				
Antimony	0.092	UJ	0.095	UJ
Arsenic	1.2		2.1	
Barium	21		100	
Beryllium	0.071	U	0.28	
Cadmium	0.048	U	0.12	U
Chromium	13		33	
Cobalt	4.3	J	55	J
Copper	40	J	73	
Lead	1.2		7.7	
Mercury	0.056		0.11	
Nickel	2.6		9.7	
Selenium	0.72		2.2	
Silver	0.028	J	0.19	U
Thallium	0.15	U	0.15	U
Tin	4.9	U	5.1	U
Vanadium	120		270	
Zinc	8.9		67	

GROUNDWATER DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03D	
Sample ID	56GW01		56GW02		56GW03		56GW03D	
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	R	0.29	U	0.29	UJ	0.29	UJ
1,1,1-Trichloroethane	0.39	R	0.39	U	0.39	UJ	0.39	UJ
1,1,2,2-Tetrachloroethane	0.26	R	0.26	U	0.26	UJ	0.26	UJ
1,1,2-Trichloroethane	0.51	R	0.51	U	0.51	UJ	0.51	UJ
1,1-Dichloroethane	0.32	R	0.32	U	0.32	UJ	0.32	UJ
1,1-Dichloroethene	0.36	R	0.36	U	0.36	UJ	0.36	UJ
1,2,3-Trichloropropane	0.42	R	0.42	U	0.42	UJ	0.42	UJ
1,2-Dibromo-3-Chloropropane	0.48	R	0.48	U	0.48	UJ	0.48	UJ
1,2-Dichloroethane	0.31	R	0.31	U	0.31	UJ	0.31	UJ
1,2-Dichloropropane	0.36	R	0.36	U	0.36	UJ	0.36	UJ
2-Butanone (MEK)	0.6	R	0.6	U	0.6	UJ	0.6	UJ
2-Chloro-1,3-butadiene	0.35	R	0.35	UJ	0.35	UJ	0.35	UJ
2-Hexanone	0.68	R	0.68	U	0.68	UJ	0.68	UJ
3-Chloro-1-propene	0.46	R	0.46	U	0.46	UJ	0.46	UJ
4-Methyl-2-pentanone (MIBK)	0.6	R	0.6	U	0.6	UJ	0.6	UJ
Acetone	5	R	5.2	J	5	UJ	5	UJ
Acetonitrile	15	R	15	UJ	15	UJ	15	UJ
Acrolein	18	R	18	U	18	UJ	18	UJ
Acrylonitrile	3.8	R	3.8	U	3.8	UJ	3.8	UJ
Benzene	0.32	R	0.32	U	0.32	UJ	0.32	UJ
Bromoform	0.41	R	0.41	U	0.41	UJ	0.41	UJ
Bromomethane	0.5	R	0.5	U	0.5	UJ	0.5	UJ
Carbon disulfide	0.17	R	0.17	UJ	0.17	UJ	0.17	UJ
Carbon tetrachloride	0.27	R	0.27	U	0.27	UJ	0.27	UJ
Chlorobenzene	0.34	R	0.34	U	0.34	UJ	0.34	UJ
Chlorodibromomethane	0.3	R	0.3	U	0.3	UJ	0.3	UJ
Chloroethane	1	R	1	UJ	1	UJ	1	UJ
Chloroform	0.29	R	0.29	U	0.29	UJ	0.29	UJ
Chloromethane	0.28	R	0.28	U	1.8	J	0.28	UJ
cis-1,3-Dichloropropene	0.37	R	0.37	U	0.37	UJ	0.37	UJ
Dibromomethane	0.29	R	0.29	U	0.29	UJ	0.29	UJ
Dichlorobromomethane	0.34	R	0.34	U	0.34	UJ	0.34	UJ
Dichlorodifluoromethane	0.33	R	0.33	U	0.33	UJ	0.33	UJ
Ethyl methacrylate	1	R	1	U	1	UJ	1	UJ
Ethylbenzene	0.3	R	0.3	U	0.3	UJ	0.3	UJ
Ethylene Dibromide	0.3	R	0.3	U	0.3	UJ	0.3	UJ
Iodomethane	1	R	1	U	1	UJ	1	UJ
Isobutyl alcohol	19	R	19	R	19	R	19	R
Methacrylonitrile	6.6	R	6.6	U	6.6	UJ	6.6	UJ
Methyl methacrylate	0.38	R	0.38	U	0.38	UJ	0.38	UJ
Methylene Chloride	1	R	1	U	1	UJ	1	UJ
Pentachloroethane	1.3	R	1.3	UJ	1.3	UJ	1.3	UJ
Propionitrile	9.2	R	9.2	U	9.2	UJ	9.2	UJ
Styrene	0.36	R	0.36	U	0.36	UJ	0.36	UJ
Tetrachloroethene	0.28	R	0.28	U	0.28	UJ	0.28	UJ
Toluene	0.31	R	0.31	U	0.31	UJ	0.31	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03D	
Sample ID	56GW01		56GW02		56GW03		56GW03D	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008	
Volatile Organic Compounds (ug/L)								
trans-1,2-Dichloroethene	0.3	R	0.3	U	0.3	UJ	0.3	UJ
trans-1,3-Dichloropropene	0.27	R	0.27	U	0.27	UJ	0.27	UJ
trans-1,4-Dichloro-2-butene	0.83	R	0.83	UJ	0.83	UJ	0.83	UJ
Trichloroethene	0.4	R	0.4	U	0.4	UJ	0.4	UJ
Trichlorofluoromethane	0.29	R	0.29	UJ	0.29	UJ	0.29	UJ
Vinyl acetate	0.62	R	0.62	U	0.62	UJ	0.62	UJ
Vinyl chloride	0.2	R	0.2	U	0.2	UJ	0.2	UJ
Xylenes, Total	0.87	R	0.87	U	0.87	UJ	0.87	UJ
Semivolatile Organic Compounds (ug/L)								
1,1'-Biphenyl	0.17	U	0.17	U	0.17	UJ	0.17	UJ
1,2,4,5-Tetrachlorobenzene	0.23	U	0.23	U	0.23	UJ	0.23	UJ
1,2,4-Trichlorobenzene	0.13	U	0.13	U	0.13	UJ	0.13	UJ
1,2-Dichlorobenzene	0.13	U	0.13	U	0.13	UJ	0.13	UJ
1,3,5-Trinitrobenzene	0.2	U	0.2	U	0.2	UJ	0.2	UJ
1,3-Dichlorobenzene	0.12	U	0.12	U	0.12	UJ	0.12	UJ
1,3-Dinitrobenzene	0.22	U	0.22	U	0.22	UJ	0.22	UJ
1,4-Dichlorobenzene	0.12	U	0.16	J	0.12	UJ	0.12	UJ
1,4-Dioxane	0.49	U	0.49	U	0.49	UJ	0.49	UJ
1,4-Naphthoquinone	0.16	U	0.16	U	0.16	UJ	0.16	UJ
2,2'-oxybis[1-chloropropane]	0.097	U	0.097	U	0.097	UJ	0.097	UJ
2,3,4,6-Tetrachlorophenol	0.29	U	0.29	U	0.29	UJ	0.29	UJ
2,4,5-Trichlorophenol	0.16	U	0.16	U	0.16	UJ	0.16	UJ
2,4,6-Trichlorophenol	0.16	U	0.16	U	0.16	UJ	0.16	UJ
2,4-Dichlorophenol	0.15	U	0.15	U	0.15	UJ	0.15	UJ
2,4-Dimethylphenol	0.4	U	0.4	U	0.4	UJ	0.4	UJ
2,4-Dinitrophenol	2.4	U	2.4	U	2.4	UJ	2.4	UJ
2,4-Dinitrotoluene	0.17	UJ	0.17	U	0.17	UJ	0.17	UJ
2,6-Dichlorophenol	0.21	U	0.21	U	0.21	UJ	0.21	UJ
2,6-Dinitrotoluene	0.15	U	0.15	U	0.15	UJ	0.15	UJ
2-Acetylaminofluorene	0.19	U	0.19	U	0.19	UJ	0.19	UJ
2-Chloronaphthalene	0.12	U	0.12	U	0.12	UJ	0.12	UJ
2-Chlorophenol	0.15	U	0.15	U	0.15	UJ	0.15	UJ
2-Methylnaphthalene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ
2-Methylphenol	0.15	U	0.15	U	0.15	UJ	0.15	UJ
2-Naphthylamine	1.1	U	1.1	U	1.1	UJ	1.1	UJ
2-Nitroaniline	0.14	U	0.14	U	0.14	UJ	0.14	UJ
2-Nitrophenol	0.17	U	0.17	U	0.17	UJ	0.17	UJ
2-Picoline	0.57	U	0.57	U	0.57	UJ	0.57	UJ
2-Toluidine	0.32	U	0.32	U	0.32	UJ	0.32	UJ
3 & 4 Methylphenol	0.15	U	0.15	U	0.15	UJ	0.15	UJ
3,3'-Dichlorobenzidine	3.7	U	3.7	U	3.7	UJ	3.7	UJ
3,3'-Dimethylbenzidine	3.7	U	3.7	UJ	3.7	UJ	3.7	UJ
3-Methylcholanthrene	0.2	U	0.2	U	0.2	UJ	0.2	UJ
3-Nitroaniline	0.28	U	0.28	U	0.28	UJ	0.28	UJ
4,6-Dinitro-2-methylphenol	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03D	
Sample ID	56GW01		56GW02		56GW03		56GW03D	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008	
Semivolatile Organic Compounds (ug/L)								
4-Aminobiphenyl	0.68	U	0.68	U	0.68	UJ	0.68	UJ
4-Bromophenyl phenyl ether	0.16	U	0.16	U	0.16	UJ	0.16	UJ
4-Chloro-3-methylphenol	0.16	U	0.16	U	0.16	UJ	0.16	UJ
4-Chloroaniline	0.4	U	0.4	U	0.4	UJ	0.4	UJ
4-Chlorophenyl phenyl ether	0.15	U	0.15	U	0.15	UJ	0.15	UJ
4-Nitroaniline	0.26	U	0.26	U	0.26	UJ	0.26	UJ
4-Nitrophenol	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
7,12-Dimethylbenz(a)anthracene	0.2	U	0.2	U	0.2	UJ	0.2	UJ
Acenaphthene	0.019	U	0.019	U	0.019	UJ	0.019	UJ
Acenaphthylene	0.049	U	0.049	U	0.049	UJ	0.049	UJ
Acetophenone	0.19	U	0.19	U	0.19	UJ	0.19	UJ
alpha,alpha-Dimethyl phenethylamine	1.3	U	1.3	U	1.3	UJ	1.3	UJ
Aniline	0.4	U	0.4	U	0.4	UJ	0.4	UJ
Anthracene	0.021	U	0.021	U	0.021	UJ	0.021	UJ
Aramite, Total	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ
Benzo[a]anthracene	0.025	U	0.025	U	0.025	UJ	0.025	UJ
Benzo[a]pyrene	0.024	U	0.024	U	0.024	UJ	0.024	UJ
Benzo[b]fluoranthene	0.036	U	0.036	U	0.036	UJ	0.036	UJ
Benzo[g,h,i]perylene	0.023	UJ	0.023	U	0.023	UJ	0.023	UJ
Benzo[k]fluoranthene	0.019	U	0.019	U	0.019	UJ	0.019	UJ
Benzyl alcohol	0.16	U	0.16	U	0.16	UJ	0.16	UJ
Bis(2-chloroethoxy)methane	0.15	U	0.15	U	0.15	UJ	0.15	UJ
Bis(2-chloroethyl)ether	0.14	U	0.14	U	0.14	UJ	0.14	UJ
Bis(2-ethylhexyl) phthalate	0.34	U	0.98		0.34	UJ	0.34	UJ
Butyl benzyl phthalate	0.17	U	0.17	U	0.17	UJ	0.17	UJ
Chrysene	0.027	U	0.027	U	0.027	UJ	0.027	UJ
Diallate	0.19	U	0.19	U	0.19	UJ	0.19	UJ
Dibenz(a,h)anthracene	0.023	UJ	0.023	U	0.023	UJ	0.023	UJ
Dibenzofuran	0.097	U	0.097	U	0.097	UJ	0.097	UJ
Diethyl phthalate	0.18	U	0.32	J	0.18	UJ	0.18	UJ
Dimethyl phthalate	0.17	U	0.17	U	0.17	UJ	0.17	UJ
Di-n-butyl phthalate	0.18	U	0.3	U	0.17	UJ	0.14	UJ
Di-n-octyl phthalate	0.097	U	0.097	U	0.097	UJ	0.097	UJ
Dinoseb	0.49	U	0.49	U	0.49	UJ	0.49	UJ
Ethyl methanesulfonate	0.23	U	0.23	U	0.23	UJ	0.23	UJ
Fluoranthene	0.049	U	0.049	U	0.049	UJ	0.049	UJ
Fluorene	0.018	U	0.018	U	0.018	UJ	0.018	UJ
Hexachlorobenzene	0.16	U	0.16	U	0.16	UJ	0.16	UJ
Hexachlorobutadiene	0.13	U	0.13	U	0.13	UJ	0.13	UJ
Hexachlorocyclopentadiene	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ
Hexachloroethane	0.15	U	0.15	U	0.15	UJ	0.15	UJ
Hexachlorophene	49	R	49	R	49	R	49	R
Hexachloropropene	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Indeno[1,2,3-cd]pyrene	0.022	U	0.022	U	0.022	UJ	0.022	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03D	
Sample ID	56GW01		56GW02		56GW03		56GW03D	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008	
Semivolatile Organic Compounds (ug/L)								
Isophorone	0.15	U	0.15	U	0.15	UJ	0.15	UJ
Isosafrole	0.3	U	0.3	U	0.3	UJ	0.3	UJ
Methapyrilene	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ
Methyl methanesulfonate	0.46	U	0.46	U	0.46	UJ	0.46	UJ
Naphthalene	0.049	U	0.049	U	0.049	UJ	0.049	UJ
Nitrobenzene	0.14	U	0.14	U	0.14	UJ	0.14	UJ
N-Nitro-o-toluidine	0.24	U	0.24	U	0.24	UJ	0.24	UJ
N-Nitrosodiethylamine	0.32	U	0.32	U	0.32	UJ	0.32	UJ
N-Nitrosodimethylamine	0.19	U	0.19	U	0.19	UJ	0.19	UJ
N-Nitrosodi-n-butylamine	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
N-Nitrosodi-n-propylamine	0.13	U	0.13	U	0.13	UJ	0.13	UJ
N-Nitrosodiphenylamine	0.17	U	0.17	U	0.17	UJ	0.17	UJ
N-Nitrosomethylethylamine	0.28	U	0.28	U	0.28	UJ	0.28	UJ
N-Nitrosomorpholine	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ
N-Nitrosopiperidine	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ
N-Nitrosopyrrolidine	0.25	U	0.25	U	0.25	UJ	0.25	UJ
p-Dimethylamino azobenzene	0.6	U	0.6	U	0.6	UJ	0.6	UJ
Pentachlorobenzene	0.27	U	0.27	U	0.27	UJ	0.27	UJ
Pentachloronitrobenzene	0.3	U	0.3	U	0.3	UJ	0.3	UJ
Pentachlorophenol	0.18	U	0.18	U	0.18	UJ	0.18	UJ
Phenacetin	0.2	U	0.2	U	0.2	UJ	0.2	UJ
Phenanthrene	0.017	U	0.017	U	0.017	UJ	0.017	UJ
Phenol	0.14	U	0.14	U	0.14	UJ	0.14	UJ
p-Phenylene diamine	2.4	U	2.4	U	2.4	UJ	2.4	UJ
Pronamide	0.25	U	0.25	U	0.25	UJ	0.25	UJ
Pyrene	0.026	U	0.026	U	0.026	UJ	0.026	UJ
Pyridine	0.22	U	0.22	U	0.22	UJ	0.22	UJ
Safrole, Total	0.23	U	0.23	U	0.23	UJ	0.23	UJ
Total Metals (ug/L)								
Antimony	0.36	U	0.36	U	0.36	UJ	0.36	UJ
Arsenic	1.8	U	1.9	U	0.5	J	0.52	J
Barium	7.1		24		21	J	21	J
Beryllium	0.065	U	0.065	U	0.065	UJ	0.065	UJ
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	1.3	U	2.4	U	0.6	UJ	0.6	UJ
Cobalt	0.18	R	0.42	R	1.2	J	1.6	J
Copper	1.2	U	1.7	U	1.6	UJ	1.8	UJ
Lead	0.15	U	0.16	U	0.16	UJ	0.15	U
Mercury	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ
Nickel	0.32	U	0.88	J	0.32	UJ	0.32	UJ
Selenium	0.6	U	0.6	U	0.6	UJ	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	UJ	0.55	UJ
Tin	0.9	U	3.4	U	2.4	UJ	1.1	UJ
Vanadium	9.3		17		14	J	16	J
Zinc	6.5	U	6.5	U	6.5	UJ	6.5	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB03D	
Sample ID	56GW01		56GW02		56GW03		56GW03D	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008	
Dissolved Metals (ug/L)								
Antimony	0.36	U	0.39	U	0.38	J	0.36	UJ
Arsenic	1.1	U	1.6	U	0.5	J	0.46	J
Barium	7.1		22		18	J	20	J
Beryllium	0.065	U	0.065	U	0.065	UJ	0.065	UJ
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	1.1	U	1.7	U	0.6	UJ	0.6	UJ
Cobalt	1.6	R	1.6	R	1.8	J	1.1	J
Copper	1.2	U	1.3	U	1.9	UJ	1.4	UJ
Lead	0.15	U	0.15	U	0.15	UJ	0.15	UJ
Mercury	0.08	U	0.08	U	0.08	UJ	0.08	UJ
Nickel	0.82	J	0.69	J	0.55	J	0.32	U
Selenium	0.6	U	0.6	U	0.6	UJ	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	UJ	0.55	UJ
Tin	0.9	U	2.4	U	0.9	UJ	0.9	UJ
Vanadium	8		14		12	J	14	J
Zinc	6.5	U	6.5	U	7.4	J	6.5	UJ

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07		56SB08	
Sample ID	56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Volatile Organic Compounds (ug/L)										
1,1,1,2-Tetrachloroethane	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
1,1,1-Trichloroethane	0.39	U	0.39	UJ	0.39	U	0.39	U	0.39	U
1,1,2,2-Tetrachloroethane	0.26	U	0.26	UJ	0.26	U	0.26	U	0.26	U
1,1,2-Trichloroethane	0.51	U	0.51	UJ	0.51	U	0.51	U	0.51	U
1,1-Dichloroethane	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
1,1-Dichloroethene	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
1,2,3-Trichloropropane	0.42	U	0.42	UJ	0.42	U	0.42	U	0.42	U
1,2-Dibromo-3-Chloropropane	0.48	U	0.48	UJ	0.48	U	0.48	U	0.48	U
1,2-Dichloroethane	0.31	U	0.31	UJ	0.31	U	0.31	U	0.31	U
1,2-Dichloropropane	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
2-Butanone (MEK)	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
2-Chloro-1,3-butadiene	0.35	UJ	0.35	UJ	0.35	U	0.35	U	0.35	U
2-Hexanone	0.68	U	0.68	UJ	0.68	U	0.68	U	0.68	U
3-Chloro-1-propene	0.46	U	0.46	UJ	0.46	U	0.46	U	0.46	U
4-Methyl-2-pentanone (MIBK)	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Acetone	5	UJ	7.1	J	5	U	5	U	5	U
Acetonitrile	15	UJ	15	UJ	15	U	15	U	15	U
Acrolein	18	U	18	UJ	18	R	18	R	18	R
Acrylonitrile	3.8	U	3.8	UJ	3.8	UJ	3.8	UJ	3.8	UJ
Benzene	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
Bromoform	0.41	U	0.41	UJ	0.41	U	0.41	U	0.41	U
Bromomethane	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	U	0.17	U	0.17	U
Carbon tetrachloride	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	U
Chlorobenzene	0.34	U	0.34	UJ	0.34	U	0.34	U	0.34	U
Chlorodibromomethane	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Chloroethane	1	UJ	1	UJ	1	U	1	U	1	U
Chloroform	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
Chloromethane	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
cis-1,3-Dichloropropene	0.37	U	0.37	UJ	0.37	U	0.37	U	0.37	U
Dibromomethane	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
Dichlorobromomethane	0.34	U	0.34	UJ	0.34	U	0.34	U	0.34	U
Dichlorodifluoromethane	0.33	U	0.33	UJ	0.33	UJ	0.33	UJ	0.33	UJ
Ethyl methacrylate	1	U	1	UJ	1	U	1	U	1	U
Ethylbenzene	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Ethylene Dibromide	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Iodomethane	1	U	1	UJ	1	U	1	U	1	U
Isobutyl alcohol	19	R	19	R	19	U	19	U	19	U
Methacrylonitrile	6.6	U	6.6	UJ	6.6	U	6.6	U	6.6	U
Methyl methacrylate	0.38	U	0.38	UJ	0.38	U	0.38	U	0.38	U
Methylene Chloride	1	U	1	UJ	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	UJ	9.2	U	9.2	U	9.2	U
Styrene	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Tetrachloroethene	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
Toluene	0.31	U	0.31	UJ	0.31	U	0.31	U	0.31	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07		56SB08	
Sample ID	56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Volatile Organic Compounds (ug/L)										
trans-1,2-Dichloroethene	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
trans-1,3-Dichloropropene	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	UJ
trans-1,4-Dichloro-2-butene	0.83	UJ	0.83	UJ	0.83	U	0.83	U	0.83	U
Trichloroethene	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
Trichlorofluoromethane	0.29	UJ	0.29	UJ	0.29	U	0.29	U	0.29	U
Vinyl acetate	0.62	U	0.62	UJ	0.62	UJ	0.62	UJ	0.62	UJ
Vinyl chloride	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
Xylenes, Total	0.87	U	0.87	UJ	0.87	U	0.87	U	0.87	U
Semivolatile Organic Compounds (ug/L)										
1,1'-Biphenyl	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
1,2,4,5-Tetrachlorobenzene	0.23	U	0.23	UJ	0.23	U	0.23	U	0.23	U
1,2,4-Trichlorobenzene	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
1,2-Dichlorobenzene	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
1,3,5-Trinitrobenzene	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
1,3-Dichlorobenzene	0.12	U	0.12	UJ	0.12	U	0.12	U	0.12	U
1,3-Dinitrobenzene	0.22	U	0.22	UJ	0.22	U	0.22	U	0.22	U
1,4-Dichlorobenzene	0.12	U	0.12	UJ	0.12	U	0.12	U	0.12	U
1,4-Dioxane	0.49	U	0.49	UJ	0.49	U	0.49	U	0.49	U
1,4-Naphthoquinone	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
2,2'-oxybis[1-chloropropane]	0.097	U	0.097	UJ	0.097	U	0.097	U	0.097	U
2,3,4,6-Tetrachlorophenol	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
2,4,5-Trichlorophenol	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
2,4,6-Trichlorophenol	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
2,4-Dichlorophenol	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
2,4-Dimethylphenol	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
2,4-Dinitrophenol	2.4	U	2.4	UJ	2.4	U	2.4	U	2.4	U
2,4-Dinitrotoluene	0.17	UJ	0.17	UJ	0.17	UJ	0.17	UJ	0.17	U
2,6-Dichlorophenol	0.21	U	0.21	UJ	0.21	U	0.21	U	0.21	U
2,6-Dinitrotoluene	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
2-Acetylaminofluorene	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
2-Chloronaphthalene	0.12	U	0.12	UJ	0.12	U	0.12	U	0.12	U
2-Chlorophenol	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
2-Methylnaphthalene	0.022	U	0.022	UJ	0.022	U	0.022	U	0.022	U
2-Methylphenol	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
2-Naphthylamine	1.1	U	1.1	UJ	1.1	U	1.1	U	1.1	U
2-Nitroaniline	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
2-Nitrophenol	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
2-Picoline	0.57	U	0.57	UJ	0.57	U	0.57	U	0.57	U
2-Toluidine	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
3 & 4 Methylphenol	0.15	U	0.15	UJ	0.15	U	0.15	U	0.63	J
3,3'-Dichlorobenzidine	3.7	U	3.7	UJ	3.7	U	3.7	U	3.7	UJ
3,3'-Dimethylbenzidine	3.7	U	3.7	UJ	3.7	U	3.7	U	3.7	UJ
3-Methylcholanthrene	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
3-Nitroaniline	0.28	U	0.28	UJ	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	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07		56SB08	
Sample ID	56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L)										
4-Aminobiphenyl	0.68	U	0.68	UJ	0.68	U	0.68	U	0.68	U
4-Bromophenyl phenyl ether	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
4-Chloro-3-methylphenol	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
4-Chloroaniline	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
4-Chlorophenyl phenyl ether	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
4-Nitroaniline	0.26	U	0.26	UJ	0.26	U	0.26	U	0.26	UJ
4-Nitrophenol	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	U
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	UJ	0.2	U	0.2	U	0.2	U
Acenaphthene	0.019	U	0.019	UJ	0.019	U	0.019	U	0.019	U
Acenaphthylene	0.049	U	0.049	UJ	0.049	U	0.049	U	0.049	U
Acetophenone	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
alpha,alpha-Dimethyl phenethylamine	1.3	U	1.3	UJ	1.3	U	1.3	U	1.3	U
Aniline	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
Anthracene	0.021	U	0.021	UJ	0.021	U	0.033	J	0.021	U
Aramite, Total	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	U
Benzo[a]anthracene	0.025	U	0.025	UJ	0.025	U	0.025	U	0.025	U
Benzo[a]pyrene	0.024	U	0.024	UJ	0.024	U	0.024	U	0.024	U
Benzo[b]fluoranthene	0.036	U	0.036	UJ	0.036	U	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
Benzo[k]fluoranthene	0.019	U	0.019	UJ	0.019	U	0.019	U	0.019	U
Benzyl alcohol	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
Bis(2-chloroethoxy)methane	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Bis(2-chloroethyl)ether	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
Bis(2-ethylhexyl) phthalate	0.34	U	0.73	UJ	0.71	U	0.66	U	0.34	U
Butyl benzyl phthalate	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
Chrysene	0.027	U	0.027	UJ	0.027	U	0.027	U	0.027	U
Diallate	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
Dibenz(a,h)anthracene	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ	0.023	U
Dibenzofuran	0.097	U	0.097	UJ	0.097	U	0.097	U	0.097	U
Diethyl phthalate	0.18	U	0.18	UJ	0.18	U	0.18	U	0.18	U
Dimethyl phthalate	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
Di-n-butyl phthalate	0.21	U	0.13	UJ	0.16	U	0.11	U	0.16	U
Di-n-octyl phthalate	0.097	U	0.097	UJ	0.097	U	0.097	U	0.097	U
Dinoseb	0.49	U	0.49	UJ	0.49	U	0.49	U	0.49	U
Ethyl methanesulfonate	0.23	U	0.23	UJ	0.23	U	0.23	U	0.23	U
Fluoranthene	0.049	U	0.049	UJ	0.049	U	0.056	J	0.049	U
Fluorene	0.018	U	0.018	UJ	0.018	U	0.055	J	0.018	U
Hexachlorobenzene	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
Hexachlorobutadiene	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
Hexachlorocyclopentadiene	0.49	UJ	0.49	UJ	0.49	U	0.49	U	0.49	U
Hexachloroethane	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Hexachlorophene	49	R	49	R	49	R	49	R	49	R
Hexachloropropene	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	U
Indeno[1,2,3-cd]pyrene	0.022	U	0.022	UJ	0.022	U	0.022	U	0.022	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07		56SB08	
Sample ID	56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L)										
Isophorone	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Isosafrole	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Methapyrilene	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	U
Methyl methanesulfonate	0.46	U	0.46	UJ	0.46	U	0.46	U	0.46	U
Naphthalene	0.049	U	0.049	UJ	0.049	U	0.049	U	0.049	U
Nitrobenzene	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
N-Nitro-o-toluidine	0.24	U	0.24	UJ	0.24	U	0.24	U	0.24	U
N-Nitrosodiethylamine	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
N-Nitrosodimethylamine	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
N-Nitrosodi-n-butylamine	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	U
N-Nitrosodi-n-propylamine	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
N-Nitrosodiphenylamine	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
N-Nitrosomethylethylamine	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
N-Nitrosomorpholine	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	U
N-Nitrosopiperidine	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	U
N-Nitrosopyrrolidine	0.25	U	0.25	UJ	0.25	U	0.25	U	0.25	U
p-Dimethylamino azobenzene	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Pentachlorobenzene	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	U
Pentachloronitrobenzene	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Pentachlorophenol	0.18	U	0.18	UJ	0.18	U	0.18	U	0.18	U
Phenacetin	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
Phenanthrene	0.017	U	0.017	UJ	0.05	J	0.39		0.017	U
Phenol	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
p-Phenylene diamine	2.4	U	2.4	UJ	2.4	U	2.4	U	2.4	U
Pronamide	0.25	U	0.25	UJ	0.25	U	0.25	U	0.25	U
Pyrene	0.026	U	0.026	UJ	0.026	U	0.026	U	0.026	U
Pyridine	0.22	U	0.22	UJ	0.22	U	0.22	U	0.22	U
Safrole, Total	0.23	U	0.23	UJ	0.23	U	0.23	U	0.23	U
Total Metals (ug/L)										
Antimony	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Arsenic	1.7	U	0.42	J	0.31	U	0.7	U	1.2	U
Barium	23		16	J	18		100		170	
Beryllium	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	U
Chromium	1.7	U	0.6	UJ	0.6	U	0.6	U	2.3	J
Cobalt	6.6		1.2	J	0.29	U	1.5	J	38	
Copper	2.5	U	1.2	UJ	2.7	U	1.2	U	8.3	
Lead	0.15	U	0.15	UJ	0.15	U	0.15	U	0.3	U
Mercury	0.08	UJ	0.08	UJ	0.08	U	0.08	U	0.08	U
Nickel	0.82	J	0.35	J	0.38	J	0.32	U	3.9	
Selenium	0.79	J	0.6	UJ	0.6	U	0.6	U	0.6	U
Silver	0.09	UJ	0.09	UJ	0.09	UJ	0.09	UJ	0.09	U
Thallium	0.55	U	0.55	UJ	0.55	U	0.55	U	0.55	U
Tin	0.9	U	0.9	UJ	0.9	U	0.9	U	0.9	U
Vanadium	20		8.8	J	7.9		2.7	U	13	
Zinc	8.7	J	6.5	UJ	6.5	U	6.5	U	18	J

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB04		56SB05		56SB06		56SB07		56SB08	
Sample ID	56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Dissolved Metals (ug/L)										
Antimony	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Arsenic	0.99	U	0.28	UJ	0.28	U	0.54	U	0.86	U
Barium	14		15	J	15		100		140	
Beryllium	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	U	0.12	U	0.12	U
Chromium	1.2	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Cobalt	2.1		1.4	J	0.45	UJ	1.9	J	31	
Copper	1.2	U	1.2	UJ	1.2	U	1.2	U	2.5	U
Lead	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Mercury	0.098	J	0.08	UJ	0.08	U	0.08	U	0.08	U
Nickel	0.58	J	0.4	J	0.32	U	0.4	J	2.6	
Selenium	0.65	J	0.7	J	0.6	U	0.6	U	0.6	U
Silver	0.09	UJ	0.09	UJ	0.09	U	0.09	U	0.09	U
Thallium	0.55	U	0.55	UJ	0.55	U	0.55	U	0.55	U
Tin	0.9	U	0.9	UJ	0.9	U	0.9	U	0.9	U
Vanadium	9.8		5.8	J	3.6	U	2.5	U	1.7	J
Zinc	6.5	U	6.5	UJ	6.5	U	6.5	U	8	J

SURFACE WATER DATA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE WATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW04D		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW04D		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Low-level PAHs (ug/L)												
1-Methylnaphthalene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.049	UJ	0.047	UJ
2-Methylnaphthalene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ
Acenaphthene	0.019	U	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Acenaphthylene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.049	UJ	0.047	UJ
Anthracene	0.021	U	0.021	UJ	0.021	UJ	0.021	UJ	0.021	UJ	0.021	UJ
Benzo[a]anthracene	0.025	U	0.025	UJ	0.025	UJ	0.025	UJ	0.025	UJ	0.025	UJ
Benzo[a]pyrene	0.024	U	0.024	UJ	0.024	UJ	0.024	UJ	0.024	UJ	0.024	UJ
Benzo[b]fluoranthene	0.036	U	0.036	UJ	0.035	UJ	0.036	UJ	0.036	UJ	0.035	UJ
Benzo[g,h,i]perylene	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ
Benzo[k]fluoranthene	0.019	U	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Chrysene	0.027	U	0.027	UJ	0.026	UJ	0.027	UJ	0.027	UJ	0.026	UJ
Dibenz(a,h)anthracene	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ
Fluoranthene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.049	UJ	0.047	UJ
Fluorene	0.018	U	0.018	UJ	0.018	UJ	0.018	UJ	0.018	UJ	0.018	UJ
Indeno[1,2,3-cd]pyrene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ
Naphthalene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.049	UJ	0.047	UJ
Phenanthrene	0.017	U	0.017	UJ	0.017	UJ	0.017	UJ	0.017	UJ	0.017	UJ
Pyrene	0.026	U	0.026	UJ	0.025	UJ	0.026	UJ	0.026	UJ	0.025	UJ
Total Metals (ug/L)												
Antimony	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U
Arsenic	3.2		1.4	U	1.4	U	1.6	U	1.7	U	2.4	U
Barium	60		15		13		35		35		86	
Beryllium	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
Cadmium	1.1	J	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	6.3		1.6	U	1.5	U	1.5	U	1.4	U	1.7	U
Cobalt	3.1		0.37	R	0.27	R	0.32	R	0.37	R	1.7	R
Copper	13		2.3	J	3.1	J	1.2	U	1.4	J	2.4	J
Lead	16		0.25	J	0.43	J	0.55	J	0.73	J	0.21	J
Mercury	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ
Nickel	3.8		0.52	J	0.53	J	0.43	J	0.43	J	1.3	
Selenium	0.71	J	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
Thallium	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
Vanadium	22		5.2		6		4.5	U	5	U	5.3	
Zinc	46		6.5	U	6.6	J	6.5	U	8.6	J	6.5	J

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SURFACE WATER
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW04D		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW04D		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Dissolved Metals (ug/L)												
Antimony	0.42	U	0.38	U	0.37	U	0.36	U	0.36	U	0.36	U
Arsenic	1.8	U	1.4	U	1.1	U	1.3	U	1.5	U	2.3	U
Barium	33		14		12		33		33		84	
Beryllium	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	1.2	U	1.3	U	1.2	U	1.3	U	1.2	U	1.5	U
Cobalt	3.7		3.7	R	2.3	R	2.1	R	0.62	R	3.8	R
Copper	1.5	U	2	J	2.6	J	1.2	U	1.2	U	1.9	J
Lead	0.43	U	0.17	J	0.15	U	0.47	J	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
Nickel	2.1		1		1.2		0.82	J	0.47	J	1.6	
Selenium	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
Thallium	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
Tin	0.9	U	1.7	U	1.2	U	4.3	U	0.9	U	0.9	U
Vanadium	4.6	U	4.6	U	4.9	U	4	U	3.8	U	4.2	U
Zinc	8.8	J	6.7	J	6.5	U	6.5	U	6.5	U	6.5	U

SEDIMENT DATA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sample ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sampling Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008
Depth Range (ft bgs)					0-0	0-0
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.37 UJ	0.85 R	1.8 UJ	1.7 UJ	NA	NA
1,1,1-Trichloroethane	0.33 UJ	0.77 R	1.7 UJ	1.5 UJ	NA	NA
1,1,2,2-Tetrachloroethane	0.81 UJ	1.9 R	4 UJ	3.7 UJ	NA	NA
1,1,2-Trichloroethane	0.69 UJ	1.6 R	3.4 UJ	3.1 UJ	NA	NA
1,1-Dichloroethane	0.29 UJ	0.67 R	1.4 UJ	1.3 UJ	NA	NA
1,1-Dichloroethene	0.31 UJ	0.72 R	1.6 UJ	1.4 UJ	NA	NA
1,2,3-Trichloropropane	0.81 UJ	1.9 R	4 UJ	3.7 UJ	NA	NA
1,2-Dibromo-3-Chloropropane	1.6 UJ	3.7 R	8 UJ	7.3 UJ	NA	NA
1,2-Dichloroethane	0.58 UJ	1.3 R	2.9 UJ	2.6 UJ	NA	NA
1,2-Dichloropropane	0.63 UJ	1.5 R	3.2 UJ	2.9 UJ	NA	NA
2-Butanone (MEK)	65 J	3.6 R	35 UJ	110 UJ	NA	NA
2-Chloro-1,3-butadiene	0.33 UJ	0.76 R	1.6 UJ	1.5 UJ	NA	NA
2-Hexanone	1.2 UJ	2.8 R	6 UJ	5.5 UJ	NA	NA
3-Chloro-1-propene	0.86 UJ	2 R	4.3 UJ	3.9 UJ	NA	NA
4-Methyl-2-pentanone (MIBK)	1.7 UJ	3.9 R	8.3 UJ	7.6 UJ	NA	NA
Acetone	200 J	5.9 R	250 J	1200 J	NA	NA
Acetonitrile	26 UJ	60 R	130 UJ	120 UJ	NA	NA
Acrolein	11 R	25 R	55 R	50 R	NA	NA
Acrylonitrile	13 UJ	31 R	66 UJ	60 UJ	NA	NA
Benzene	0.46 UJ	1.1 R	2.3 UJ	2.1 UJ	NA	NA
Bromoform	0.63 UJ	1.5 R	3.2 UJ	2.9 UJ	NA	NA
Bromomethane	0.92 UJ	2.1 R	4.6 UJ	4.2 UJ	NA	NA
Carbon disulfide	0.29 UJ	19 J	15 J	800 J	NA	NA
Carbon tetrachloride	0.58 UJ	1.3 R	2.9 UJ	2.6 UJ	NA	NA
Chlorobenzene	0.42 UJ	0.98 R	2.1 UJ	1.9 UJ	NA	NA
Chlorodibromomethane	0.29 UJ	0.67 R	1.4 UJ	1.3 UJ	NA	NA
Chloroethane	0.69 UJ	1.6 R	3.4 UJ	3.1 UJ	NA	NA
Chloroform	0.29 UJ	0.67 R	1.4 UJ	1.3 UJ	NA	NA
Chloromethane	0.41 UJ	0.95 R	2 UJ	1.9 UJ	NA	NA
cis-1,3-Dichloropropene	0.5 UJ	1.2 R	2.5 UJ	2.3 UJ	NA	NA
Dibromomethane	0.69 UJ	1.6 R	3.4 UJ	3.1 UJ	NA	NA
Dichlorobromomethane	0.48 UJ	1.1 R	2.4 UJ	2.2 UJ	NA	NA
Dichlorodifluoromethane	0.51 UJ	1.2 R	2.6 UJ	2.3 UJ	NA	NA
Ethyl methacrylate	1.3 UJ	2.9 R	6.3 UJ	5.8 UJ	NA	NA
Ethylbenzene	0.43 UJ	1 R	2.2 UJ	2 UJ	NA	NA
Ethylene Dibromide	0.86 UJ	2 R	4.3 UJ	3.9 UJ	NA	NA
Iodomethane	0.58 UJ	1.3 R	2.9 UJ	36 J	NA	NA
Isobutyl alcohol	40 UJ	92 R	200 UJ	180 UJ	NA	NA
Methacrylonitrile	14 UJ	32 R	69 UJ	63 UJ	NA	NA
Methyl methacrylate	2.1 UJ	4.9 R	11 UJ	9.7 UJ	NA	NA
Methylene Chloride	0.58 UJ	1.3 R	2.9 UJ	2.6 UJ	NA	NA
Pentachloroethane	1.3 UJ	2.9 R	6.3 UJ	5.8 UJ	NA	NA
Propionitrile	12 UJ	28 R	60 UJ	55 UJ	NA	NA
Styrene	0.38 UJ	0.88 R	1.9 UJ	1.7 UJ	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD04D		56SD05		56SD12	56SD13
Sample ID	56SD03		56SD04		56SD04D		56SD05		56SD12	56SD13
Sampling Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008
Volatile Organic Compounds (ug/kg)										
Tetrachloroethene	0.42	UJ	0.98	R	2.1	UJ	1.9	UJ	NA	NA
Toluene	0.46	UJ	1.1	R	2.3	UJ	2.1	UJ	NA	NA
trans-1,2-Dichloroethene	0.56	UJ	1.3	R	2.8	UJ	2.5	UJ	NA	NA
trans-1,3-Dichloropropene	0.5	UJ	1.2	R	2.5	UJ	2.3	UJ	NA	NA
trans-1,4-Dichloro-2-butene	1.8	UJ	4.1	R	8.9	UJ	8.1	UJ	NA	NA
Trichloroethene	0.58	UJ	1.3	R	2.9	UJ	2.6	UJ	NA	NA
Trichlorofluoromethane	0.86	UJ	2	R	4.3	UJ	3.9	UJ	NA	NA
Vinyl acetate	0.86	UJ	2	R	4.3	UJ	3.9	UJ	NA	NA
Vinyl chloride	0.33	UJ	0.77	R	1.7	UJ	1.5	UJ	NA	NA
Xylenes, Total	1.3	UJ	3.1	R	6.6	UJ	6	UJ	NA	NA
Semivolatile Organic Compound (ug/kg)										
1,1'-Biphenyl	15	UJ	30	UJ	26	UJ	43	UJ	NA	NA
1,2,4,5-Tetrachlorobenzene	13	UJ	25	UJ	22	UJ	36	UJ	NA	NA
1,2,4-Trichlorobenzene	15	UJ	30	UJ	26	UJ	43	UJ	NA	NA
1,2-Dichlorobenzene	14	UJ	28	UJ	25	UJ	40	UJ	NA	NA
1,3,5-Trinitrobenzene	35	UJ	68	UJ	61	UJ	98	UJ	NA	NA
1,3-Dichlorobenzene	12	UJ	24	UJ	21	UJ	34	UJ	NA	NA
1,3-Dinitrobenzene	8.1	UJ	16	UJ	14	UJ	22	UJ	NA	NA
1,4-Dichlorobenzene	13	UJ	25	UJ	22	UJ	36	UJ	NA	NA
1,4-Dioxane	17	UJ	32	UJ	29	UJ	46	UJ	NA	NA
1,4-Naphthoquinone	8.1	UJ	16	UJ	14	UJ	22	UJ	NA	NA
2,2'-oxybis[1-chloropropane]	13	UJ	25	UJ	22	UJ	36	UJ	NA	NA
2,3,4,6-Tetrachlorophenol	8.7	UJ	17	UJ	15	UJ	24	UJ	NA	NA
2,4,5-Trichlorophenol	14	UJ	27	UJ	24	UJ	39	UJ	NA	NA
2,4,6-Trichlorophenol	16	UJ	32	UJ	28	UJ	45	UJ	NA	NA
2,4-Dichlorophenol	17	UJ	33	UJ	29	UJ	47	UJ	NA	NA
2,4-Dimethylphenol	35	UJ	68	UJ	61	UJ	98	UJ	NA	NA
2,4-Dinitrophenol	170	UJ	330	UJ	300	UJ	480	UJ	NA	NA
2,4-Dinitrotoluene	12	UJ	24	UJ	21	UJ	34	UJ	NA	NA
2,6-Dichlorophenol	13	UJ	26	UJ	23	UJ	37	UJ	NA	NA
2,6-Dinitrotoluene	13	UJ	25	UJ	22	UJ	36	UJ	NA	NA
2-Acetylaminofluorene	11	UJ	20	UJ	18	UJ	29	UJ	NA	NA
2-Chloronaphthalene	13	UJ	25	UJ	22	UJ	36	UJ	NA	NA
2-Chlorophenol	14	UJ	27	UJ	24	UJ	38	UJ	NA	NA
2-Methylnaphthalene	3.5	UJ	6.8	UJ	6.1	UJ	9.8	UJ	NA	NA
2-Methylphenol	17	UJ	33	UJ	29	UJ	47	UJ	NA	NA
2-Naphthylamine	41	UJ	80	UJ	71	UJ	110	UJ	NA	NA
2-Nitroaniline	13	UJ	26	UJ	23	UJ	37	UJ	NA	NA
2-Nitrophenol	15	UJ	29	UJ	26	UJ	42	UJ	NA	NA
2-Picoline	25	UJ	48	UJ	43	UJ	69	UJ	NA	NA
2-Toluidine	19	UJ	37	UJ	33	UJ	53	UJ	NA	NA
3 & 4 Methylphenol	15	UJ	29	UJ	26	UJ	42	UJ	NA	NA
3,3'-Dichlorobenzidine	19	UJ	37	UJ	33	UJ	53	UJ	NA	NA
3,3'-Dimethylbenzidine	370	UJ	720	UJ	640	UJ	1000	UJ	NA	NA
3-Methylcholanthrene	13	UJ	25	UJ	22	UJ	35	UJ	NA	NA
3-Nitroaniline	9.3	UJ	18	UJ	16	UJ	26	UJ	NA	NA
4,6-Dinitro-2-methylphenol	12	UJ	23	UJ	21	UJ	33	UJ	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sample ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sampling Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008
Semivolatile Organic Compound (ug/kg)						
4-Aminobiphenyl	27 UJ	52 UJ	46 UJ	75 UJ	NA	NA
4-Bromophenyl phenyl ether	15 UJ	29 UJ	25 UJ	41 UJ	NA	NA
4-Chloro-3-methylphenol	16 UJ	30 UJ	27 UJ	43 UJ	NA	NA
4-Chloroaniline	12 UJ	24 UJ	21 UJ	34 UJ	NA	NA
4-Chlorophenyl phenyl ether	13 UJ	25 UJ	22 UJ	36 UJ	NA	NA
4-Nitroaniline	16 UJ	31 UJ	27 UJ	44 UJ	NA	NA
4-Nitrophenol	68 UJ	130 UJ	120 UJ	190 UJ	NA	NA
4-Nitroquinoline-1-oxide	23 R	44 R	39 R	63 UJ	NA	NA
7,12-Dimethylbenz(a)anthracene	19 UJ	37 UJ	33 UJ	53 UJ	NA	NA
Acenaphthene	1.2 UJ	2.3 UJ	2 UJ	3.3 UJ	NA	NA
Acenaphthylene	3.5 UJ	6.8 UJ	6.1 UJ	9.8 UJ	NA	NA
Acetophenone	18 UJ	35 UJ	31 UJ	49 UJ	NA	NA
alpha,alpha-Dimethyl phenethylamine	120 UJ	240 UJ	210 UJ	340 UJ	NA	NA
Aniline	13 UJ	25 UJ	22 UJ	36 UJ	NA	NA
Anthracene	3.5 UJ	6.8 UJ	6.1 UJ	9.8 UJ	NA	NA
Aramite, Total	23 UJ	44 UJ	39 UJ	63 UJ	NA	NA
Benzo[a]anthracene	270 J	58 J	28 J	9.8 UJ	NA	NA
Benzo[a]pyrene	300 J	85 J	39 J	3.8 UJ	NA	NA
Benzo[b]fluoranthene	1.6 UJ	3.1 UJ	77 J	4.4 UJ	NA	NA
Benzo[g,h,i]perylene	150 J	46 J	31 J	9.8 UJ	NA	NA
Benzo[k]fluoranthene	630 J	160 J	3.6 UJ	5.7 UJ	NA	NA
Benzyl alcohol	17 UJ	32 UJ	29 UJ	47 J	NA	NA
Bis(2-chloroethoxy)methane	14 UJ	27 UJ	24 UJ	39 UJ	NA	NA
Bis(2-chloroethyl)ether	12 UJ	23 UJ	20 UJ	33 UJ	NA	NA
Bis(2-ethylhexyl) phthalate	260 J	79 U	70 U	160 U	NA	NA
Butyl benzyl phthalate	22 J	29 UJ	26 UJ	41 UJ	NA	NA
Chrysene	410 J	87 J	36 J	7.1 J	NA	NA
Diallate	20 UJ	39 UJ	34 UJ	55 UJ	NA	NA
Dibenz(a,h)anthracene	52 J	2.4 UJ	2.1 UJ	3.4 UJ	NA	NA
Dibenzofuran	8.7 UJ	17 UJ	15 UJ	24 UJ	NA	NA
Diethyl phthalate	23 UJ	44 UJ	39 UJ	63 UJ	NA	NA
Dimethyl phthalate	13 UJ	26 UJ	23 UJ	37 UJ	NA	NA
Di-n-butyl phthalate	52 UJ	100 UJ	89 UJ	610 UJ	NA	NA
Di-n-octyl phthalate	6.8 UJ	13 UJ	12 UJ	19 UJ	NA	NA
Dinoseb	35 UJ	68 UJ	61 UJ	98 UJ	NA	NA
Ethyl methanesulfonate	23 UJ	44 UJ	39 UJ	63 UJ	NA	NA
Fluoranthene	350 J	79 J	32 J	9.8 UJ	NA	NA
Fluorene	1.6 UJ	3.1 UJ	2.7 UJ	4.4 UJ	NA	NA
Hexachlorobenzene	14 UJ	27 UJ	24 UJ	39 UJ	NA	NA
Hexachlorobutadiene	19 UJ	37 UJ	32 UJ	52 UJ	NA	NA
Hexachlorocyclopentadiene	29 UJ	56 UJ	50 UJ	80 UJ	NA	NA
Hexachloroethane	15 UJ	30 UJ	26 UJ	43 UJ	NA	NA
Hexachlorophene	1700 R	3300 R	3000 R		NA	NA
Hexachloropropene	15 UJ	29 UJ	26 UJ	41 UJ	NA	NA
Indeno[1,2,3-cd]pyrene	110 J	32 J	19 J	6.9 UJ	NA	NA
Isophorone	13 UJ	25 UJ	22 UJ	36 UJ	NA	NA
Isosafrole	15 UJ	29 UJ	25 UJ	41 UJ	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sample ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sampling Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008
Semivolatile Organic Compound (ug/kg)						
Methapyrilene	19 UJ	37 UJ	33 UJ	53 UJ	NA	NA
Methyl methanesulfonate	19 UJ	37 UJ	33 UJ	53 UJ	NA	NA
Naphthalene	1.2 UJ	2.4 UJ	2.1 UJ	3.4 UJ	NA	NA
Nitrobenzene	14 UJ	28 UJ	25 UJ	40 UJ	NA	NA
N-Nitro-o-toluidine	12 UJ	24 UJ	21 UJ	34 UJ	NA	NA
N-Nitrosodiethylamine	25 UJ	48 UJ	43 UJ	69 UJ	NA	NA
N-Nitrosodimethylamine	20 UJ	39 UJ	35 UJ	56 UJ	NA	NA
N-Nitrosodi-n-butylamine	19 UJ	37 UJ	32 UJ	52 UJ	NA	NA
N-Nitrosodi-n-propylamine	13 UJ	26 UJ	23 UJ	37 UJ	NA	NA
N-Nitrosodiphenylamine	15 UJ	29 UJ	25 UJ	41 UJ	NA	NA
N-Nitrosomethylethylamine	12 UJ	23 UJ	20 UJ	33 UJ	NA	NA
N-Nitrosomorpholine	14 UJ	27 UJ	24 UJ	38 UJ	NA	NA
N-Nitrosopiperidine	18 UJ	34 UJ	30 UJ	49 UJ	NA	NA
N-Nitrosopyrrolidine	18 UJ	36 UJ	32 UJ	51 UJ	NA	NA
p-Dimethylamino azobenzene	15 UJ	29 UJ	25 UJ	41 UJ	NA	NA
Pentachlorobenzene	13 UJ	25 UJ	22 UJ	36 UJ	NA	NA
Pentachloronitrobenzene	12 UJ	24 UJ	21 UJ	34 UJ	NA	NA
Pentachlorophenol	17 UJ	33 UJ	30 UJ	48 UJ	NA	NA
Phenacetin	9.7 UJ	19 UJ	17 UJ	27 UJ	NA	NA
Phenanthrene	21 J	19 J	13 J	9.8 UJ	NA	NA
Phenol	9.9 UJ	19 UJ	19 J	28 UJ	NA	NA
p-Phenylene diamine	330 UJ	640 UJ	570 UJ	920 UJ	NA	NA
Pronamide	19 UJ	36 UJ	32 UJ	52 UJ	NA	NA
Pyrene	570 J	110 J	51 J	9.8 UJ	NA	NA
Pyridine	23 UJ	44 UJ	39 UJ	63 UJ	NA	NA
Safrole, Total	17 UJ	33 UJ	30 UJ	48 UJ	NA	NA
Total Metals (mg/kg)						
Antimony	0.59 UJ	1.4 UJ	1.3 UJ	0.66 UJ	0.42 UJ	0.97 UJ
Arsenic	3.9 J	4.2 J	3 J	3.8 J	2.6 J	3.2 J
Barium	54 J	78 J	70 J	160 J	78 J	110 J
Beryllium	0.21 J	0.29 J	0.24 J	0.27 J	0.26 UJ	0.25 UJ
Cadmium	2.6 J	3.9 J	3.4 J	0.54 J	0.54 J	0.72 J
Chromium	39 J	46 J	43 J	34 J	29 J	38 J
Cobalt	18 J	24 J	17 J	40 J	29 J	29 J
Copper	130 J	130 J	110 J	110 J	100 J	110 J
Lead	280 J	110 J	160 J	25 J	13 J	48 J
Mercury	0.052 J	0.11 J	0.069 J	0.069 J	0.039 UJ	0.086 J
Nickel	13 J	19 J	16 J	16 J	11 J	14 J
Selenium	1.2 J	4.2 J	2.9 J	2 J	1.3 J	1.2 J
Silver	0.18 J	0.15 J	0.21 J	0.23 J	0.074 UJ	0.72 J
Thallium	0.23 UJ	0.46 UJ	0.39 UJ	0.68 UJ	0.41 UJ	0.39 UJ
Tin	7.8 UJ	15 UJ	13 UJ	23 UJ	14 UJ	13 UJ
Vanadium	220 J	250 J	160 J	190 J	240 J	180 J
Zinc	89 J	140 J	130 J	110 J	86 J	100 J

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sample ID	56SD03	56SD04	56SD04D	56SD05	56SD12	56SD13
Sampling Date	4/29/2008	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008
AVS (µmole/g):		NA	NA	NA	NA	NA
SEM (µmole/g)						
Cadmium	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA
Total SEM (µmole/g)	NA	NA	NA	NA	NA	NA
SEM-to-AVS	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/kg)						
Total Organic Carbon	36000 J	42000 J	NA	76000 J	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sample ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sampling Date	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0	0-0	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sample ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sampling Date	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Volatile Organic Compounds (ug/kg)						
Tetrachloroethene	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compound (ug/kg)						
1,1'-Biphenyl	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
2-Picoline	NA	NA	NA	NA	NA	NA
2-Toluidine	NA	NA	NA	NA	NA	NA
3 & 4 Methylphenol	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sample ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sampling Date	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Semivolatile Organic Compound (ug/kg)						
4-Aminobiphenyl	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA
Aramite, Total	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA	NA
Ethyl methanesulfonate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sample ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sampling Date	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Semivolatile Organic Compound (ug/kg)						
Methapyrilene	NA	NA	NA	NA	NA	NA
Methyl methanesulfonate	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA
N-Nitro-o-toluidine	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
p-Phenylene diamine	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA	NA
Safrole, Total	NA	NA	NA	NA	NA	NA
Total Metals (mg/kg)						
Antimony	0.62 UJ	0.66 UJ	0.57 UJ	0.64 UJ	0.66 UJ	0.92 J
Arsenic	3.4 J	4 J	1.5 J	0.96 J	2.2 J	3.4 J
Barium	43 J	51 J	93 J	67.3 J	140 J	101 J
Beryllium	0.28 J	0.3 J	0.45 UJ	0.5 UJ	0.5 UJ	0.56 UJ
Cadmium	0.39 J	0.23 J	0.09 UJ	0.1 UJ	0.1 UJ	0.13 UJ
Chromium	51 J	46 J	28.7 J	27.7 J	29.7 J	25.1 J
Cobalt	43 J	59 J	27.5 J	23.6 J	41.9 J	58.8 J
Copper	98 J	100 J	107 J	100 J	96.6 J	89.3 J
Lead	34 J	54 J	32.4 J	39.4 J	45.7 J	23.3 J
Mercury	0.063 J	0.064 J	0.092 J	0.38 J	0.068 J	0.11 J
Nickel	16 J	19 J	9.5 J	9.6 J	11.5 J	10.5 J
Selenium	0.88 J	0.99 J	0.92 UJ	2 J	1.1 UJ	1.8 J
Silver	0.089 UJ	0.14 UJ	4.6 J	0.31 J	0.12 UJ	0.16 UJ
Thallium	0.28 UJ	0.26 UJ	1.2 UJ	1.3 UJ	1.3 UJ	1.8 UJ
Tin	9.5 UJ	8.7 UJ	8.2 J	7.7 J	13.6 J	10.7 J
Vanadium	260 J	230 J	184 J	172 J	189 J	201 J
Zinc	120 J	110 J	93.3 J	90.5 J	98.1 J	104 J

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sample ID	56SD14D	56SD14	56SD15	56SD16	56SD17	56SD18
Sampling Date	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009	6/24/2009
AVS (µmole/g):	NA	NA	2.3 J	0.38 UJ	0.29 UJ	0.47 UJ
SEM (µmole/g)						
Cadmium	NA	NA	0.0059 J	0.0086 J	0.0054 J	0.0079 J
Copper	NA	NA	0.616 J	0.835 J	0.494 J	0.512 J
Lead	NA	NA	0.115 J	0.184 J	0.137 J	0.077 J
Nickel	NA	NA	0.049 J	0.071 J	0.05 J	0.058 J
Silver	NA	NA	0.0196 J	0.0043 J	0.0065 J	0.0048 UJ
Zinc	NA	NA	0.79 J	1.08 J	0.587 J	0.93 J
Total SEM (µmole/g)	NA	NA	1.5857	2.1808	1.2767	1.5873
SEM-to-AVS	NA	NA	0.6894	5.7388	4.4022	3.3772
Total Organic Carbon (mg/kg)						
Total Organic Carbon	NA	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sample ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)					
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sample ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Volatile Organic Compounds (ug/kg)					
Tetrachloroethene	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA
Semivolatile Organic Compound (ug/kg)					
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

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sample ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Semivolatile Organic Compound (ug/kg)					
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
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
Ethyl methanesulfonate	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
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

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sample ID	56SD19	56SD20	56SD21	56SD22	56SD22D
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Semivolatile Organic Compound (ug/kg)					
Methapyrilene	NA	NA	NA	NA	NA
Methyl methanesulfonate	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
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
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
Total Metals (mg/kg)					
Antimony	0.29 UJ	0.81 UJ	0.72 UJ	0.74 UJ	0.86 UJ
Arsenic	2	1.1 UJ	1 J	10.4 J	2.4 J
Barium	42	109 J	105 J	571 J	197 J
Beryllium	0.4 U	0.44 UJ	0.57 UJ	1.2 UJ	0.59 UJ
Cadmium	0.04 U	0.12 UJ	0.11 UJ	0.11 UJ	0.13 UJ
Chromium	29.2	19.8 J	24.4 J	34.4 J	18.2 J
Cobalt	33	50.8 J	36.7 J	91.4 J	47.6 J
Copper	77.3	75.1 J	85.7 J	92.8 J	67.6 J
Lead	73.1	16.7 J	19.7 J	22 J	15.1 J
Mercury	0.11	0.15 J	0.1 J	0.086 UJ	0.088 J
Nickel	11.9	8.7 J	9.9 J	19.1 J	8.7 J
Selenium	0.46 UJ	1.3 UJ	1.4 J	1.2 UJ	1.4 UJ
Silver	0.05 U	0.15 UJ	0.13 UJ	0.14 UJ	0.16 UJ
Thallium	0.59 U	1.7 UJ	1.5 UJ	1.5 UJ	1.8 UJ
Tin	4.6 J	14.6 J	10.1 J	16 J	14.1 J
Vanadium	167	147 J	176 J	171 J	151 J
Zinc	86	69.2 J	75.5 J	98.2 J	71.1 J

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - SEDIMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD19		56SD20		56SD21		56SD22		56SD22D	
Sample ID	56SD19		56SD20		56SD21		56SD22		56SD22D	
Sampling Date	6/24/2009		6/24/2009		6/24/2009		6/24/2009		6/24/2009	
AVS (µmole/g):	0.17	UJ	3.7	J	4.6	J	1.29	J	2	J
SEM (µmole/g)										
Cadmium	0.00554	J	0.0044	J	0.0055	J	0.0052	J	0.0063	J
Copper	0.429	J	0.449	J	0.735	J	0.500	J	0.595	J
Lead	0.31	J	0.057	J	0.097	J	0.065	J	0.066	J
Nickel	0.062	J	0.057	J	0.080	J	0.067	J	0.077	J
Silver	0.0017	UJ	0.0120	J	0.0031	J	0.0165	J	0.0111	J
Zinc	0.68	J	0.57	J	0.85	J	0.63	J	0.68	J
Total SEM (µmole/g)	1.4874		1.1434				1.2755		1.4299	
SEM-to-AVS	8.7494		0.3090		0.0000		0.9887		0.7149	
Total Organic Carbon (mg/kg)										
Total Organic Carbon	NA		NA		NA		NA		NA	

QA/QC DATA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	56TB01		56TB02		56TB03		56TB04		QATB01	
Date	4/29/2008		4/30/2008		5/2/2008		5/4/2008		5/2/2008	
Volatile Organic Compounds (ug/L)										
1,1,1,2-Tetrachloroethane	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	U
1,1,1-Trichloroethane	0.39	R	0.39	U	0.39	UJ	0.39	U	0.39	U
1,1,2,2-Tetrachloroethane	0.26	R	0.26	U	0.26	UJ	0.26	U	0.26	U
1,1,2-Trichloroethane	0.51	R	0.51	U	0.51	UJ	0.51	U	0.51	U
1,1-Dichloroethane	0.32	R	0.32	U	0.32	UJ	0.32	U	0.32	U
1,1-Dichloroethene	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	U
1,2,3-Trichloropropane	0.42	R	0.42	U	0.42	UJ	0.42	U	0.42	U
1,2-Dibromo-3-Chloropropane	0.48	R	0.48	U	0.48	UJ	0.48	U	0.48	U
1,2-Dichloroethane	0.31	R	0.31	U	0.31	UJ	0.31	U	0.31	U
1,2-Dichloropropane	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	U
2-Butanone (MEK)	0.6	R	0.6	U	0.6	UJ	0.6	U	0.6	U
2-Chloro-1,3-butadiene	0.35	R	0.35	UJ	0.35	UJ	0.35	U	0.35	U
2-Hexanone	0.68	R	0.68	U	0.68	UJ	0.68	U	0.68	U
3-Chloro-1-propene	0.46	R	0.46	U	0.46	UJ	0.46	U	0.46	U
4-Methyl-2-pentanone (MIBK)	0.6	R	0.6	U	0.6	UJ	0.6	U	0.6	U
Acetone	5	R	5	UJ	5	UJ	5	U	5	U
Acetonitrile	15	R	15	UJ	15	UJ	15	U	15	U
Acrolein	18	R	18	U	18	R	18	R	18	U
Acrylonitrile	3.8	R	3.8	U	3.8	UJ	3.8	UJ	3.8	U
Benzene	0.32	R	0.32	U	0.32	UJ	0.32	U	0.32	U
Bromoform	0.41	R	0.41	U	0.41	UJ	0.41	U	0.41	U
Bromomethane	0.5	R	0.5	U	0.5	UJ	0.5	UJ	0.5	U
Carbon disulfide	0.17	R	0.17	UJ	0.17	UJ	0.17	U	0.17	U
Carbon tetrachloride	0.27	R	0.27	U	0.27	UJ	0.27	U	0.27	U
Chlorobenzene	0.34	R	0.34	U	0.34	UJ	0.34	U	0.34	U
Chlorodibromomethane	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	U
Chloroethane	1	R	1	UJ	1	UJ	1	U	1	U
Chloroform	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	U
Chloromethane	0.28	R	0.28	U	0.38	J	0.28	U	0.28	U
cis-1,3-Dichloropropene	0.37	R	0.37	U	0.37	UJ	0.37	U	0.37	U
Dibromomethane	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	U
Dichlorobromomethane	0.34	R	0.34	U	0.34	UJ	0.34	U	0.34	U
Dichlorodifluoromethane	0.33	R	0.33	U	0.33	UJ	0.33	UJ	0.33	U
Ethyl methacrylate	1	R	1	U	1	UJ	1	U	1	U
Ethylbenzene	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	U
Ethylene Dibromide	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	U
Iodomethane	1	R	1	U	1	UJ	1	U	1	U
Isobutyl alcohol	19	R	19	R	19	UJ	19	U	19	U
Methacrylonitrile	6.6	R	6.6	U	6.6	UJ	6.6	U	6.6	U
Methyl methacrylate	0.38	R	0.38	U	0.38	UJ	0.38	U	0.38	U
Methylene Chloride	1	R	1	U	1	UJ	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	U	9.2	UJ	9.2	U	9.2	U
Styrene	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	U
Tetrachloroethene	0.28	R	0.28	U	0.28	UJ	0.28	U	0.28	U
Toluene	0.31	R	0.31	U	0.31	UJ	0.31	U	0.31	U
trans-1,2-Dichloroethene	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	U

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	56TB01	56TB02	56TB03	56TB04	QATB01
Date	4/29/2008	4/30/2008	5/2/2008	5/4/2008	5/2/2008
Volatile Organic Compounds (ug/L)					
trans-1,3-Dichloropropene	0.27 R	0.27 U	0.27 UJ	0.27 U	0.27 U
trans-1,4-Dichloro-2-butene	0.83 R	0.83 UJ	0.83 UJ	0.83 U	0.83 U
Trichloroethene	0.4 R	0.4 U	0.4 UJ	0.4 U	0.4 U
Trichlorofluoromethane	0.29 R	0.29 UJ	0.29 UJ	0.29 U	0.29 U
Vinyl acetate	0.62 R	0.62 U	0.62 UJ	0.62 UJ	0.62 UJ
Vinyl chloride	0.2 R	0.2 U	0.2 UJ	0.2 U	0.2 U
Xylenes, Total	0.87 R	0.87 U	0.87 UJ	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
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

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	56TB01	56TB02	56TB03	56TB04	QATB01
Date	4/29/2008	4/30/2008	5/2/2008	5/4/2008	5/2/2008
Semivolatile Organic Compounds (ug/L)					
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
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
Ethyl methanesulfonate	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
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

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	56TB01	56TB02	56TB03	56TB04	QATB01
Date	4/29/2008	4/30/2008	5/2/2008	5/4/2008	5/2/2008
Semivolatile Organic Compounds (ug/L)					
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
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
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
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
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	NA	0.012 U

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	74TB12	FB01	ER01	ER02	ER04
Date	5/7/2008	5/2/2008	4/28/2008	4/29/2008	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 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	0.69 J	0.6 U	0.6 U	0.6 U
2-Chloro-1,3-butadiene	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
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 R	18 U	18 U	18 U	18 U
Acrylonitrile	3.8 UJ	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 UJ	0.5 UJ	0.5 U	0.5 U	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 UJ	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 UJ	0.28 U	0.28 U	0.28 U
cis-1,3-Dichloropropene	0.37 UJ	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 U
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 UJ	1 U	1 U	1 U	1 U
Isobutyl alcohol	19 U	19 U	19 U	19 U	19 U
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 U
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
Toluene	0.31 U	0.31 U	0.31 U	0.31 U	0.79 J
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID Date	74TB12 5/7/2008	FB01 5/2/2008	ER01 4/28/2008	ER02 4/29/2008	ER04 5/1/2008
Volatile Organic Compounds (ug/L)					
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 U
Trichloroethene	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Trichlorofluoromethane	0.29 UJ	0.29 U	0.29 U	0.29 U	0.29 U
Vinyl acetate	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 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	NA	0.17 UJ	0.16 UJ	0.17 UJ	0.17 UJ
1,2,4,5-Tetrachlorobenzene	NA	0.23 UJ	0.23 UJ	0.23 UJ	0.23 UJ
1,2,4-Trichlorobenzene	NA	0.13 UJ	0.12 UJ	0.13 UJ	0.13 UJ
1,2-Dichlorobenzene	NA	0.13 UJ	0.12 UJ	0.13 UJ	0.13 UJ
1,3,5-Trinitrobenzene	NA	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
1,3-Dichlorobenzene	NA	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ
1,3-Dinitrobenzene	NA	0.22 UJ	0.22 UJ	0.22 UJ	0.22 UJ
1,4-Dichlorobenzene	NA	0.16 J	0.21 J	0.17 J	0.12 UJ
1,4-Dioxane	NA	0.49 UJ	0.48 UJ	0.49 UJ	0.49 UJ
1,4-Naphthoquinone	NA	0.16 UJ	0.15 UJ	0.16 UJ	0.16 UJ
2,2'-oxybis[1-chloropropane]	NA	0.097 UJ	0.096 UJ	0.097 UJ	0.097 UJ
2,3,4,6-Tetrachlorophenol	NA	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ
2,4,5-Trichlorophenol	NA	0.16 UJ	0.15 UJ	0.16 UJ	0.16 UJ
2,4,6-Trichlorophenol	NA	0.16 UJ	0.15 UJ	0.16 UJ	0.16 UJ
2,4-Dichlorophenol	NA	0.15 UJ	0.14 UJ	0.15 UJ	0.15 UJ
2,4-Dimethylphenol	NA	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
2,4-Dinitrophenol	NA	2.4 UJ	2.4 UJ	2.4 UJ	2.4 UJ
2,4-Dinitrotoluene	NA	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ
2,6-Dichlorophenol	NA	0.21 UJ	0.21 UJ	0.21 UJ	0.21 UJ
2,6-Dinitrotoluene	NA	0.15 UJ	0.14 UJ	0.15 UJ	0.15 UJ
2-Acetylaminofluorene	NA	0.19 UJ	0.19 UJ	0.19 UJ	0.19 UJ
2-Chloronaphthalene	NA	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ
2-Chlorophenol	NA	0.15 UJ	0.14 UJ	0.15 UJ	0.15 UJ
2-Methylnaphthalene	NA	0.022 UJ	0.022 UJ	0.022 UJ	0.022 UJ
2-Methylphenol	NA	0.15 UJ	0.14 UJ	0.15 UJ	0.15 UJ
2-Naphthylamine	NA	1.1 UJ	1.1 UJ	1.1 UJ	1.1 UJ
2-Nitroaniline	NA	0.14 UJ	0.13 UJ	0.14 UJ	0.14 UJ
2-Nitrophenol	NA	0.17 UJ	0.16 UJ	0.17 UJ	0.17 UJ
2-Picoline	NA	0.57 UJ	0.57 UJ	0.57 UJ	0.57 UJ
2-Toluidine	NA	0.32 UJ	0.32 UJ	0.32 UJ	0.32 UJ
3 & 4 Methylphenol	NA	0.15 UJ	0.14 UJ	0.15 UJ	0.15 UJ
3,3'-Dichlorobenzidine	NA	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ
3,3'-Dimethylbenzidine	NA	3.7 UJ	3.7 UJ	3.7 UJ	3.7 UJ
3-Methylcholanthrene	NA	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
3-Nitroaniline	NA	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ
4,6-Dinitro-2-methylphenol	NA	0.49 UJ	0.48 UJ	0.49 UJ	0.49 UJ
4-Aminobiphenyl	NA	0.68 UJ	0.67 UJ	0.68 UJ	0.68 UJ
4-Bromophenyl phenyl ether	NA	0.16 UJ	0.15 UJ	0.16 UJ	0.16 UJ
4-Chloro-3-methylphenol	NA	0.16 UJ	0.15 UJ	0.16 UJ	0.16 UJ
4-Chloroaniline	NA	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
4-Chlorophenyl phenyl ether	NA	0.15 UJ	0.14 UJ	0.15 UJ	0.15 UJ

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	74TB12	FB01		ER01		ER02		ER04	
Date	5/7/2008	5/2/2008		4/28/2008		4/29/2008		5/1/2008	
Semivolatile Organic Compounds (ug/L									
4-Nitroaniline	NA	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ
4-Nitrophenol	NA	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ
4-Nitroquinoline-1-oxide	NA	0.26	R	0.26	R	0.26	R	0.26	R
7,12-Dimethylbenz(a)anthracene	NA	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ
Acenaphthene	NA	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Acenaphthylene	NA	0.049	UJ	0.048	UJ	0.049	UJ	0.049	UJ
Acetophenone	NA	0.38	J	0.47	J	0.42	J	0.35	J
alpha,alpha-Dimethyl phenethylamine	NA	1.3	UJ	1.2	UJ	1.3	UJ	1.3	UJ
Aniline	NA	0.4	UJ	0.39	UJ	0.4	UJ	0.4	UJ
Anthracene	NA	0.021	UJ	0.021	UJ	0.021	UJ	0.021	UJ
Aramite, Total	NA	0.49	UJ	0.48	UJ	0.49	UJ	0.49	UJ
Benzo[a]anthracene	NA	0.025	UJ	0.025	UJ	0.025	UJ	0.025	UJ
Benzo[a]pyrene	NA	0.024	UJ	0.024	UJ	0.024	UJ	0.024	R
Benzo[b]fluoranthene	NA	0.036	UJ	0.036	UJ	0.036	UJ	0.036	R
Benzo[g,h,i]perylene	NA	0.023	UJ	0.023	UJ	0.023	UJ	0.023	R
Benzo[k]fluoranthene	NA	0.019	UJ	0.019	UJ	0.019	UJ	0.019	R
Benzyl alcohol	NA	0.16	UJ	0.15	UJ	0.16	UJ	0.16	UJ
Bis(2-chloroethoxy)methane	NA	0.15	UJ	0.14	UJ	0.15	UJ	0.15	UJ
Bis(2-chloroethyl)ether	NA	0.14	UJ	0.13	UJ	0.14	UJ	0.14	UJ
Bis(2-ethylhexyl) phthalate	NA	0.34	UJ	0.39	J	12		0.34	UJ
Butyl benzyl phthalate	NA	0.17	UJ	0.16	UJ	0.17	UJ	0.17	UJ
Chrysene	NA	0.027	UJ	0.027	UJ	0.027	UJ	0.027	UJ
Diallate	NA	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ
Dibenz(a,h)anthracene	NA	0.023	UJ	0.023	UJ	0.023	UJ	0.023	R
Dibenzofuran	NA	0.097	UJ	0.096	UJ	0.097	UJ	0.097	UJ
Diethyl phthalate	NA	0.33	J	0.42	J	0.3	J	0.18	UJ
Dimethyl phthalate	NA	0.17	UJ	0.17	UJ	0.17	UJ	0.17	UJ
Di-n-butyl phthalate	NA	1.2	J	1.6	J	1.3	J	0.32	J
Di-n-octyl phthalate	NA	0.097	UJ	0.096	UJ	0.097	UJ	0.097	R
Dinoseb	NA	0.49	UJ	0.48	UJ	0.49	UJ	0.49	UJ
Ethyl methanesulfonate	NA	0.23	UJ	0.23	UJ	0.23	UJ	0.23	UJ
Fluoranthene	NA	0.049	UJ	0.048	UJ	0.049	UJ	0.049	UJ
Fluorene	NA	0.018	UJ	0.018	UJ	0.018	UJ	0.018	UJ
Hexachlorobenzene	NA	0.16	UJ	0.15	UJ	0.16	UJ	0.16	UJ
Hexachlorobutadiene	NA	0.13	UJ	0.12	UJ	0.13	UJ	0.13	UJ
Hexachlorocyclopentadiene	NA	0.49	UJ	0.48	UJ	0.49	UJ	0.49	UJ
Hexachloroethane	NA	0.15	UJ	0.14	UJ	0.15	UJ	0.15	UJ
Hexachlorophene	NA	49	R	48	R	49	R	49	R
Hexachloropropene	NA	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Indeno[1,2,3-cd]pyrene	NA	0.022	UJ	0.022	UJ	0.022	UJ	0.022	R
Isophorone	NA	0.15	UJ	0.14	UJ	0.15	UJ	0.15	UJ
Isosafrole	NA	0.3	UJ	0.3	UJ	0.3	UJ	0.3	UJ
Methapyrilene	NA	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ
Methyl methanesulfonate	NA	0.46	UJ	0.45	UJ	0.46	UJ	0.46	UJ

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	74TB12	FB01	ER01	ER02	ER04
Date	5/7/2008	5/2/2008	4/28/2008	4/29/2008	5/1/2008
Semivolatile Organic Compounds (ug/L					
Naphthalene	NA	0.049 UJ	0.048 UJ	0.049 UJ	0.049 UJ
Nitrobenzene	NA	0.14 UJ	0.13 UJ	0.14 UJ	0.14 UJ
N-Nitro-o-toluidine	NA	0.24 UJ	0.24 UJ	0.24 UJ	0.24 UJ
N-Nitrosodiethylamine	NA	0.32 UJ	0.32 UJ	0.32 UJ	0.32 UJ
N-Nitrosodimethylamine	NA	0.19 UJ	0.19 UJ	0.19 UJ	0.19 UJ
N-Nitrosodi-n-butylamine	NA	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ
N-Nitrosodi-n-propylamine	NA	0.13 UJ	0.12 UJ	0.13 UJ	0.13 UJ
N-Nitrosodiphenylamine	NA	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ
N-Nitrosomethylethylamine	NA	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ
N-Nitrosomorpholine	NA	0.19 UJ	0.19 UJ	0.19 UJ	0.19 UJ
N-Nitrosopiperidine	NA	0.22 UJ	0.22 UJ	0.22 UJ	0.22 UJ
N-Nitrosopyrrolidine	NA	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ
p-Dimethylamino azobenzene	NA	0.6 UJ	0.6 UJ	0.6 UJ	0.6 UJ
Pentachlorobenzene	NA	0.27 UJ	0.27 UJ	0.27 UJ	0.27 UJ
Pentachloronitrobenzene	NA	0.3 UJ	0.3 UJ	0.3 UJ	0.3 UJ
Pentachlorophenol	NA	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ
Phenacetin	NA	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Phenanthrene	NA	0.017 UJ	0.017 UJ	0.017 UJ	0.017 UJ
Phenol	NA	0.14 UJ	0.17 J	0.14 UJ	0.14 UJ
p-Phenylene diamine	NA	2.4 UJ	2.4 UJ	2.4 UJ	2.4 UJ
Pronamide	NA	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ
Pyrene	NA	0.026 UJ	0.026 UJ	0.026 UJ	0.026 UJ
Pyridine	NA	0.22 UJ	0.22 UJ	0.22 UJ	0.22 UJ
Safrole, Total	NA	0.23 UJ	0.23 UJ	0.23 UJ	0.23 UJ
Metals (ug/L)					
Antimony	NA	0.36 UJ	0.36 UJ	0.36 UJ	0.36 UJ
Arsenic	NA	0.28 UJ	0.28 UJ	0.28 UJ	0.28 UJ
Barium	NA	2 UJ	2 UJ	2 UJ	2 UJ
Beryllium	NA	0.065 UJ	0.065 UJ	0.065 UJ	0.065 UJ
Cadmium	NA	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ
Chromium	NA	0.6 UJ	0.6 UJ	0.6 UJ	0.6 UJ
Cobalt	NA	0.029 UJ	0.029 UJ	0.029 UJ	0.029 UJ
Copper	NA	2.1 J	2.1 J	1.9 J	1.2 UJ
Lead	NA	0.38 J	0.48 J	0.15 UJ	0.15 UJ
Mercury	NA	0.08 UJ	0.08 UJ	0.08 UJ	0.08 UJ
Nickel	NA	0.32 UJ	0.32 UJ	0.32 UJ	0.32 UJ
Selenium	NA	0.6 UJ	0.6 UJ	0.6 UJ	0.6 UJ
Silver	NA	0.09 UJ	0.09 UJ	0.09 UJ	0.09 UJ
Thallium	NA	0.55 UJ	0.55 UJ	0.55 UJ	0.55 UJ
Tin	NA	0.9 UJ	1.1 J	0.9 UJ	0.9 UJ
Vanadium	NA	0.8 UJ	0.8 UJ	0.8 UJ	0.8 UJ
Zinc	NA	6.5 UJ	6.5 UJ	6.5 UJ	6.5 UJ
TPH DRO and GRO (ug/L)					
Diesel Range Organics [C10-C28]	NA	0.028 UJ	0.12	0.03 U	NA
Gasoline Range Organics (GRO)-C6-C10	NA	0.012 U	0.012 U	0.012 U	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER05	ER06	ER07	ER10
Date	5/2/2008	5/3/2008	5/4/2008	5/7/2008
Volatile Organic Compounds (ug/L)				
1,1,1,2-Tetrachloroethane	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
1,1,2,2-Tetrachloroethane	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
1,1-Dichloroethane	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
1,2,3-Trichloropropane	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
1,2-Dichloroethane	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
2-Butanone (MEK)	0.6 U	0.6 U	0.6 U	0.6 U
2-Chloro-1,3-butadiene	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
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 U
Acetone	5 U	5 U	5 U	5 U
Acetonitrile	15 U	15 U	15 U	15 UJ
Acrolein	18 U	18 R	18 R	18 R
Acrylonitrile	3.8 U	3.8 UJ	3.8 UJ	3.8 UJ
Benzene	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
Bromomethane	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ
Carbon disulfide	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
Chlorobenzene	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
Chloroethane	1 U	1 U	1 U	1 UJ
Chloroform	0.29 U	0.29 U	0.29 U	0.29 U
Chloromethane	0.28 U	0.28 UJ	0.28 UJ	0.28 U
cis-1,3-Dichloropropene	0.37 U	0.37 UJ	0.37 UJ	0.37 UJ
Dibromomethane	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
Dichlorodifluoromethane	0.33 U	0.33 U	0.33 U	0.33 U
Ethyl methacrylate	1 U	1 U	1 U	1 U
Ethylbenzene	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
Iodomethane	1 U	1 UJ	1 UJ	1 UJ
Isobutyl alcohol	19 U	19 U	19 U	19 U
Methacrylonitrile	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
Methylene Chloride	1 U	1 U	1 U	1 U
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 U
Styrene	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
Toluene	0.9 J	0.31 U	0.31 U	0.31 U
trans-1,2-Dichloroethene	0.3 U	0.3 U	0.3 U	0.3 U

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER05		ER06		ER07		ER10	
Date	5/2/2008		5/3/2008		5/4/2008		5/7/2008	
Volatile Organic Compounds (ug/L)								
trans-1,3-Dichloropropene	0.27	U	0.27	U	0.27	U	0.27	UJ
trans-1,4-Dichloro-2-butene	0.83	U	0.83	U	0.83	U	0.83	U
Trichloroethene	0.4	U	0.4	U	0.4	U	0.4	U
Trichlorofluoromethane	0.29	U	0.29	UJ	0.29	UJ	0.29	U
Vinyl acetate	0.62	UJ	0.62	U	0.62	U	0.62	U
Vinyl chloride	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
Semivolatile Organic Compounds (ug/L								
1,1'-Biphenyl	0.22	UJ	NA		NA		NA	
1,2,4,5-Tetrachlorobenzene	0.31	UJ	NA		NA		NA	
1,2,4-Trichlorobenzene	0.17	UJ	NA		NA		NA	
1,2-Dichlorobenzene	0.17	UJ	NA		NA		NA	
1,3,5-Trinitrobenzene	0.27	UJ	NA		NA		NA	
1,3-Dichlorobenzene	0.15	UJ	NA		NA		NA	
1,3-Dinitrobenzene	0.29	UJ	NA		NA		NA	
1,4-Dichlorobenzene	0.15	UJ	NA		NA		NA	
1,4-Dioxane	0.64	UJ	NA		NA		NA	
1,4-Naphthoquinone	0.21	UJ	NA		NA		NA	
2,2'-oxybis[1-chloropropane]	0.13	UJ	NA		NA		NA	
2,3,4,6-Tetrachlorophenol	0.38	UJ	NA		NA		NA	
2,4,5-Trichlorophenol	0.21	UJ	NA		NA		NA	
2,4,6-Trichlorophenol	0.21	UJ	NA		NA		NA	
2,4-Dichlorophenol	0.19	UJ	NA		NA		NA	
2,4-Dimethylphenol	0.53	UJ	NA		NA		NA	
2,4-Dinitrophenol	3.2	UJ	NA		NA		NA	
2,4-Dinitrotoluene	0.23	UJ	NA		NA		NA	
2,6-Dichlorophenol	0.28	UJ	NA		NA		NA	
2,6-Dinitrotoluene	0.19	UJ	NA		NA		NA	
2-Acetylaminofluorene	0.26	UJ	NA		NA		NA	
2-Chloronaphthalene	0.15	UJ	NA		NA		NA	
2-Chlorophenol	0.19	UJ	NA		NA		NA	
2-Methylnaphthalene	0.029	UJ	NA		NA		NA	
2-Methylphenol	0.19	UJ	NA		NA		NA	
2-Naphthylamine	1.4	UJ	NA		NA		NA	
2-Nitroaniline	0.18	UJ	NA		NA		NA	
2-Nitrophenol	0.22	UJ	NA		NA		NA	
2-Picoline	0.76	UJ	NA		NA		NA	
2-Toluidine	0.42	UJ	NA		NA		NA	
3 & 4 Methylphenol	0.19	UJ	NA		NA		NA	
3,3'-Dichlorobenzidine	4.9	UJ	NA		NA		NA	
3,3'-Dimethylbenzidine	4.9	UJ	NA		NA		NA	
3-Methylcholanthrene	0.27	UJ	NA		NA		NA	
3-Nitroaniline	0.37	UJ	NA		NA		NA	
4,6-Dinitro-2-methylphenol	0.64	UJ	NA		NA		NA	
4-Aminobiphenyl	0.9	UJ	NA		NA		NA	
4-Bromophenyl phenyl ether	0.21	UJ	NA		NA		NA	
4-Chloro-3-methylphenol	0.21	UJ	NA		NA		NA	
4-Chloroaniline	0.53	UJ	NA		NA		NA	
4-Chlorophenyl phenyl ether	0.19	UJ	NA		NA		NA	

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER05	ER06	ER07	ER10
Date	5/2/2008	5/3/2008	5/4/2008	5/7/2008
Semivolatile Organic Compounds (ug/L				
4-Nitroaniline	0.35 UJ	NA	NA	NA
4-Nitrophenol	0.24 UJ	NA	NA	NA
4-Nitroquinoline-1-oxide	0.35 R	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	0.27 UJ	NA	NA	NA
Acenaphthene	0.026 UJ	NA	NA	NA
Acenaphthylene	0.064 UJ	NA	NA	NA
Acetophenone	0.35 J	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	1.7 UJ	NA	NA	NA
Aniline	0.53 UJ	NA	NA	NA
Anthracene	0.028 UJ	NA	NA	NA
Aramite, Total	0.64 UJ	NA	NA	NA
Benzo[a]anthracene	0.033 UJ	NA	NA	NA
Benzo[a]pyrene	0.032 UJ	NA	NA	NA
Benzo[b]fluoranthene	0.047 UJ	NA	NA	NA
Benzo[g,h,i]perylene	0.031 UJ	NA	NA	NA
Benzo[k]fluoranthene	0.026 UJ	NA	NA	NA
Benzyl alcohol	0.21 UJ	NA	NA	NA
Bis(2-chloroethoxy)methane	0.19 UJ	NA	NA	NA
Bis(2-chloroethyl)ether	0.18 UJ	NA	NA	NA
Bis(2-ethylhexyl) phthalate	0.45 UJ	NA	NA	NA
Butyl benzyl phthalate	0.22 UJ	NA	NA	NA
Chrysene	0.036 UJ	NA	NA	NA
Diallate	0.26 UJ	NA	NA	NA
Dibenz(a,h)anthracene	0.031 UJ	NA	NA	NA
Dibenzofuran	0.13 UJ	NA	NA	NA
Diethyl phthalate	0.24 UJ	NA	NA	NA
Dimethyl phthalate	0.23 UJ	NA	NA	NA
Di-n-butyl phthalate	0.42 J	NA	NA	NA
Di-n-octyl phthalate	0.13 UJ	NA	NA	NA
Dinoseb	0.64 UJ	NA	NA	NA
Ethyl methanesulfonate	0.31 UJ	NA	NA	NA
Fluoranthene	0.064 UJ	NA	NA	NA
Fluorene	0.024 UJ	NA	NA	NA
Hexachlorobenzene	0.21 UJ	NA	NA	NA
Hexachlorobutadiene	0.17 UJ	NA	NA	NA
Hexachlorocyclopentadiene	0.64 UJ	NA	NA	NA
Hexachloroethane	0.19 UJ	NA	NA	NA
Hexachlorophene	64 R	NA	NA	NA
Hexachloropropene	0.15 UJ	NA	NA	NA
Indeno[1,2,3-cd]pyrene	0.029 UJ	NA	NA	NA
Isophorone	0.19 UJ	NA	NA	NA
Isosafrole	0.4 UJ	NA	NA	NA
Methapyrilene	0.35 UJ	NA	NA	NA
Methyl methanesulfonate	0.6 UJ	NA	NA	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	ER05		ER06		ER07		ER10	
Date	5/2/2008		5/3/2008		5/4/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L								
Naphthalene	0.064	UJ	NA		NA		NA	
Nitrobenzene	0.18	UJ	NA		NA		NA	
N-Nitro-o-toluidine	0.32	UJ	NA		NA		NA	
N-Nitrosodiethylamine	0.42	UJ	NA		NA		NA	
N-Nitrosodimethylamine	0.26	UJ	NA		NA		NA	
N-Nitrosodi-n-butylamine	0.24	UJ	NA		NA		NA	
N-Nitrosodi-n-propylamine	0.17	UJ	NA		NA		NA	
N-Nitrosodiphenylamine	0.23	UJ	NA		NA		NA	
N-Nitrosomethylethylamine	0.37	UJ	NA		NA		NA	
N-Nitrosomorpholine	0.26	UJ	NA		NA		NA	
N-Nitrosopiperidine	0.29	UJ	NA		NA		NA	
N-Nitrosopyrrolidine	0.33	UJ	NA		NA		NA	
p-Dimethylamino azobenzene	0.79	UJ	NA		NA		NA	
Pentachlorobenzene	0.36	UJ	NA		NA		NA	
Pentachloronitrobenzene	0.4	UJ	NA		NA		NA	
Pentachlorophenol	0.24	UJ	NA		NA		NA	
Phenacetin	0.27	UJ	NA		NA		NA	
Phenanthrene	0.023	UJ	NA		NA		NA	
Phenol	0.18	UJ	NA		NA		NA	
p-Phenylene diamine	3.2	UJ	NA		NA		NA	
Pronamide	0.33	UJ	NA		NA		NA	
Pyrene	0.035	UJ	NA		NA		NA	
Pyridine	0.29	UJ	NA		NA		NA	
Safrole, Total	0.31	UJ	NA		NA		NA	
Metals (ug/L)								
Antimony	0.36	UJ	0.36	U	0.36	U	0.36	U
Arsenic	0.28	UJ	0.46	J	0.33	J	0.35	J
Barium	2	UJ	2	U	2	U	2	U
Beryllium	0.065	UJ	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	U	0.12	U	0.12	U
Chromium	0.6	UJ	0.6	U	0.6	U	0.6	U
Cobalt	0.029	UJ	0.029	U	0.029	U	0.029	U
Copper	1.2	UJ	3.6	J	5.2		1.9	J
Lead	0.15	UJ	0.15	U	0.15	U	0.15	U
Mercury	0.08	UJ	0.08	U	0.08	U	0.08	U
Nickel	0.32	UJ	0.32	U	0.32	U	0.32	U
Selenium	0.6	UJ	0.6	U	0.6	U	0.6	U
Silver	0.09	UJ	0.09	U	0.09	U	0.09	U
Thallium	0.55	UJ	0.55	U	0.55	U	0.55	U
Tin	0.9	UJ	0.9	U	0.9	U	0.9	U
Vanadium	0.8	UJ	1.2	J	1.1	J	0.8	U
Zinc	6.5	UJ	6.5	U	6.5	U	6.5	U
TPH DRO and GRO (ug/L)								
Diesel Range Organics [C10-C28]	NA		0.03	U	0.028	U	0.028	U
Gasoline Range Organics (GRO)-C6-C10	NA		0.012	U	0.012	U	0.012	U

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	JUNE09-ER02		JUNE09-FB02
Date	6/24/2009		6/24/2009
Volatile Organic Compounds (ug/L)			
1,1,1,2-Tetrachloroethane	0.5	U	NA
1,1,1-Trichloroethane	0.5	U	NA
1,1,2,2-Tetrachloroethane	0.5	U	NA
1,1,2-Trichloroethane	0.5	U	NA
1,1-Dichloroethane	0.5	U	NA
1,1-Dichloroethene	0.5	U	NA
1,2,3-Trichloropropane	0.5	U	NA
1,2-Dibromo-3-chloropropane	0.5	U	NA
1,2-Dibromoethane	0.5	U	NA
1,2-Dichloroethane	0.5	U	NA
1,2-Dichloropropane	0.5	U	NA
1,4-Dioxane	25	R	NA
2-Butanone	2.5	R	NA
2-Hexanone	2.5	U	NA
3-Chloropropene	0.5	U	NA
4-Methyl-2-pentanone	2.5	U	NA
Acetone	4.9	J	NA
Acetonitrile	0.5	U	NA
Acrolein	5	R	NA
Acrylonitrile	5	R	NA
Benzene	0.5	U	NA
Bromodichloromethane	0.5	U	NA
Bromoform	0.5	U	NA
Bromomethane	0.5	U	NA
Carbon disulfide	0.5	U	NA
Carbon tetrachloride	0.5	U	NA
Chlorobenzene	0.5	U	NA
Chloroethane	0.5	U	NA
Chloroform	0.5	U	NA
Chloromethane	0.5	U	NA
Chloroprene	0.5	U	NA
cis-1,3-Dichloropropene	0.5	U	NA
Dibromochloromethane	0.5	U	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	JUNE09-ER02		JUNE09-FB02
Date	6/24/2009		6/24/2009
Volatile Organic Compounds (ug/L)			
Dibromomethane	0.5	U	NA
Dichlorodifluoromethane	0.5	U	NA
Ethylbenzene	0.5	U	NA
Ethylmethacrylate	5	U	NA
Iodomethane	0.5	U	NA
Isobutyl alcohol	25	R	NA
m,p-xylene	1	U	NA
Methacrylonitrile	5	U	NA
Methylene chloride	0.5	U	NA
Methylmethacrylate	5	U	NA
o-xylene	0.5	U	NA
Pentachloroethane	0.5	U	NA
Propionitrile	25	R	NA
Styrene	0.5	U	NA
Tetrachloroethene	0.5	U	NA
Toluene	0.5	U	NA
trans-1,2-Dichloroethene	0.5	U	NA
trans-1,3-Dichloropropene	0.5	U	NA
trans-1,4-Dichloro-2-butene	2	U	NA
Trichloroethene	0.5	U	NA
Trichlorofluoromethane	0.5	U	NA
Vinyl acetate	1	U	NA
Vinyl chloride	0.5	U	NA
Xylene (total)	0.5	U	NA
Semivolatile Organic Compounds (ug/L)			
1,2,4,5-Tetrachlorobenzene	1	U	NA
1,2,4-Trichlorobenzene	1	U	NA
1,2-Dichlorobenzene	1	U	NA
1,3,5-Trinitrobenzene	1	U	NA
1,3-Dichlorobenzene	1	U	NA
1,3-Dinitrobenzene	1	U	NA
1,4-Dichlorobenzene	1	U	NA
1,4-Napthoquinone	1	U	NA
1-Naphthylamine	1	U	NA
2,2'-Oxybis(1-chloropropane)	1	U	NA
2,3,4,6-Tetrachlorophenol	1	U	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	JUNE09-ER02		JUNE09-FB02
Date	6/24/2009		6/24/2009
Semivolatile Organic Compounds (ug/L)			
2,4,5-Trichlorophenol	1	U	NA
2,4,6-Trichlorophenol	1	U	NA
2,4-Dichlorophenol	1	U	NA
2,4-Dimethylphenol	1	U	NA
2,4-Dinitrophenol	1	U	NA
2,4-Dinitrotoluene	1	U	NA
2,6-Dichlorophenol	1	U	NA
2,6-Dinitrotoluene	1	U	NA
2-Acetylaminofluorene	1	U	NA
2-Chloronaphthalene	1	U	NA
2-Chlorophenol	1	U	NA
2-Methylnaphthalene	1	U	NA
2-Methylphenol	1	U	NA
2-Naphthylamine	1	U	NA
2-Nitroaniline	1	U	NA
2-Nitrophenol	1	U	NA
2-Picoline	1	U	NA
3,3'-Dichlorobenzidine	1	U	NA
3-4-Methylphenol	1	UJ	NA
3-Methylcholanthrene	1	U	NA
3-Nitroaniline	1	U	NA
4,6-Dinitro-2-methylphenol	1	U	NA
4-Aminobiphenyl	1	U	NA
4-Bromophenyl-phenylether	1	U	NA
4-Chloro-3-methylphenol	1	U	NA
4-Chloroaniline	1	U	NA
4-Chlorophenyl-phenylether	1	U	NA
4-Nitroaniline	1	U	NA
4-Nitrophenol	1	U	NA
4-Nitroquinoline-1-oxide	1	UJ	NA
5-Nitro-o-toluidine	1	U	NA
7,12-Dimethylbenz(a)anthracene	1	U	NA
A,a-dimethylphenethylamine	1	U	NA
Acenaphthene	1	UJ	NA
Acenaphthylene	1	U	NA
Acetophenone	1	U	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	JUNE09-ER02		JUNE09-FB02
Date	6/24/2009		6/24/2009
Semivolatile Organic Compounds (ug/L)			
Aniline	1	U	NA
Anthracene	1	U	NA
Aramite	1	U	NA
Benzo(a)anthracene	1	U	NA
Benzo(a)pyrene	1	U	NA
Benzo(b)fluoranthene	1	U	NA
Benzo(g,h,i)perylene	1	U	NA
Benzo(k)fluoranthene	1	U	NA
Benzyl alcohol	4.1		NA
bis(2-Chloroethoxy)methane	1	U	NA
bis(2-Chloroethyl)ether	1	U	NA
bis(2-Ethylhexyl)phthalate	1	U	NA
Butylbenzylphthalate	0.86	J	NA
Chlorobenzilate	1	U	NA
Chrysene	1	U	NA
Diallate total	1	U	NA
Dibenzo(a,h)anthracene	1	U	NA
Dibenzofuran	1	U	NA
Diethylphthalate	1	U	NA
Dimethylphthalate	1	U	NA
Di-n-butylphthalate	2.4		NA
Di-n-octylphthalate	1	UJ	NA
Ethyl methanesulfonate	1	U	NA
Fluoranthene	1	UJ	NA
Fluorene	1	U	NA
Hexachlorobenzene	1	U	NA
Hexachlorobutadiene	1	U	NA
Hexachlorocyclopentadiene	1	U	NA
Hexachloroethane	1	U	NA
Hexachloropropene	1	U	NA
indeno(1,2,3-C,d)pyrene	1	U	NA
Isophorone	1	U	NA
Isosafrole	1	U	NA
Kepone	5	U	NA
Methapyrilene	1	U	NA
Methyl methanesulfonate	1	U	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	JUNE09-ER02		JUNE09-FB02
Date	6/24/2009		6/24/2009
Semivolatile Organic Compounds (ug/L)			
Naphthalene	1	U	NA
Nitrobenzene	1	U	NA
Nitrosomethylethylamine	1	U	NA
N-nitrosodiethylamine	1	U	NA
N-nitrosodimethylamine	1	U	NA
N-nitroso-di-n-butylamine	1	U	NA
N-nitroso-di-n-propylamine	1	U	NA
N-nitrosodiphenylamine	1	U	NA
N-nitrosomorpholine	1	U	NA
N-nitrosopiperidine	1	U	NA
N-nitrosopyrrolidine	1	U	NA
O-toluidine	1	U	NA
P-dimethylaminoazobenzene	1	U	NA
Pentachlorobenzene	1	U	NA
Pentachloronitrobenzene	1	U	NA
Pentachlorophenol	1	U	NA
Phenacetin	1	U	NA
Phenanthrene	1	U	NA
Phenol	1	U	NA
P-phenylenediamine	1	U	NA
Pronamide	1	U	NA
Pyrene	1	U	NA
Pyridine	1	U	NA
Safrole	1	U	NA
Pesticides (ug/L)			
4,4'-DDD	0.1	U	NA
4,4'-DDE	0.1	U	NA
4,4'-DDT	0.1	U	NA
Aldrin	0.05	U	NA
Alpha-bhc	0.054	R	NA
Alpha-chlordane	0.05	U	NA
Aroclor-1016	0.93	U	NA
Aroclor-1221	1.3	U	NA
Aroclor-1232	0.93	U	NA
Aroclor-1242	0.63	U	NA
Aroclor-1248	0.63	U	NA

APPENDIX B

SUMMARY OF DETECTED LABORATORY RESULTS - QA/QC
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	JUNE09-ER02		JUNE09-FB02	
Date	6/24/2009		6/24/2009	
Pesticides (ug/L)				
Aroclor-1254	0.63	U	NA	
Aroclor-1260	0.93	U	NA	
beta-BHC	0.05	U	NA	
Delta-BHC	0.05	U	NA	
Dieldrin	0.1	U	NA	
Endosulfan I	0.05	U	NA	
Endosulfan II	0.1	U	NA	
Endosulfan sulfate	0.1	U	NA	
Endrin	0.1	U	NA	
Endrin aldehyde	0.1	U	NA	
Endrin ketone	0.1	U	NA	
gamma-BHC (Lindane)	0.05	U	NA	
Gamma-chlordane	0.05	U	NA	
Heptachlor	0.05	U	NA	
Heptachlor epoxide	0.05	U	NA	
Isodrin	0.3		NA	
Methoxychlor	0.5	U	NA	
Toxaphene	2.5	U	NA	
Metals (ug/L)				
Antimony	1.8	U	1.8	U
Arsenic	2.4	U	2.4	U
Barium	0.38	U	0.38	U
Beryllium	0.35	U	0.35	U
Cadmium	0.27	U	0.27	U
Chromium	0.64	U	0.64	U
Cobalt	0.58	U	0.58	U
Copper	0.88	U	0.88	U
Lead	1.8	U	1.8	U
Mercury	0.1	U	0.1	U
Nickel	1.1	U	1.1	U
Selenium	2.9	U	2.9	U
Silver	0.33	U	0.33	U
Thallium	3.7	U	3.7	U
Tin	4.8	U	4.8	U
Vanadium	0.46	U	0.46	U
Zinc	1.1	U	1.1	U

ECP PHASE II DATA

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT - INORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	2E-SD01	
Sample Date	05/15/04	
Sample Depth (ft bgs)	(1)	
Appendix IX Metals (mg/kg)		
Silver	0.77	B
Arsenic	3.4	U
Barium	400	
Beryllium	0.36	B
Cadmium	15	
Cobalt	27	
Chromium	140	
Copper	130	
Nickel	26	
Lead	1500	
Antimony	6.8	U
Selenium	3.4	U
Tin	17	B
Thallium	20	U
Vanadium	110	
Zinc	1200	
Mercury	0.11	S

Note:

(1) - This sample was composited from several locations throughout the drainage ditch. The depth of the sample was down to the concrete liner within the drainage ditch.

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	2E-SD01	
Sample Date	05/15/04	
Sample Depth (ft bgs)	(1)	
Volatile Organic Compounds (ug/kg)		
Chloroform	18	U
Dichlorodifluoromethane	18	U
1,1-Dichloroethane	18	U
1,2-Dichloroethane	18	U
1,1-Dichloroethene	18	U
1,2-Dichloropropane	18	U
Ethyl benzene	18	U
Acrolein	370	U
Methylene chloride	8.9	J
1,1,2,2-Tetrachloroethane	18	U
Tetrachloroethene	22	
Toluene	44	
trans-1,2-Dichloroethene	18	U
1,1,1-Trichloroethane	18	U
1,1,2-Trichloroethane	18	U
2-Butanone	92	U
Chloroprene	18	U
2-Hexanone	92	U
Acrylonitrile	370	U
3-Chloro-1-propene	18	U
Benzene	18	U
Bromoform	18	U
Carbon tetrachloride	18	U
Chlorobenzene	18	U
Acetonitrile	740	U
1,2-Dibromo-3-chloropropane	37	U
Dibromomethane	18	U
trans-1,4-Dichloro-2-butene	37	U
cis-1,3-Dichloropropene	18	U
trans-1,3-Dichloropropene	18	U
Ethyl methacrylate	18	U
Iodomethane	18	U
Methacrylonitrile	370	U
Methyl methacrylate	18	U
Pentachloroethane	92	U
1,1,1,2-Tetrachloroethane	18	U
Trichlorofluoromethane	18	U
1,2,3-Trichloropropane	18	U
Vinyl chloride	18	U
Dibromochloromethane	18	U
Chloroethane	18	U
Acetone	41	J
Bromodichloromethane	18	U
Bromomethane	18	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	2E-SD01	
Sample Date	05/15/04	
Sample Depth (ft bgs)	(1)	
Volatile Organic Compounds (ug/kg) (Cont.)		
Chloromethane	18	U
Carbon disulfide	18	U
1,2-Dibromoethane	18	U
Propionitrile	370	U
Isobutanol	740	U
4-Methyl-2-pentanone	92	U
Styrene	18	U
Trichloroethene	18	U
Vinyl acetate	37	U
Xylene	37	U
Semivolatile Organic Compounds (ug/kg)		
Phenol	1,300	U
bis(2-Chloroethoxy)methane	1,300	U
2,4,6-Trichlorophenol	1,300	U
bis(2-Chloroethyl)ether	1,300	U
bis(2-Chloroisopropyl)ether	1,300	U
bis(2-Ethylhexyl)phthalate	1,300	U
4-Bromophenylphenyl ether	1,300	U
Butylbenzylphthalate	1,300	U
2-Chloronaphthalene	1,300	U
4-Chlorophenyl phenyl ether	1,300	U
Chrysene	190	J
Dibenzo(a,h)anthracene	1,300	U
2-Chlorophenol	1,300	U
Acenaphthene	1,300	U
3,3'-Dichlorobenzidine	2,600	U
Diethylphthalate	1,300	U
Dimethyl phthalate	1,300	U
2,4-Dinitrotoluene	1,300	U
2,6-Dinitrotoluene	1,300	U
Di-n-octylphthalate	1,300	U
2,4-Dichlorophenol	1,300	U
Acenaphthylene	1,300	U
2-Methylnaphthalene	1,300	U
Fluoranthene	160	J
Fluorene	1,300	U
Hexachlorobenzene	1,300	U
Hexachlorobutadiene	1,300	U
Hexachlorocyclopentadiene	1,300	U
Hexachloroethane	1,300	U
Indeno(1,2,3-cd)pyrene	1,300	U
Isophorone	1,300	U
Naphthalene	1,300	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	2E-SD01	
Sample Date	05/15/04	
Sample Depth (ft bgs)	(1)	
Semivolatile Organic Compounds (ug/kg) (Cont.)		
2,4-Dimethylphenol	1,300	U
Anthracene	1,300	U
4,6-Dinitro-2-methylphenol	6,800	U
Nitrobenzene	1,300	U
N-Nitrosodimethylamine	1,300	U
N-Nitrosodiphenylamine	1,300	U
Phenanthrene	1,300	U
Pyrene	120	J
1,2,4-Trichlorobenzene	1,300	U
4-Nitroquinoline-1-oxide	13,000	U
2,4-Dinitrophenol	6,800	U
Benzo(a)anthracene	1,300	U
Benzo(a)pyrene	1,300	U
2,6-Dichlorophenol	1,300	U
Benzo(b)fluoranthene	1,300	U
4-Aminobiphenyl	1,300	U
p-(Dimethylamino)azobenzene	1,300	U
7,12-Dimethylbenz(a)anthracene	1,300	U
3,3'-Dimethyl benzidine	6,800	U
alpha,alpha-Dimethylphenethylamine	270,000	U
1,4-Dioxane	1,300	U
n-Nitrosodi-n-propylamine	1,300	U
Aniline	1,300	U
Ethylmethanesulfonate	1,300	U
Acetophenone	1,300	U
Aramite	1,300	U
Hexachlorophene	680,000	U
Hexachloropropene	1,300	U
Isosafrole	1,300	U
Methapyrilene	270,000	U
3-Methylcholanthrene	1,300	U
Methyl methanesulfonate	1,300	U
1,4-Naphthoquinone	1,300	U
1-Naphthylamine	1,300	U
2-Naphthylamine	1,300	U
N-Nitrosodi-n-butylamine	1,300	U
N-Nitrosodiethylamine	1,300	U
N-Nitrosomethylethylamine	1,300	U
N-Nitrosomorpholine	1,300	U
N-Nitrosopiperidine	1,300	U
N-Nitrosopyrrolidine	1,300	U
5-Nitro-o-toluidine	1,300	U
Pentachlorobenzene	1,300	U
Pentachloronitrobenzene	1,300	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Sample ID	2E-SD01	
Sample Date	05/15/04	
Sample Depth (ft bgs)	[1]	
Semivolatile Organic Compounds (ug/kg) (Cont.)		
Phenacetin	1,300	U
2-Picoline	1,300	U
Pronamide	1,300	U
Pyridine	1,300	U
Safrole	1,300	U
1,2,4,5-Tetrachlorobenzene	1,300	U
2,3,4,6-Tetrachlorophenol	1,300	U
2,4,5-Trichlorophenol	1,300	U
1,3,5-Trinitrobenzene	1,300	U
2-Acetylaminofluorene	1,300	U
Dinoseb	1,300	U
4-Chloroaniline	2,600	U
4-Chloro-3-methylphenol	1,300	U
Benzo(g,h,i)perylene	1,300	U
Pentachlorophenol	6,800	U
Benzo(k)fluoranthene	1,300	U
Benzyl alcohol	1,300	U
Diallate	1,300	U
Dibenzofuran	1,300	U
Di-n-butylphthalate	1,300	U
Cresol, m & p	3,000	
m-Dichlorobenzene	1,300	U
m-Dinitrobenzene	1,300	U
3-Nitroaniline	6,800	U
Cresol (ortho)	1,300	U
o-Dichlorobenzene	1,300	U
2-Nitroaniline	6,800	U
2-Nitrophenol	1,300	U
o-Toluidine	1,300	U
p-Dichlorobenzene	1,300	U
4-Nitroaniline	6,800	U
4-Nitrophenol	6,800	U
1,4-Phenylenediamine	6,800	U
Total Petroleum Hydrocarbons (mg/kg)		
Diesel Range Organics	290	
Gasoline Range Organics	1	U

Note:

[1] - This sample was composited from several locations throughout the drainage ditch. The depth of the sample was down to the concrete liner within the drainage ditch.

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SURFACE WATER - INORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	2E-SW01		2E-SW01		2E-SW02	
Sample ID	2E-SW01		2E-SW01D		2E-SW02	
Sample Date	05/15/04		05/15/04		05/15/04	
Sample Depth (ft bgs)						
Appendix IX (Total) Metals (mg/L)						
Silver	0.005	U	0.005	U	0.005	U
Arsenic	0.01	U	0.01	U	0.01	U
Barium	0.019		0.019		0.029	
Beryllium	0.004	U	0.004	U	0.004	U
Cadmium	0.005	U	0.005	U	0.005	U
Cobalt	0.01	U	0.01	U	0.01	U
Chromium	0.01	U	0.01	U	0.01	U
Copper	0.02	U	0.02	U	0.0038	B
Nickel	0.04	U	0.04	U	0.04	U
Lead	0.005	U	0.005	U	0.005	U
Antimony	0.02	U	0.02	U	0.02	U
Selenium	0.01	U	0.01	U	0.01	U
Tin	0.05	U	0.05	U	0.05	U
Thallium	0.01	U	0.01	U	0.01	U
Vanadium	0.0015	B	0.0016	B	0.0008	B
Zinc	0.0018	B	0.0021	B	0.0061	B
Cyanide	0.01	U	0.01	U	0.01	U
Sulfide	1	U	1	U	1	U
Mercury	0.0002	U	0.000097	B	0.0002	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SURFACE WATER - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	2E-SW01		2E-SW01		2E-SW02	
Sample ID	2E-SW01		2E-SW01D		2E-SW02	
Sample Date	05/15/04		05/15/04		05/15/04	
Sample Depth (ft bgs)						
Volatile Organic Compounds (ug/kg)						
Chloroform	1	U	1	U	1	U
Dichlorodifluoromethane	1	U	1	U	1	U
1,1-Dichloroethane	1	U	1	U	1	U
1,2-Dichloroethane	1	U	1	U	1	U
1,1-Dichloroethene	1	U	1	U	1	U
1,2-Dichloropropane	1	U	1	U	1	U
Ethyl benzene	1	U	1	U	1	U
Acrolein	20	U	20	U	20	U
Methylene chloride	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	1	U	1	U	1	U
Tetrachloroethene	1	U	1	U	1	U
Toluene	1	U	1	U	1.1	
trans-1,2-Dichloroethene	1	U	1	U	1	U
1,1,1-Trichloroethane	1	U	1	U	1	U
1,1,2-Trichloroethane	1	U	1	U	1	U
2-Butanone	10	U	10	U	10	U
Chloroprene	1	U	1	U	1	U
2-Hexanone	10	U	10	U	10	U
Acrylonitrile	20	U	20	U	20	U
3-Chloro-1-propene	1	U	1	U	1	U
Benzene	1	U	1	U	1	U
Bromoform	1	U	1	U	1	U
Carbon tetrachloride	1	U	1	U	1	U
Chlorobenzene	1	U	1	U	1	U
Acetonitrile	40	U	40	U	40	U
1,2-Dibromo-3-chloropropane	1	U	1	U	1	U
Dibromomethane	1	U	1	U	1	U
trans-1,4-Dichloro-2-butene	2	U	2	U	2	U
cis-1,3-Dichloropropene	1	U	1	U	1	U
trans-1,3-Dichloropropene	1	U	1	U	1	U
Ethyl methacrylate	1	U	1	U	1	U
Iodomethane	1	U	1	U	1	U
Methacrylonitrile	20	U	20	U	20	U
Methyl methacrylate	1	U	1	U	1	U
Pentachloroethane	5	U	5	U	5	U
1,1,1,2-Tetrachloroethane	1	U	1	U	1	U
Trichlorofluoromethane	1	U	1	U	1	U
1,2,3-Trichloropropane	1	U	1	U	1	U
Vinyl chloride	1	U	1	U	1	U
Dibromochloromethane	1	U	1	U	1	U
Chloroethane	1	U	1	U	1	U
Acetone	25	U	25	U	25	U
Bromodichloromethane	1	U	1	U	1	U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SURFACE WATER - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	2E-SW01	2E-SW01	2E-SW02
Sample ID	2E-SW01	2E-SW01D	2E-SW02
Sample Date	05/15/04	05/15/04	05/15/04
Sample Depth (ft bgs)			
Volatile Organic Compounds (ug/kg) (Cont.)			
Bromomethane	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U
Carbon disulfide	1 U	1 U	1 U
1,2-Dibromoethane	1 U	1 U	1 U
Propionitrile	20 U	20 U	20 U
Isobutanol	40 U	40 U	40 U
4-Methyl-2-pentanone	10 U	10 U	10 U
Styrene	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U
Vinyl acetate	2 U	2 U	2 U
Xylene	2 U	2 U	2 U
Semivolatile Organic Compounds (ug/kg)			
Phenol	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U	10 U
4-Bromophenylphenyl ether	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U
2-Chloronaphthalene	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U
Dibenzo(a,h)anthracene	10 U	1 J	10 U
2-Chlorophenol	10 U	10 U	10 U
Acenaphthene	10 U	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U
Diethylphthalate	10 U	10 U	10 U
Dimethyl phthalate	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U
Di-n-octylphthalate	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	1 J	10 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SURFACE WATER - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	2E-SW01	2E-SW01	2E-SW02
Sample ID	2E-SW01	2E-SW01D	2E-SW02
Sample Date	05/15/04	05/15/04	05/15/04
Sample Depth (ft bgs)			
Semivolatile Organic Compounds (ug/kg) (Cont.)			
Isophorone	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U
Nitrobenzene	10 U	10 U	10 U
N-Nitrosodimethylamine	10 U	10 U	10 U
N-Nitrosodiphenylamine	10 U	10 U	10 U
Phenanthrene	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U
4-Nitroquinoline-1-oxide	20 U	20 U	20 U
2,4-Dinitrophenol	50 U	50 U	50 U
Benzo(a)anthracene	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U
2,6-Dichlorophenol	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U
4-Aminobiphenyl	10 U	10 U	10 U
p-(Dimethylamino)azobenzene	10 U	10 U	10 U
7,12-Dimethylbenz(a)anthracene	10 U	10 U	10 U
3,3'-Dimethyl benzidine	20 U	20 U	20 U
alpha,alpha-Dimethylphenethylamine	2,000 U	2,000 U	2,000 U
1,4-Dioxane	10 U	10 U	10 U
n-Nitrosodi-n-propylamine	10 U	10 U	10 U
Aniline	20 U	20 U	20 U
Ethylmethanesulfonate	10 U	10 U	10 U
Acetophenone	10 U	10 U	10 U
Aramite	10 U	10 U	10 U
Hexachlorophene	5,000 U	5,000 U	5,000 U
Hexachloropropene	10 U	10 U	10 U
Isosafrole	10 U	10 U	10 U
Methapyrilene	2,000 U	2,000 U	2,000 U
3-Methylcholanthrene	10 U	10 U	10 U
Methyl methanesulfonate	10 U	10 U	10 U
1,4-Naphthoquinone	10 U	10 U	10 U
1-Naphthylamine	10 U	10 U	10 U
2-Naphthylamine	10 U	10 U	10 U
N-Nitrosodi-n-butylamine	10 U	10 U	10 U
N-Nitrosodiethylamine	10 U	10 U	10 U
N-Nitrosomethylethylamine	10 U	10 U	10 U
N-Nitrosomorpholine	10 U	10 U	10 U
N-Nitrosopiperidine	10 U	10 U	10 U
N-Nitrosopyrrolidine	10 U	10 U	10 U

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS IN SURFACE WATER - ORGANICS - ECP PHASE II REPORT
SWMU 69 - AIRCRAFT PARKING AREA
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	2E-SW01	2E-SW01	2E-SW02
Sample ID	2E-SW01	2E-SW01D	2E-SW02
Sample Date	05/15/04	05/15/04	05/15/04
Sample Depth (ft bgs)			
Semivolatile Organic Compounds (ug/kg) (Cont.)			
5-Nitro-o-toluidine	10 U	10 U	10 U
Pentachlorobenzene	10 U	10 U	10 U
Pentachloronitrobenzene	10 U	10 U	10 U
Phenacetin	10 U	10 U	10 U
2-Picoline	10 U	10 U	10 U
Pronamide	10 U	10 U	10 U
Pyridine	50 U	50 U	50 U
Safrole	10 U	10 U	10 U
1,2,4,5-Tetrachlorobenzene	10 U	10 U	10 U
2,3,4,6-Tetrachlorophenol	10 U	10 U	10 U
2,4,5-Trichlorophenol	10 U	10 U	10 U
1,3,5-Trinitrobenzene	10 U	10 U	10 U
2-Acetylaminofluorene	10 U	10 U	10 U
Dinoseb	10 U	10 U	10 U
4-Chloroaniline	20 U	20 U	20 U
4-Chloro-3-methylphenol	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	1 J	10 U
Pentachlorophenol	50 U	50 U	50 U
Benzo(k)fluoranthene	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U
Diallate	10 U	10 U	10 U
Dibenzofuran	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U
Cresol, m & p	10 U	10 U	10 U
m-Dichlorobenzene	10 U	10 U	10 U
m-Dinitrobenzene	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U
Cresol (ortho)	10 U	10 U	10 U
o-Dichlorobenzene	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U
2-Nitrophenol	10 U	10 U	10 U
o-Toluidine	10 U	10 U	10 U
p-Dichlorobenzene	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U
1,4-Phenylenediamine	2,000 U	2,000 U	2,000 U
Total Petroleum Hydrocarbons (mg/kg)			
Diesel Range Organics	0.1 U	0.1 U	0.088 J
Gasoline Range Organics	0.05 U	0.05 U	0.011 J

APPENDIX C
DATA VALIDATION REPORT SUMMARIES

TEST AMERICA SAVANNAH SDG 36289-1

DataQual
Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36289-1, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36289-1. 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, 7471A, & 9060). 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	TOC
56SB01-00	680-36289-1	soil	X	X	X	
56SB01-01	680-36289-2	soil	X	X	X	
56SB01-04	680-36289-3	soil	X	X	X	
56SB02-00	680-36289-4	soil	X	X	X	
56SB02-02	680-36289-5	soil	X	X	X	
56SB02-04	680-36289-6	soil	X	X	X	
56SB04-00	680-36289-7	soil	X	X	X	
56SB04-03	680-36289-8	soil	X	X	X	
56SB04-04	680-36289-9	soil	X	X	X	
56SD03	680-36289-10	soil	X	X	X	X
56SD04	680-36289-11	soil	X	X	X	X
56SD04D	680-36289-12	soil	X	X	X	
56SD05	680-36289-13	soil	X	X	X	X
56SD04 MS	680-36289-11MS	soil	X	X	X	
56SD04 MSD	680-36289-11 MSD	soil	X	X	X	

The following quality control samples were provided with this SDG: sample 56SD04D-field duplicate of sample 56SD04.

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

Four of the soil samples contained 50-90% water that resulted in the qualification of the results as estimated.

Blank contamination was noted in the method and QC blanks associated with samples in this batch. Qualifications were added to the data.

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.

Due to low internal standard area recoveries qualifications were added to one sample, estimating results associated with the non-compliant standard. In one sample, extremely low internal standard area recoveries required the rejection of non-detect results and the qualification of positive results for those compounds associated with the non-compliant internal standards.

One sample, 56SD05, exhibited results for carbon disulfide that exceeded the calibration range; the result was qualified as estimated. The sample was re-analyzed at a dilution with limited sample volume; however results did not compare. The dilution was not used since no usable data was obtained from the analysis.

The field duplicate pair did not exhibit comparable results for one compound. This compound was qualified in the field duplicate pair.

SVOA

Four of the soil samples contained 50-90% water that resulted in the qualification of results as estimated.

The initial and continuing calibration exhibited some compounds with low RRF values, which resulted in the qualification of 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 the qualification of the data.

One sample exhibited non-compliant internal standards that resulted in qualification of the data.

The associated matrix spike and matrix spike duplicate exhibited 1% and 0% recoveries for two compounds; therefore the results for these compounds in the native sample 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.

The field duplicate pair did not exhibit comparable results for two compounds. These compounds were qualified in the field duplicate pair.

Metals

The four sediment 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 three analytes for which qualifications were required. Positive and non-detect results for barium and copper were flagged as estimated J/UJ in the samples. These analytes exhibited one recovery above and one below QC limits. Positive and non-detect results for zinc were flagged as estimated J/UJ. Please note that although the MS for zinc was acceptable, the MSD exhibited a recovery that was below 30%. Based on professional judgment, the validator did not reject zinc in the samples but it should be noted that a biased low matrix effect might be present.

The associated matrix duplicate exhibited non-compliant %Ds for four analytes. Positive and non-detect results for the analytes barium, copper, vanadium and zinc were qualified as estimated J in the samples.

The associated serial dilution exhibited a non-compliant %D for one analyte. Positive and non-detect results for the analyte zinc were qualified as estimated J in the samples.

The field duplicate pair of samples 56SD04 and 56SD04D exhibited non-compliant RPD for the analytes lead and vanadium >35% but less than 120%. Based on the Region II guidance, these analytes were qualified as estimated in both the sample and field duplicate.

TOC

The four sediment samples contained 50-90% water that resulted in the qualification of results as estimated.

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 sediment samples contained 50-90% water. All results in these samples were qualified as estimated J/UJ.

Sample ID	% Moisture	Qualifier
56SD03	51.8	J/UJ
56SD04	75.4	J/UJ
56SD04D	72.4	J/UJ
56SD05	82.8	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

<u>VOA</u>

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.

<table>
<tr><th>Standard ID</th><th>Compound(s)</th><th>RRF, %RSD, %D</th><th>Samples</th><th>Q Flag</th></tr>
<tr><td>IC 05/02/08</td><td>acrolein</td><td>0.0298</td><td>all samples</td><td>J/R</td></tr>
<tr><td rowspan="2">CC 05/02/08</td><td>acrolein
acetone</td><td>0.03179
0.04008</td><td rowspan="2">56SB01-01, 56SB01-04, 56SB02-00, 56SB02-04, 56SB04-00, 56SB04-03, 56SB04-04, 56SD03, 56SD04D, 56SD05</td><td>J/R</td></tr>
<tr><td>iodomethane
3-chloro-1-propene</td><td>30.2%
39.3%</td><td>J/UJ</td></tr>
<tr><td rowspan="2">CC 05/03/08</td><td>acrolein
acetone
3-chloro-1-propene</td><td>0.01628
0.03509
110.6%</td><td rowspan="2">56SB01-00, 56SB02-02, 56SD04</td><td>J/R</td></tr>
<tr><td>acetonitrile
acrylonitrile
2-chloro-1,3-butadiene
propionitrile
bromomethane
vinyl acetate</td><td>35.6%
32.0%
70.5%
25.3%
41.1%
22.2%</td><td>J/UJ</td></tr>
</table>

<u>SVOA</u>

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 05/09/08	4-nitroquinoline-1-oxide hexachlorophene	0.03268 0.02812	56SB01-01, 56SB01-04, 56SB02-00, 56SB02-02, 56SB04-00, 56SB04-03, 56SD03, 56SD04, 56SD04D	J/R
	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	29.3% 20.2% 23.5% 24.9% 25.5% 26.0% 24.2% 27.8% 40.6% 27.3% 22.3% 34.5% 40.2%		J/UJ
CC 05/12/08	n-nitrosopyrrolidine n-nitrosomorpholine n-nitrosopiperidine n-nitroso-di-n-butylamine hexachloropropene 2-naphthylamine methapyrilene 3,3-dimethylbenzidine aramite, total disulfoton 2,4-dinitrophenol 4,6-dinitro-2-methylphenol phenanthrene indeno(1,2,3-cd)pyrene	22.0% 22.6% 21.2% 29.5% 37.7% 24.5% 40.7% 51.9% 33.2% 20.3% 23.1% 30.7% 27.7% 21.5%	56SB01-00, 56SB02-04, 56SB04-04	J/UJ
	4-nitroquinoline-1-oxide hexachlorophene	0.03336 0.03592		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	2-butanone	4.4 ug/Kg	25 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
56SD04D, 56SD05	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
ER01	bis(2ethylhexyl)phthalate	1.6 ug/L	0 96 ug/L	2X RL
	di-n-butylphthalate	1.6	0.96	2X RL
ER02	bis(2ethylhexyl)phthalate	12 ug/L	0.97 ug/L	2X RL
	di-n-butylphthalate	1.3	0.97	2X RL
FB01	di-n-butylphthalate	1.2 ug/L	0.97 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56SB01-00, 56SB01-01, 56SB01-04, 56SB02-00, 5602-02, 56SB02-04, 56SB04-00, 56SB04-03, 56SB04-04, 56SD04, 56SD04D, 56SD05	bis(2ethylhexyl)phthalate	U at reported value
56SB04-03, 56SD05	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
CCB	antimony	0.09643J ug/L	>MDL up to RL	U

* 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
56SB01-04, 56SB02-00, 56SB04-04, 56SD03, 56SD04, 56SBD04D, 56SD05	antimony	U

Internal Standards

VOA

Sample 56SD03 exhibited low recovery for internal standard chlorobenzene-d5; therefore all the associated compounds were qualified as estimated (J/UJ).

Sample 56SD04 exhibited extremely low recovery for all internal standards; therefore all associated compound positive results were qualified as estimated (J) and non-detected results were qualified as rejected (R).

SVOA

Sample 56SD03 exhibited low recovery for internal standards perylene-d12 and chrysene-d12; therefore all the associated compounds were qualified as estimated (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
56SB02-04	2-fluorophenol phenol-d5	39% 39%	41-110% 43-110%	J/UJ acid fraction
56SB04-04	2-fluorophenol phenol-d5	35% 35%	41-110% 43-110%	J/UJ acid fraction
56SD03	2-fluorophenol phenol-d5	38% 38%	41-110% 43-110%	J/UJ acid fraction

Matrix Spike Recoveries

SVOA

A matrix spike and matrix spike duplicate was submitted for sample 56SD04. The MS exhibited 1% recovery and the MSD exhibited 0% for hexachlorocyclopentadiene and the MSD exhibited 9% recovery for 2,4-dinitrophenol. These compounds were qualified as estimated (J/UJ) in sample 56SD04.

Metals

The matrix spikes of sample 56SD04 exhibited non-compliant %Rs for analytes 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
56SD04	barium	all samples	126%/57%	J/UJ
	copper		153%/33%	
	zinc		11%	

Matrix Duplicates

Metals

The matrix duplicate of sample 56SD04 exhibited non-compliant %Ds for four analytes that required 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
56SD04	barium	all samples	23.6%	J/UJ
	copper		28.5%	
	vanadium		26.2%	
	zinc		23.0%	

Serial Dilutions

Metals

The serial dilution of sample 56SD04 exhibited a non-compliant %D 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.

SD	Analytes	Samples	%D	Q Flag
56SD04	zinc	all samples	11.6%	J/UJ

Field Duplicates

VOA

The field duplicate pair of samples 56SD04 and 56SD04D exhibited non-comparable results for acetone with 200% RPD. The results for acetone were qualified estimated (J/UJ).

SVOA

The field duplicate pair of samples 56SD04 and 56SD04D exhibited non-comparable results for benzo(b)fluoranthene with 200% RPD and benzo(k)fluoranthene with 200% RPD. The results for these compounds were qualified estimated (J/UJ).

Metals

The field duplicate pair of samples 56SD04 and 56SD04D exhibited non-comparable results for lead and vanadium based on Region II guidelines. The reported positive results for these analytes were qualified estimated J.

Identification/Quantitation

VOA

Sample 56SD05 exhibited results for carbon disulfide that exceeded the calibration range; the result was qualified as estimated. The sample was re-analyzed at a dilution with limit amount of sample volume; however results did not compare. The dilution was not used since no usable data was obtained from the analysis.

SVOA

The samples 56SB02-04RE, 56SB04-04RE, 56SD03RE, 56SD03RA and 56SD03RERA were re-extracted out of holding time due to non-compliant surrogate recoveries in the initial analysis. The re-extracted samples exhibited similar results. Therefore, the re-extracted samples were not used in favor 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

Laura Maschhoff
President

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
56SD03, 56SD04, 56SD04D, 56SD05	all results	+/-	J/UJ
all samples	acrolein	+/-	J/R
56SB01-01, 56SB01-04, 56SB02-00, 56SB02-04, 56SB04-00, 56SB04-03, 56SB04-04, 56SD03, 56SD04D, 56SD05	acrolein acetone	+/-	J/R
56SB01-01, 56SB01-04, 56SB02-00, 56SB02-04, 56SB04-00, 56SB04-03, 56SB04-04, 56SD03, 56SD04D, 56SD05	iodomethane 3-chloro-1-propene	+/-	J/UJ
56SB01-00, 56SB02-02, 56SD04	acrolein acetone 3-chloro-1-propene	+/-	J/R
56SB01-00, 56SB02-02, 56SD04	acetonitrile acrylonitrile 2-chloro-1,3-butadiene propionitrile bromomethane vinyl acetate	+/-	J/UJ
56SD04D, 56SD05	2-butanone	+	U at reported value
56SD03	all compounds associated with chlorobenzene-d5	+/-	J/UJ
56SD04	all results	+/-	J/R
56SD04 and 56SD04D	acetone	+/-	J/UJ
56SD05	carbon disulfide	+	J
56SD05DL	all results	+/-	R

SVOA

Sample ID	Compound	Results	Q flag
56SD03, 56SD04, 56SD04D, 56SD05	all results	+/-	J/UJ
all samples	hexachlorophene	+/-	J/R
56SB01-01, 56SB01-04, 56SB02-00, 56SB02-02, 56SB04-00, 56SB04-03, 56SD03, 56SD04, 56SD04D	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R

Summary of Data Qualifications, continued

SVOA

Sample ID	Compound	Results	Q flag
56SB01-01, 56SB01-04, 56SB02-00, 56SB02-02, 56SB04-00, 56SB04-03, 56SD03, 56SD04, 56SD04D	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
56SB01-00, 56SB02-04, 56SB04-04	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 phenanthrene indeno(1,2,3-cd)pyrene	+/-	J/UJ
56SB01-00, 56SB02-04, 56SB04-04	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
56SB01-00, 56SB01-01, 56SB01-04, 56SB02-00, 5602-02, 56SB02-04, 56SB04-00, 56SB04-03, 56SB04-04, 56SD04, 56SD04D, 56SD05	bis(2ethylhexyl)phthalate	+	U at reported value
56SB04-03, 56SD05	di-n-butylphthalate	+	U at reported value
56SD03	all compounds associated with: perylene-d12 chrysene-d12	+/-	J/UJ
56SB02-04, 56SB04-04, 56SD03	acid fraction compounds	+/-	J/UJ
56SD04	hexachlorocyclopentadiene 2,4-dinitrophenol	+/-	J/UJ
56SD04 and 56SD04D	benzo(b)fluoranthene benzo(k)fluoranthene	+/-	J/UJ
56SB02-04RE, 56SB04-04RE, 56SD03RE, 56SD03RA, 56SD03RERA	all results	+/-	R

Summary of Data Qualifications, continued

Metals

Sample ID	Analyte	Results	Q flag
56SD03, 56SD04, 56SD04D, 56SD05	all results	+/-	J/UJ
all samples	cadmium	+/-	J/UJ
56SB01-04, 56SB02-00, 56SB04-04, 56SD03, 56SD04, 56SBD04D, 56SD05	antimony	>MDL up to RL	U
all samples	barium copper zinc	+/-	J/UJ
all samples	barium copper vanadium zinc	+/-	J/UJ
all samples	zinc	+/-	J/UJ
56SD04, 56SD04D	lead vanadium	+	J

TOC

Sample ID	Parameter	Results	Q flag
56SD03, 56SD04, 56SD05	all results	+/-	J/UJ

 014 JAC 7808

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 36289-4

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36289-4, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36289-4. 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 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	LL-PAH	TMetals	DMetals
56TB01	680-36289-19	water	X			
56SW02	680-36289-14	water		X	X	X
56SW03	680-36289-15	water		X	X	X
56SW04	680-36289-16	water		X	X	X
56SW04D	680-36289-17	water		X	X	X
56SW05	680-36289-18	water		X	X	X

The following quality control samples were provided with this SDG: sample 56TB01-trip blank; sample 56SW04D-field duplicate of sample 56SW04.

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 *

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

- 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. 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 56TB01 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 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.

PAH

All samples were re-extracted out of extraction holding time due to non-compliant LCS recoveries. The re-extracted LCS 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 (from SDG SWMU36360-5) 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 all of the samples. Based on Region II validation guidelines the reported results for cobalt were rejected 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.

Sample Condition

VOA

All sample vials for sample 56TB01 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 04/29/08 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.

PAH

All samples in the data package were re-extracted out of extraction holding time due to non-compliant LCS recoveries. The re-extracted LCS exhibited compliant recoveries; therefore the re-extracted sample batch was used. All re-extracted samples 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	all samples	J/R
CC 05/02/08	2-chloro-1,3-butadiene methacrylonitrile isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane dichlorodifluoromethane	27.7% 20.4% 32.5% 23.2% 33.9% 24.2% 26.3%	56TB01	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 (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

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. (t & d in the following table refer to total and dissolved blank contamination concentrations)

Blank ID	Analyte	Concentration	Action Level	Q Flag
PBW	arsenic	0.8930J ug/L (d) 1.0655J ug/L (t)	>MDL up to RL	U
	chromium	0.9955J ug/L (d) 1.0350J ug/L (t)	>MDL up to RL	U
	cobalt	0.0663J ug/L	>MDL up to RL	U
	tin	2.8885J ug/L	>MDL up to RL	U
	vanadium	0.019J ug/L (d) 2.6115J ug/L (t)	>MDL up to RL	U
ICB/CCB	antimony	0.14370J ug/L (d)	>MDL up to RL	U
	cobalt	0.009J ug/L (t)	>MDL up to RL	U
	tin	0218J ug/L (t)	>MDL up to RL	U

* There were no field QC blanks assigned to these surface water samples. 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
56SW02F, 56SW03F	antimony	U
all samples	arsenic	U
all samples	chromium	U
56SW02, 56SW03, 56SW04, 56SW04D	cobalt	U
56SW02F, 56SW03F, 56SW04F	tin	U
56SW02F, 56SW03F, 56SW04, 56SW04F, 56SW04D, 56SW04DF, 56SW05F	vanadium	U

Matrix Spike Recoveries

Metals

The matrix spikes (from SDG SWMU36360-5) 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

PAH

The LCS associated with samples, 56SW02, 56SW03, 56SW04, 56SW04D and 56SW05, exhibited non-compliant recoveries. These samples were re-extracted; the re-extracted batch exhibited compliant recoveries for the LCS. Therefore, the initial analysis of these samples was not used in favor of the re-extraction.

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 all samples. Based on the guidelines (>20%RPD results are qualified, >50%RPD results are rejected) the positive results reported for cadmium were rejected in all samples. Please note that cobalt in these samples was significantly higher in the dissolved analysis. The cobalt results in almost all of the total samples (except 56SW05) were negated due to blank contamination. However, the cobalt concentrations in the dissolved samples were above the RL in all cases so they were not flagged due to the low concentration blank contamination. The RPDs between total and dissolved results were greater than 50% in all cases (51% up to 164%).

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
56TB01	all results	+/-	J/R
56TB01	isobutyl alcohol	+/-	J/R
56TB01	2-chloro-1,3-butadiene methacrylonitrile isobutyl alcohol methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane dichlorodifluoromethane	+/-	J/UJ

PAH

Sample ID	Compound	Results	Q flag
56SW0RE2, 56SW03RE, 56SW04RE, 56SW04DRE, 56SW05RE	all results	+/-	J/UJ
56SW02, 56SW03, 56SW04, 56SW04D, 56SW05	all results	+/-	R

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all samples	cadmium silver	+/-	J/UJ
56SW02F, 56SW03F	antimony	>MDL up to RL	U
all samples	arsenic	>MDL up to RL	U
all samples	chromium	>MDL up to RL	U
56SW02, 56SW03, 56SW04, 56SW04D	cobalt	>MDL up to RL	U
56SW02F, 56SW03F, 56SW04F	tin	>MDL up to RL	U
56SW02F, 56SW03F, 56SW04, 56SW04F, 56SW04D, 56SW04DF, 56SW05F	vanadium	>MDL up to RL	U
all total metals samples	mercury	+/-	J/UJ
all samples	cobalt	+ /-	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)

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 36360-6

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36360-6, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36360-6. 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
56SB03-00	680-36360-59	soil	X	X	X
56SB03-00D	680-36360-60	soil	X	X	X
56SB03-02	680-36360-61	soil	X	X	X
56SB03-04	680-36360-62	soil	X	X	X
56SB05-00	680-36360-63	soil	X	X	X
56SB05-03	680-36360-64	soil	X	X	X
56SB05-05	680-36360-65	soil	X	X	X
56SB06-00	680-36360-66	soil	X	X	X
56SB06-01	680-36360-67	soil	X	X	X
56SB06-01D	680-36360-68	soil	X	X	X
56SB06-03	680-36360-69	soil	X	X	X
56SB07-00	680-36360-75	soil	X	X	X
56SB07-02	680-36360-76	soil	X	X	X
56SB07-03	680-36360-77	soil	X	X	X
56SB05-03 MS	680-36360-64MS	soil	X	X	X
56SB05-03 MSD	680-36360-64MSD	soil	X	X	X
56SB06-03 MS	680-36360-69MS	soil	X	X	X
56SB06-03 MSD	680-36360-69MSD	soil	X	X	X

The following quality control samples were provided with this SDG: sample 56SB03-00D-field duplicate of sample 56SB03-00 and sample 56SB06-01D-field duplicate of sample 56SB06-01.

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

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 continuing calibration exhibited to high %D values that resulted in qualifying these compounds 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 field duplicate pair did not exhibit comparable results for one compound that resulted in qualifications.

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.

Several samples exhibited non-compliant surrogate recoveries that resulted in qualifications to the data.

One sample exhibited a non-compliant internal standard that resulted in qualifications to the associated compounds.

Metals

The ICSAB standard exhibited non-compliant recoveries below the QC limit for the analyte silver and cadmium. Based on Region II guidelines all positive and non-detect results for silver and 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 several analytes for which qualifications were required. Positive and non-detect results for antimony, zinc, and selenium were flagged as estimated J/UJ in the samples. Positive results for barium, cobalt and mercury were flagged as estimated J in the samples.

The associated matrix duplicate exhibited non-compliant RPDs for several analytes for which qualifications were required. Positive and non-detect results for vanadium, barium, chromium, copper, lead and zinc were flagged as estimated J/UJ in the samples.

The associated serial dilution exhibited a non-compliant %D for one analytes. Positive and non-detect results for the analyte nickel were qualified as estimated J/UJ in the samples.

The field duplicate pair of samples 56SB06-01 and 56SB06-01D exhibited non-compliant RPD >35% but less than 120% for the analytes barium, cobalt, copper and nickel and a absolute difference >2X the CRDL for the analyte mercury. These analytes were flagged as estimated in the field duplicate pair. The analytes chromium, lead and vanadium exhibited RPDs >120% and the analyte arsenic exhibited an absolute difference > 4X

CRDL. These analytes were rejected in the field duplicate pair. All qualifications were made based on the Region II guidance.

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 05/01-02/08. 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
CC 05/09/08	acrolein isobutyl alcohol acetone	0.04896 0.02421 0.04602	56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01	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 05/10/08	acrolein isobutyl alcohol	0.03757 0.02072	56SB05-00, 56SB06-01D, 56SB06-03, 56SB07-00, 56SB07-02, 56SB07-03	J/R
	3-chloro-1-propene acrylonitrile pentachloroethane	53.5% 22.0% 42.5%		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	56SB07-00, 56SB07-02, 56SB07-03	J/R
CC 05/15/08	4-nitroquinoline-1-oxide	0.02950	56SB07-00, 56SB07-02, 56SB07-03	J/R
	2,4-dinitrotoluene 2,4-dinitro-2-methylphenol n-nitrosomorpholine n-nitrosopiperidine hexachloropropene a,a-dimethylphenethylamine n-nitroso-di-n-butylamine 2-acetylaminofluorene aramite, total	24.2% 35.3% 23.2% 26.3% 43.5% 29.1% 28.1% 23.7% 24.9%		J/UJ
IC 05/28/08	4-nitroquinoline-1-oxide	0.0276	56SB06-00, 56SB06-01, 56SB06-01D, 56SB06-03, 56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03	J/R
CC 05/28/08	sulfotepp 4-nitroaniline 3,3-dichlorobenzidine	22.6% 31.1% 39.9%	56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03	J/UJ
CC 05/30/08	4-nitroquinoline-1-oxide hexachlorophene	0.02940 0.03491	56SB06-00, 56SB06-01, 56SB06-01D, 56SB06-03	J/R
	3,3'dimethylbenzidine 4-nitroaniline 4,6-dinitro-2-methylphenol 3,3'-dichlorobenzidine indeno(1,2,3-cd)pyrene benzo(g,h,i)perylene dinoseb	56.1% 34.5% 20.7% 27.1% 21.7% 21.6% 22.4%		J/UJ
CC 06/05/08	4-nitroquinoline-1-oxide hexachlorophene	0.02879 0.03294	56SB05-05	J/R
	3-nitroaniline 4-nitroaniline 3,3'-dichlorobenzidine benzo(g,h,i)perylene 3,3-dimethylbenzidine famphur	24.1% 36.9% 47.3% 24.7% 54.1% 24.3%		J/UJ

ICSA/ICSAB Standards

Metals

The associated ICSAB standards exhibited non-compliant recoveries less than the lower QC limit for the analytes 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

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	9.4J 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
56SB05-00, 56SB06-01D, 56SB06-03, 56SB07-03	acetone	U at reported value
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-01D, 56SB07-00, 56SB07-02, 56SB07-03	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 05/12	bis(2-ethylhexyl)phthalate	19J ug/Kg	33 ug/Kg	2X RL
Method Blk 05/13	bis(2-ethylhexyl)phthalate	18J ug/Kg	33 ug/Kg	2X RL
ER01	bis(2-ethylhexyl)phthalate	0.39J ug/L	0.96 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB07-00, 56SB07-02, 56SB07-03	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
PBS	arsenic	0.305J mg/Kg	>MDL up to RL	U
ICB	antimony	0.07970J ug/L	>MDL up to RL	U
CCB	beryllium	0.020J ug/L	>MDL up to RL	U
	silver	0.022J 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
56SB03-00, 56SB03-00D, 56SB03-04, 56SB05-00, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-03, 56SB07-00, 56SB07-02, 56SB07-03	antimony	U
56SB03-02	arsenic	U
56SB03-02	beryllium	U
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-01D 56SB06-03, 56SB07-00,	silver	U

Internal Standards

SVOA

Sample 56SB03-04 exhibited low internal standard area recoveries for perylene-d12; therefore all compounds associated with the standard were qualified as estimated (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
56SB03-00	2-fluorophenol phenol-d5 nitrobenzene-d5 2-fluorobiphenyl	38 41 33 40	41-110 43-110 36-110 44-110	J/UJ all
56SB03-00D	2-fluorophenol phenol-d5 nitrobenzene-d5 2-fluorobiphenyl	37 38 32 37	41-110 43-110 36-110 44-110	J/UJ all
56SB03-02	2-fluorophenol phenol-d5 nitrobenzene-d5 2-fluorobiphenyl 2,4,6-tribromophenol	26 27 19 24 27	41-110 43-110 36-110 44-110 36-128	J/UJ all
56SB03-04	2-fluorophenol phenol-d5 nitrobenzene-d5 2-fluorobiphenyl 2,4,6-tribromophenol	22 22 17 23 22	41-110 43-110 36-110 44-110 36-128	J/UJ all
56SB05-00	2-fluorophenol phenol-d5 nitrobenzene-d5 2-fluorobiphenyl	39 42 30 40	41-110 43-110 36-110 44-110	J/UJ all
56SB05-03	2-fluorophenol phenol-d5 nitrobenzene-d5 2-fluorobiphenyl	34 35 26 33	41-110 43-110 36-110 44-110	J/UJ all

008 7708 JAC

Sample ID	Non-compliant surrogate	% Rec	QC limits	Qualification
56SB05-05	2-fluorophenol	21	41-110	J/UJ all
	phenol-d5	24	43-110	
	nitrobenzene-d5	20	36-110	
	2-fluorobiphenyl	23	44-110	
	2,4,6-tribromophenol	31	36-128	
56SB06-00	2-fluorophenol	31	41-110	J/UJ all
	phenol-d5	30	43-110	
	nitrobenzene-d5	28	36-110	
	2-fluorobiphenyl	32	44-110	
	2,4,6-tribromophenol	30	36-128	
56SB06-01	2-fluorophenol	31	41-110	J/UJ all
	phenol-d5	31	43-110	
	nitrobenzene-d5	29	36-110	
	2-fluorobiphenyl	31	44-110	
	2,4,6-tribromophenol	34	36-128	
56SB06-01D	2-fluorophenol	25	41-110	J/UJ all
	phenol-d5	24	43-110	
	nitrobenzene-d5	23	36-110	
	2-fluorobiphenyl	26	44-110	
	2,4,6-tribromophenol	29	36-128	
56SB06-03	2-fluorophenol	24	41-110	J/UJ all
	phenol-d5	24	43-110	
	nitrobenzene-d5	22	36-110	
	2-fluorobiphenyl	25	44-110	
	2,4,6-tribromophenol	25	36-128	

Matrix Spike Recoveries

Metals

The matrix spikes of samples 56SB05-03 & 56SB06-03 exhibited non-compliant %Rs for analytes that required qualification in the field samples. A summary of these non-compliances and affected samples are noted in the following table. Please note that some of the recoveries were below 10% or above 200%. However, the validator did not reject the reported results for those analytes because not all of the recoveries for a particular analyte were below 10% or above 200%.

MS	Analytes	Samples	%R	Q Flag
56SB05-03	antimony	all samples	51%/47%	J/UJ
	zinc		50%/7%	
	barium		218%/221%	J+
56SB06-03	antimony	all samples	57%/49%	J/UJ
	selenium		73%/73%	
	barium		151%/72%	J+
	cobalt		128%/160%	
	mercury		241%/177%	

Matrix Duplicates

Metals

The matrix duplicate of samples 56SB05-03 & 56SB06-03 exhibited non-compliant %Ds for several analytes that required 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
56SB05-03	vanadium	all samples	28.9%	J/UJ
56SB06-03	barium	all samples	30.8%	J/UJ
	chromium		30.4%	
	copper		46.4%	
	lead		42.2%	
	vanadium		45.5%	
	zinc		21%	

Serial Dilutions

Metals

The serial dilution of sample 56SB05-03 exhibited a non-compliant %D for nickel 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
56SB05-03	nickel	all samples	21.1%	J/UJ

Field Duplicates

VOA

The field duplicate pair of samples 56SB06-01 and 56SB06-01D exhibited non-comparable results for acetone with 200% RPD. The results for acetone were qualified estimated (J/UJ).

SVOA

The field duplicate pair of samples 56SB03-00 and 56SB03-00D exhibited non-comparable results for benzo(a)pyrene with 139% RPD, benzo(b)fluoranthene with 131% RPD, chrysene with 170% RPD, fluoranthene with 1223% RPD, benzo(a)anthracene with 200% RPD, benzo(g,h,i)perylene with 200% RPD and perylene with 200% RPD. The results for these compounds were qualified estimated (J/UJ).

Metals

The field duplicate pair of samples 56SB06-01 and 56SB06-01D exhibited non-compliant RPD >35% but less than 120% for the analytes barium (43%,) cobalt (63%), copper (86%) and nickel (38%) and a absolute difference >2X the CRDL for the analyte mercury (0.053). These analytes were flagged as estimated J in the field duplicate pair. The analytes chromium (130%), lead (155%) and vanadium (168%) exhibited RPDs >120% and the analyte arsenic (4.04) exhibited an absolute difference > 4X CRDL. These analytes were rejected R in the field duplicate pair. All qualifications were made based on the Region II guidance.

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 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,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01	acrolein isobutyl alcohol acetone	+/-	J/R
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01	iodomethane 3-chloro-1-propene methacrylonitrile methyl methacrylate trans-1,4-dichloro-2-butene pentachloroethane	+/-	J/UJ
56SB05-00, 56SB06-01D, 56SB06-03, 56SB07-00, 56SB07-02, 56SB07-03	acrolein isobutyl alcohol	+/-	J/R
56SB05-00, 56SB06-01D, 56SB06-03, 56SB07-00, 56SB07-02, 56SB07-03	3-chloro-1-propene acrylonitrile pentachloroethane	+/-	J/UJ
56SB05-00, 56SB06-01D, 56SB06-03, 56SB07-03	acetone	+	U at reported value
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-01D, 56SB07-00, 56SB07-02, 56SB07-03	2-butanone	+	U at reported value
56SB06-01, 56SB06-01D	acetone	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
56SB07-00, 56SB07-02, 56SB07-03	hexachlorophene	+/-	J/R
56SB07-00, 56SB07-02, 56SB07-03	4-nitroquinoline-1-oxide	+/-	J/R
56SB07-00, 56SB07-02, 56SB07-03	2,4-dinitrotoluene 2,4-dinitro-2-methylphenol n-nitrosomorpholine n-nitrosopiperidine hexachloropropene a,a-dimethylphenethylamine n-nitroso-di-n-butylamine 2-acetylaminofluorene aramite, total	+/-	J/UJ
56SB06-00, 56SB06-01, 56SB06-01D, 56SB06-03, 56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03	4-nitroquinoline-1-oxide	+/-	J/R
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03	sulfotepp 4-nitroaniline 3,3-dichlorobenzidine	+/-	J/UJ

Summary of Data Qualifications, continued

SVOA, continued

Sample ID	Compound	Results	Q flag
56SB06-00, 56SB06-01, 56SB06-01D, 56SB06-03	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
56SB06-00, 56SB06-01, 56SB06-01D, 56SB06-03	3,3'dimethylbenzidine 4-nitroaniline 4,6-dinitro-2-methylphenol 3,3'-dichlorobenzidine indeno(1,2,3-cd)pyrene benzo(g,h,i)perylene dinoseb	+/-	J/UJ
56SB05-05	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
56SB05-05	3-nitroaniline 4-nitroaniline 3,3'-dichlorobenzidine benzo(g,h,i)perylene 3,3-dimethylbenzidine famphur	+/-	J/UJ
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB07-00, 56SB07-02, 56SB07-03	bis(2-ethylhexyl)phthalate	+/-	U at reported value
56SB03-04	all compounds associated with: perylene-d12	+/-	J/UJ
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-01D, 56SB06-03	all results	+/-	J/UJ all
56SB03-00, 56SB03-00D	benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, benzo(a)anthracene, benzo(g,h,i)perylene, perylene	+/-	J/UJ
all re-extracted samples	all results	+/-	R

Summary of Data Qualifications, continued

Metals

Sample ID	Analyte	Results	Q flag
all samples	cadmium silver	+/-	J/UJ
56SB03-00, 56SB03-00D, 56SB03-04, 56SB05-00, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-03, 56SB07-00, 56SB07-02, 56SB07-03	antimony	>MDL up to RL	U
56SB03-02	arsenic	>MDL up to RL	U
56SB03-02	beryllium	>MDL up to RL	U
56SB03-00, 56SB03-00D, 56SB03-02, 56SB03-04, 56SB05-00, 56SB05-03, 56SB05-05, 56SB06-00, 56SB06-01, 56SB06-01D 56SB06-03, 56SB07-00,	silver	>MDL up to RL	U
all samples	antimony zinc selenium	+/-	J/UJ
all samples	barium cobalt mercury	+	J
all samples	barium chromium copper lead vanadium zinc	+/-	J/UJ
all samples	nickel	+/-	J/UJ
56SB06-01, 56SB06-01D	mercury barium cobalt copper nickel	+	J
56SB06-01, 56SB06-01D	arsenic chromium lead 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)

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 36360-7

DataQual
Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 19, 2008
SDG# SWMU36360-7 Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36360-7. 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 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	LL PAH	TMetals	DMetals
56SW01	680-36360-70	water			X	X	X
56TB02	680-36360-71	water	X				
56GW01	680-36360-72	water	X	X		X	X
56GW02	680-36360-73	water	X	X		X	X
56GW04	680-36360-74	water	X	X		X	X

The following quality control samples were provided with this SDG: sample 56TB02-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

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

- 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. 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 56GW01 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 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.

SVOA

All samples were re-extracted due to non-compliant LCS recoveries. The re-extraction exceeded the extraction holding time and therefore was not used in favor of the initial analysis.

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.

The associated LCS did not exhibit compliant results that required one compound to be qualified as estimated.

PAH

No qualifications to the data were required 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 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 two of the samples. Based on Region II validation guidelines the reported results for cobalt were rejected 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.

Sample Condition

VOA

All sample vials for sample 56GW01 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 2-chloro-1,3-butadiene isobutyl alcohol trans-1,4-dichloro-2-butene pentachloroethane chloroethane trichlorofluoromethane acetone carbon disulfide	27.9% 51.6% 40.6% 39.1% 32.4% 21.8% 32.5% 21.3% 22.9%	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 05/13/08	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	23.5% 43.1% 23.2% 20.8% 32.6% 28.6% 21.6% 32.7% 45.6% 38.7%	56GW02	J/UJ
	4-nitroquinline-1-oxide hexachlorophene	0.03507 0.03126		J/R

Standard ID	Compound(s)	RRF, %RSD, %D	Samples	Q Flag
CC 05/14/08	4-nitrophenol	23.4%	56GW01, 56GW04	J/JU
	2,4-dinitrotoluene	21.9%		
	4,6-dinitro-2-methylphenol	42.7%		
	dibenzo(a,h)anthracene	23.8%		
	benzo(g,h,i)perylene	23.3%		
	n-nitrosomorpholine	24.0%		
	n-nitrosopiperidine	22.6%		
	hexachloropropene	32.5%		
	n-nitroso-di-n-butylamine	29.0%		
	methapyrilene	29.1%		
	aramite, total	33.3%		
	4-nitroquinline-1-oxide	0.03234		J/R
	hexachlorophene	0.04782		

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	0.24 ug/L	1 ug/L	2X RL
ER04	di-n-butylphthalate	0.32J ug/L	0.97 ug/L	2X RL
FB01	di-n-butylphthalate	1.2 ug/L	0.97 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56GW02, 56GW01, 56GW04	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
	tin	2.8885J ug/L	>MDL up to RL	U
	vanadium	2.5000J 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
ICB (all)	antimony	0.0797 ug/L	>MDL up to RL	U
CCB	cobalt	0.009Jug/L	>MDL up to RL	U
	tine	0.247J ug/L	>MDL up to RL	U
FB01	copper	2.1J ug/L	>MDL up to RL	U
	lead	0.38 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 dissolved samples, 56GW01, 56GW02, 56GW04	arsenic	U
all dissolved samples, 56GW01, 56GW02, 56GW04	chromium	U
56GW02, 56GW02F	tin	U
56SW01F	vanadium	U
56SW01F, 56GW02F	antimony	U
56GW01, 56GW02	cobalt	U
56SW01F, 56GW02F, 56GW02, 56GW04	copper	U
56SW01F, 56GW02	lead	U

Matrix Spike Recoveries

Metals

The matrix spikes of sample 69GW11 (from SDG SWMU36360-5) 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 samples	72.7%/ 74.4%	J/UJ

LCS

SVOA

The LCS associated with the samples exhibited low recovery for hexachlorocyclopentadiene at 7%. The results for this compound were qualified as estimated (J/UJ) in all the samples.

Identification/Quantitation

SVOA

All samples were re-extracted due to non-compliant LCS recoveries. The re-extraction exceeded the extraction holding time and therefore was not used in favor of the initial analysis.

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 all samples. Based on the guidelines (>20%RPD results are qualified, >50%RPD results are rejected) the positive results reported for cadmium were rejected in samples 56GW01, 56GW01F, 56GW02, and 56GW02F. Please note that cobalt in these samples was significantly higher in the dissolved analysis. The RPDs between total and dissolved results were greater than 50% in all cases (148% and 117%).

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
56GW01	all results	+/-	J/R
all samples	isobutyl alcohol	+/-	J/R
all samples	acetonitrile 2-chloro-1,3-butadiene isobutyl alcohol trans-1,4-dichloro-2-butene pentachloroethane chloroethane trichlorofluoromethane acetone carbon disulfide	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
all samples	hexachlorophene	+/-	J/R
56GW02	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
56GW02	4-nitroquinline-1-oxide hexachlorophene	+/-	J/R
56GW01, 56GW04	4-nitrophenol 2,4-dinitrotoluene 4,6-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/JU
56GW01, 56GW04	4-nitroquinline-1-oxide hexachlorophene	+/-	J/R
56GW02, 56GW01, 56GW04	di-n-butylphthalate	+	U at reported value
all samples	hexachlorocyclopentadiene	+/-	J/UJ
56GW01RE, 56GW02RE, 56GW04RE	all results	+/-	R

Summary of Data Qualifications, continued

PAH

Sample ID	Compound	Results	Q flag
No qualifications required.			

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all samples	cadmium silver	+/-	J/UJ
all dissolved samples, 56GW01, 56GW02, 56GW04	arsenic	>MDL up to RL	U
all dissolved samples, 56GW01, 56GW02, 56GW04	chromium	>MDL up to RL	U
56GW02, 56GW02F	tin	>MDL up to RL	U
56SW01F	vanadium	>MDL up to RL	U
56SW01F, 56GW02F	antimony	>MDL up to RL	U
56GW01, 56GW02	cobalt	>MDL up to RL	U
56SW01F, 56GW02F, 56GW02, 56GW04	copper	>MDL up to RL	U
56SW01F, 56GW02	lead	>MDL up to RL	U
all total metals samples	mercury	+/-	J/UJ
56GW01, 56GW01F, 56GW02, 56GW02F	cobalt	+	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)

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 36419-1

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36419-1, Test America-Savannah
NAPR SWMU 56, 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 36419-1. 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
56GW03	680-36419-1	water	X	X	X	X
56GW03D	680-36419-2	water	X	X	X	X
56GW05	680-36419-3	water	X	X	X	X
56TB03	680-36419-4	water	X			
56GW03 MS	680-36419-1MS	water	X	X	X	X
56GW03 MSD	680-36419-1MSD	water	X	X	X	X

The following quality control samples were provided with this SDG: Sample 56GW03D was the field duplicate of sample 56GW03; Sample 56TB03- 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. 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 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 some compounds were qualified as estimated.

The submitted field duplicate pair did not exhibit comparable result for one compound, qualifications were added to the data.

SVOA

All samples were re-extracted out of extraction holding time 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.

The 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 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.

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 05/1-2/08 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

All samples in the data package were re-extracted out of extraction holding time, by one day, 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. All re-extracted samples were qualified as estimated (J/UJ).

Sample Condition

VOA, SVOA, and 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
IC 05/07/08	isobutyl alcohol	0.0489	56GW03, 56GW03D, 56GW05	J/R
CC 05/09/08	pentachloroethane vinyl acetate	67.6% 28.9%	56GW03, 56GW03D, 56GW05	J/UJ
CC 05/12/08	acrolein	0.03356	56TB03	J/R
	acrylonitrile pentachloroethane bromomethane cis-1,3-dichloropropene trans-1,3-dichloropropene	39.0% 77.6% 25.9% 24.5% 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
CC 05/29/08	4-nitroquinoline-1-oxide hexachlorophene	0.02872 0.04644	all samples	J/R
	2-naphthylamine 3,3-dimethylbenzidine	41.0% 46.5%		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	2.2 ug/L	1 ug/L	2X RL
	bis(2-ethylhexyl)phthalate	0.18J ug/L	1 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56GW05RE	bis(2-ethylhexyl)phthalate	U at reported value
56GW03RE, 56GW03DRE, 56GW05RE	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
CCB (total)	lead	0.031J 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
56GW03, 56GW03D	tin	U
56GW03	lead	U
56GW03, 56GW03F, 56GW03D, 56GW03DF	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

Field Duplicate

VOA

The field duplicate pair of samples 56GW03 and 56GW03D exhibited non-comparable results for chloromethane with 200% RPD. The results for chloromethane were qualified estimated (J/UJ).

Identification/Quantitation

SVOA

The LCS and MS/MSD associated with samples, 56GW03, 56GW03D, 56GW05, 56GW03MS and 56GW03MSD, 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.

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 56GW03 and 56GW05. 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 56GW03 and 56GW03F due to an RPD of 40%.

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
56GW03, 56GW03D, 56GW05	isobutyl alcohol	+/-	J/R
56GW03, 56GW03D, 56GW05	pentachloroethane vinyl acetate	+/-	J/UJ
56TB03	acrolein	+/-	J/R
56TB03	acrylonitrile pentachloroethane bromomethane cis-1,3-dichloropropene trans-1,3-dichloropropene	+/-	J/UJ
56GW03, 56GW03D	chloromethane	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
all samples	all results	+/-	J/UJ
all samples	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
all samples	2-naphthylamine 3,3-dimethylbenzidine	+/-	J/UJ
56GW05RE	bis(2-ethylhexyl)phthalate	+	U at reported value
56GW03RE, 56GW03DRE, 56GW05RE	di-n-butylphthalate	+	U at reported value
56GW03, 56GW03D, 56GW05, 56GW03MS, 56GW03MSD	all results	+/-	R

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all samples	all analytes	+/-	J/UJ
all total metals samples	cadmium silver	+/-	J/UJ
56GW03, 56GW03D	tin	>MDL up to RL	U
56GW03	lead	>MDL up to RL	U
56GW03, 56GW03F, 56GW03D, 56GW03DF	copper	>MDL up to RL	U
all dissolved metals samples	cobalt	+/-	J/UJ
56GW03, 56GW03F	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 *

• 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 hexachlorocyclo-pentadiene 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 36426-5

DataQual
Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36426-5, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36426-5. 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, 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
56GW06	680-36426-81	water	X	X	X	X
56GW07	680-36426-82	water	X	X	X	X
56TB04	680-36426-86	water	X			

The following quality control samples were provided with this SDG: sample 56TB04-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 *

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

- 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 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 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 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.

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 required for the SVOA fraction due to a missing Form V and information listing the temperatures of the sample coolers upon receipt at the laboratory. The information was requested and provided by the laboratory. 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 05/3-5/08 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

<u>VOA</u>

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
	acrylonitrile pentachloroethane dichlorodifluoromethane bromomethane vinyl acetate	53.5% 76.0% 20.3% 39.5% 28.0%		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 05149/08	4-nitroquinoline-1-oxide hexachlorophene	0.03234 0.04782	all samples	J/R
	4-nitrophenol 2,4-dinitrotoluene 4,6-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	bis(2ethylhexyl)phthalate	0.73J ug/L	1 ug/L	2X RL
	di-n-butylphthalate	0.19J	1	2X RL
FB01	di-n-butylphthalate	1.2 ug/L	0.97 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56GW06, 56GW07	bis(2ethylhexyl)phthalate	U at reported value
56GW06, 56GW07	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	cobalt	0.0492J ug/L	>MDL up to RL	U
CCB dissolved	cobalt	0.0472J ug/L	>MDL up to RL	U
FB01	copper	2.1J ug/L	>MDL up to RL	U
ER06	arsenic	0.28J ug/L	>MDL up to RL	U
	vanadium	1.2J 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
56GW06, 56GW06F	cobalt	U
56GW06	copper	U
56GW06, 56GW07, 56GW07F	arsenic	U
56GW06F, 56GW07, 56GW07F	vanadium	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

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 sample 56GW07. 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 56GW07 and 56GW07F due to an RPD of 24%.

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	acrylonitrile pentachloroethane dichlorodifluoromethane bromomethane vinyl acetate	+/-	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 4,6-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
56GW06, 56GW07	bis(2ethylhexyl)phthalate	+	U at reported value
56GW06, 56GW07	di-n-butylphthalate	+	U at reported value

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all total metals samples	cadmium silver	+/-	J/UJ
56GW06, 56GW06F	cobalt	>MDL up to RL	U
56GW06	copper	>MDL up to RL	U
56GW06, 56GW07, 56GW07F	arsenic	>MDL up to RL	U
56GW06F, 56GW07, 56GW07F	vanadium	>MDL up to RL	U
all dissolved metals samples	cobalt	+/-	J/UJ
56GW07, 56GW07F	cobalt	+	J

JLC 062308

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 36426-6

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36426-6, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36426-6. 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
56SB08-00	680-36426-83	soil	X	X	X
56SB08-01	680-36426-84	soil	X	X	X
56SB08-02	680-36426-85	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

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

- 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 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 QC blank associated with samples in this batch. Qualifications were added to the data.

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.

Two of the samples exhibited low surrogate recoveries that required qualification to the data.

Metals

Blank contamination was noted and qualification was required in the samples in this SDG.

The associated matrix spikes exhibited a non-compliant %Rs for antimony for which qualifications were required. Positive and non-detect results for antimony were flagged as estimated J/UJ in the samples.

The associated matrix duplicate exhibited non-compliant RPDs for one analyte for which qualifications were required. Positive and non-detect results for cobalt 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 05/3-5/08 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
IC 05/12/08	acetonitrile	0.0356	all samples	J/R
CC 05/14/08	acetonitrile isobutyl alcohol	102.1% 0.02361	56SB08-01, 56SB08-02	J/R
	methacrylonitrile pentachloroethane	32.0% 40.6%		J/UJ
CC 05/14/08	acrolein isobutyl alcohol	0.04653 0.02484	56SB08-00	J/R
	acetonitrile 2-chloro-1,3-butadiene methacrylonitrile pentachloroethane	88.7% 24.0% 26 6% 31.8%		J/UJ

003 JAC 7708

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 05/288	4-nitroquinoline-1-oxide	0.0276	all samples	J/R
CC 05/308	4-nitroquinoline-1-oxide hexachlorophene	0.02940 0.03491	all samples	J/R
	4-nitroaniline 2,4-dinitro-2-methylphenol 3,3'-dichlorobenzidine indeno(1,2,3-de)pyrene benzo(g,h,i) perylene dinoseb 3,3-dimethylbenzidine	34.5% 20.7% 27.1% 21.7% 21.6% 22.4% 56.1%		J/UJ

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
FB01	2-butanone	0.69/L	10ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56SB08-00, 56SB08-02	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-ethlhexyl)phthalate	23J ug/Kg	33 ug/Kg	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56SB08-00, 56SB08-01, 56SB08-02	bis(2-ethlhexyl)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	0.08181J ug/L	>MDL up to RL	U
	silver	0.093J ug/L	>MDL up to RL	U
	beryllium	0.052J ug/L	>MDL up to RL	U
	cadmium	0.057J ug/L	>MDL up to RL	U
ER07	copper	5.2 ug/L – 5.2 mg/Kg	> blank level & up to 10X blank level	J
FB01	lead	0.38 ug/L -- 0.38 mg/Kg	> blank level & up to 10X blank level	J

* 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
56SB08-00	antimony	U
56SB08-00, 56SB08-01, 56SB08-02	silver	U
56SB08-01	beryllium	U
56SB08-01, 56SB08-02	cadmium	U
56SB08-01	copper	J
56SB08-01	lead	J

SVOA

The following samples exhibited non-compliant surrogate recoveries and were qualified as indicated.

Sample ID	Non-compliant surrogate	% Rec	QC limits	Qualification
56SB08-01	2-fluorophenol	40	41-110	J/UJ acid
	phenol-d5	40	43-110	
	2-fluorobiphenyl	40	44-110	
56SB08-02	2-fluorophenol	32	41-110	J/UJ all
	phenol-d5	32	43-110	
	nitrobenzene-d5	31	36-110	
	2-fluorobiphenyl	35	44-110	

Matrix Spike Recoveries

Metals

The matrix spikes of sample 56SB08-02 exhibited non-compliant %Rs for one analyte that required qualification in the field samples. A summary of this non-compliance and affected samples is noted in the following table.

MS	Analytes	Samples	%R	Q Flag
56SB08-02	antimony	all samples	47%/49%	J/UJ

Matrix Duplicates

Metals

The matrix duplicate of sample 56SB08-02 exhibited a non-compliant %D for one analyte that required qualification in the field samples. A summary of this non-compliance and affected samples are noted in the following table.

MD	Analytes	Samples	RPD	Q Flag
56SB08-02	cobalt	all samples	58.6%	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 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,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
all samples	acetonitrile	+/-	J/R
56SB08-01, 5SB08-02	acetonitrile isobutyl alcohol	+/-	J/R
56SB08-01, 5SB08-02	methacrylonitrile pentachloroethane	+/-	J/UJ
56SB08-00	acrolein isobutyl alcohol	+/-	J/R
56SB08-00	acetonitrile 2-chloro-1,3-butadiene methacrylonitrile pentachloroethane	+/-	J/UJ
56SB08-00, 56SB08-02	2-butanone	+	U at reported value

SVOA

Sample ID	Compound	Results	Q flag
all samples	4-nitroquinoline-1-oxide	+/-	J/R
all samples	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
all samples	4-nitroaniline 2,4-dinitro-2-methylphenol 3,3'-dichlorobenzidine indeno(1,2,3-de)pyrene benzo(g,h,i) perylene dinoseb 3,3-dimethylbenzidine	+/-	J/UJ
56SB08-00, 56SB08-01, 56SB08-02	bis(2-ethlhexyl)phthalate	+	U at reported value
56SB08-01	all acid fraction compounds	+/-	J/UJ
56SB08-02	all results	+/-	J/UJ
all re-extracted samples	all results	+/-	J/R

Summary of Data Qualifications, continued

Metals

Sample ID	Analyte	Results	Q flag
56SB08-00	antimony	>MDL up to RL	U
56SB08-00, 56SB08-01, 56SB08-02	silver	>MDL up to RL	U
56SB08-01	beryllium	>MDL up to RL	U
56SB08-01, 56SB08-02	cadmium	>MDL up to RL	U
56SB08-01	copper	> blank level & up to 10X blank level	J
all samples	antimony	+/-	J/UJ
all samples	cobalt	+	J

009 JAC 7808

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 36517-3

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

July 16, 2008
SDG# SWMU36517-3, Test America-Savannah
NAPR SWMU74, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36517-3. 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, 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	LL PAH	DRO/GRO	GRO	TMetals	DMetals
74GW57	680-36517-11	water	X		X		X	X
74GW09	680-36517-12	water		X	X		X	X
74GW26	680-36517-14	water			X		X	
74TB11	680-36517-40	water	X			X		
74TB12	680-36517-41	water	X			X		

The following quality control samples were provided with this SDG: samples 74TB11, and 74TB12-trip blanks.

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

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

• Internal Standards	*
• Surrogate Recoveries	*
• 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. 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

The 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 some compounds were qualified as estimated.

PAH

No qualifications to the data were required.

DRO/GRO

No qualifications to the data were required.

Metals

The ICSAB standards exhibited non-compliant recoveries above the QC limit for the analyte zinc. Based on Region II guidelines all positive results for zinc in the samples were qualified as estimated J.

Blank contamination was noted and qualification was required in the samples in this SDG.

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 DRO and GRO fractions. A copy of the e-mail correspondence is included in the project file.

Technical Holding Times

According to chain of custody records, sampling was performed on 05/06-07/08 and samples were received at the laboratory 05/08/08. 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 05/14/08	acrolein	0.02622	74TB12	J/R
	iodomethane acrylonitrile pentachloroethane bromomethane chloroethane trichlorofluoromethane cis-1,3-dichloropropene	30.8% 56.3% 87.6% 20.4% 31.5% 22.3% 20.8%		J/UJ
CC 05/13/08	acrolein	0.02624	74GW57, 74TB11	J/R
	acrylonitrile pentachloroethane dichlorodifluoromethane bromomethane vinyl acetate cis-1,3-dichloropropene trans-1,3-dichloropropene	53.5% 76.0% 20.3% 39.5% 28.0% 23.7% 20.9%		J/UJ

ICSA/ICSAB Standards

Metals

The ICSAB standards associated with the metals analysis exhibited non-compliant recoveries above the upper QC limit for the analyte zinc (132%/129%). Based on Region II guidelines, reported positive results for zinc were qualified as estimated J in all samples.

Blanks

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	arsenic	0.3886J ug/L	>MDL up to RL	U
	copper	3.8175J ug/L	>MDL up to RL	U
	tin	1.0950J ug/L	>MDL up to RL	U
	vanadium	0.8615J ug/L	>MDL up to RL	U
PBW1 – dissolved	copper	1.3010J ug/L	>MDL up to RL	U
ICB	antimony	0.07684J ug/L	>MDL up to RL	U
CCB (total)	beryllium	0.024J ug/L	>MDL up to RL	U
	silver	0.021J ug/L	>MDL up to RL	U
FB01	lead	0.38J ug/L	>MDL up to RL	U

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag
all samples >MDL up to RL	antimony	U
all total samples >MDL up to RL	arsenic	U
74GW26, 74GW09F	copper	U
all total samples >MDL up to RL & 74GW34F	tin	U
74GW34, 74GW26	vanadium	U
74GW57	beryllium	U
74GW57	silver	U
74GW09, 74GW34	lead	U

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
74TB12	acrolein	+/-	J/R
74TB12	iodomethane acrylonitrile pentachloroethane bromomethane chloroethane trichlorofluoromethane cis-1,3-dichloropropene	+/-	J/UJ
74GW57, 74TB11	acrolein	+/-	J/R
74GW57, 74TB11	acrylonitrile pentachloroethane dichlorodifluoromethane bromomethane vinyl acetate cis-1,3-dichloropropene trans-1,3-dichloropropene	+/-	J/UJ

PAH

Sample ID	Compound	Results	Q flag
No qualifications required.			

DRO/GRO

Sample ID	Compound	Results	Q flag
No qualifications required			

Metals

Sample ID	Analyte	Results	Q flag
all samples	zinc	+	J
all samples >MDL up to RL	antimony	+ >MDL up to RL	U
all total samples >MDL up to RL	arsenic	+ >MDL up to RL	U
74GW26, 74GW09F	copper	+ >MDL up to RL	U
all total samples >MDL up to RL & 74GW34F	tin	+ >MDL up to RL	U
74GW34, 74GW26	vanadium	+ >MDL up to RL	U
74GW57	beryllium	+ >MDL up to RL	U
74GW57	silver	+ >MDL up to RL	U
74GW09, 74GW34	lead	+ >MDL up to RL	U

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 36517-4

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

June 23, 2008
SDG# SWMU36517-4, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU36517-4. 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 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	DMetals	TMetals
56GW08	680-36517-42	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.

Two of the samples exhibited low surrogate recoveries that required qualification to the data.

One compound was flagged due to low LCS recoveries.

Metals

The ICSAB standards exhibited non-compliant recoveries above the QC limit for the analyte zinc. Based on Region II guidelines all positive results for zinc in the samples were qualified as estimated J.

Blank contamination was noted and qualification was required in the samples in this SDG.

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 05/07/08 and samples were received at the laboratory 05/08/08. 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	56GW08	J/R
	acrylonitrile pentachloroethane dichlorodifluoromethane bromomethane vinyl acetate trans-1,3-dichloropropene	53.5% 76.0% 20.3% 39.5% 28.0% 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	56GW08	J/R
CC 06/05/08	4-nitroquinoline-1-oxide hexachlorophene	0.028979 0.03294	56GW08	J/R
	3,3-dimethylbenzidine 3-nitroaniline 4-nitroaniline 3,3'-dichlorobenzidine benzo(g,h,i) perylene famphur	54.1% 24.1% 36.9% 47.3% 24.7% 24.3%		J/UJ

ICSA/ICSAB Standards

Metals

The ICSAB standards associated with the analysis exhibited non-compliant recoveries above than the upper QC limit for the analyte zinc (132% & 129%). Based on Region II guidelines, reported positive results for zinc were qualified as estimated J in all 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
FB01	di-n-butylphthalate	1.2 ug/L	0.97 ug/L	2X RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Compound	Q Flag
56GW08	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	arsenic	0.3886J ug/L	>MDL up to RL	U
PBW2 – dissolved	copper	1.3010J ug/L	>MDL up to RL	U
FB01	lead	0.38 ug/L	>MDL up to RL	U
ER10	arsenic	0.35J 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
56GW08, 56GW08F	arsenic	U
56GW08F	copper	U
56GW08	lead	U

SVOA

The following samples exhibited non-compliant surrogate recoveries and were qualified as indicated.

Sample ID	Non-compliant surrogate	% Rec	QC limits	Qualification
56SB08-01	2-fluorophenol	40	41-110	J/UJ acid
	phenol-d5	40	43-110	
	2-fluorobiphenyl	40	44-110	
56SB08-02	2-fluorophenol	32	41-110	J/UJ all
	phenol-d5	32	43-110	
	nitrobenzene-d5	31	36-110	
	2-fluorobiphenyl	35	44-110	

LCS

SVOA

The associated LCS exhibited low recovery for 3,3-dichlorobenzidine at 1%. The LCS and associated sample was re-extracted; however, the extraction holding time was grossly exceeded and therefore not used. Therefore, compound 3,3-dichlorobenzidine was qualified as estimated (J/UJ) in sample 56GW08.

Identification/Quantitation

SVOA

Sample 56GW08 was re-extracted out of holding time due to non-compliant LCS recoveries. The re-extracted sample was not used due to 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,

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
56GW08	acrolein	+/-	J/R
56GW08	acrylonitrile pentachloroethane dichlorodifluoromethane bromomethane vinyl acetate trans-1,3-dichloropropene	+/-	J/UJ

SVOA

Sample ID	Compound	Results	Q flag
56GW08	4-nitroquinoline-1-oxide	+/-	J/R
56GW08	4-nitroquinoline-1-oxide hexachlorophene	+/-	J/R
56GW08	3,3-dimethylbenzidine 3-nitroaniline 4-nitroaniline 3,3'-dichlorobenzidine benzo(g,h,i) perylene famphur	+/-	J/UJ
56GW08	di-n-butylphthalate	+	U at reported value
56GW08	3,3-dichlorobenzidine	+/-	J/UJ
56GW08RE	all results	+/-	R

Total & Dissolved Metals

Sample ID	Analyte	Results	Q flag
all samples	zinc	+	J
56GW08, 56GW08F	arsenic	>MDL up to RL	U
56GW08F	copper	>MDL up to RL	U
56GW08	lead	>MDL up to RL	U

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 36517-5

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

July 30, 2008
SDG# SWMU36517-5, 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 # SWMU36517-5. 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 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	DRO/GRO	Metals
ER06	680-36517-43	water	X	X	X
ER07	680-36517-44	water	X	X	X
ER08	680-36517-45	water	X	X	X
ER09	680-36517-46	water	X	X	X
ER10	680-36517-47	water	X	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 *
- 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.

DRO/GRO

No qualification of the data was required.

Metals

The associated ICSA/ICSAB standards exhibited non-compliant recoveries for the analyte zinc. Positive results for this analyte 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 05/03-07/08 and samples were received at the laboratory 05/08/08. 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 05/14/08	acrolein	0.02622	ER06, ER07	J/R
	iodomethane acrylonitrile pentachloroethane bromomethane chloromethane trichlorofluoromethane cis-1,3-dichloropropene	30.8% 56.3% 87.6% 20.4% 31.5% 22.3% 20.8%		J/UJ
CC 05/16/08	acrolein	128.9%	ER08, ER09, ER10	J/R
	iodomethane acetonitrile 3-chloro-1-propene acrylonitrile 2-chloro-1,3-butadiene pentachloroethane bromomethane chloroethane cis-1,3-dichloropropene trans-1,3-dichloropropene	59.2% 33.6% 23.7% 30.0% 22.5% 79.8% 23.3% 37.1% 22.0% 20.4%		J/UJ

ICSA/ICSAB Standards

Metals

The ICSAB standards associated with the metals analysis exhibited non-compliant recoveries above the upper QC limit for the analyte zinc (132%/129%). Based on Region II guidelines, reported positive results for zinc were qualified as estimated J in all samples.

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
ER06, ER07	acrolein	+/-	J/R
ER06, ER07	iodomethane acrylonitrile pentachloroethane bromomethane chloromethane trichlorofluoromethane cis-1,3-dichloropropene	+/-	J/UJ
ER08, ER09, ER10	acrolein	+/-	J/R
ER08, ER09, ER10	iodomethane acetonitrile 3-chloro-1-propene acrylonitrile 2-chloro-1,3-butadiene pentachloroethane bromomethane chloroethane cis-1,3-dichloropropene trans-1,3-dichloropropene	+/-	J/UJ

DRO/GRO

Sample ID	Compound	Results	Q flag
No qualifications were required			

Metals

Sample ID	Analyte	Results	Q flag
all samples	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)

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 40743-1

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

November 17, 2008
SDG# SWMU40743-1, Test America-Savannah
NAPR SWMU56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU40743-1. 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 method in this SDG (SW-846 method 6020B) 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	Metals
56SS01	680-40743-1	soil	X
56SS02	680-40743-2	soil	X
56SS03	680-40743-3	soil	X
56SS04	680-40743-4	soil	X
56SS05	680-40743-5	soil	X
56SS06	680-40743-6	soil	X
56SS07	680-40743-14	soil	X
56SS08	680-40743-15	soil	X
56SS09	680-40743-16	soil	X
56SS10	680-40743-18	soil	X
56SS11	680-40743-19	soil	X
56SS11D	680-40743-20	soil	X
56SS12	680-40743-21	soil	X
56SS09MS	680-40743-16MS	soil	X
56SS09MSD	680-40743-16MSD	soil	X

The following quality control samples were provided with this SDG: sample 56SS11D-field duplicate of sample 56SS11.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *

- CRDL Standards *
- Blanks *
- 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

The field duplicate pair exhibited a non-compliant RPD for one analyte. This analyte was qualified as estimated J in both the field sample and duplicate.

Specific Evaluation of Data

Data Completeness

The data package was received complete and intact.

Technical Holding Times

According to chain of custody records, sampling was performed on 9/24/08 and samples were received at the laboratory 9/25/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Field Duplicates

Metals

The field duplicate pair of samples 56SS11 and 56SS11D exhibited an RPD greater than 35% but less than 120% for the analyte vanadium (38%). Therefore, vanadium was qualified as estimated J based on Region II guidelines in both samples.

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

Sample ID	Analyte	Results	Q flag
56SS11, 56SS11D	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 40837

DataQual

Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

December 10, 2008
SDG# SWMU40837, Test America-Savannah
NAPR SWMU56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # SWMU40837. 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 method in this SDG (SW-846 method 6020B) 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	Metals
56SD06	680-40837-1	soil	X
56SD07	680-40837-2	soil	X
56SD08	680-40837-3	soil	X
56SD09	680-40837-4	soil	X
56SD11	680-40837-5	soil	X
56SD12	680-40837-6	soil	X
56SD13	680-40837-7	soil	X
56SD14	680-40837-8	soil	X
56SD14D	680-40837-9	soil	X
56SD14MS	680-40837-8MS	soil	X
56SD14MSD	680-40837-8MSD	soil	X

The following quality control samples were provided with this SDG: sample 56SD14D-field duplicate of sample 56SD14.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- Initial/Continuing Calibrations *
- ICSA/ICSAB Standards *
- CRDL Standards *
- Blanks
- 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

Blank contamination was noted in the calibration blanks associated with the samples. Qualifications were added to the data.

The field duplicate pair exhibited a non-compliant RPD for one analyte. This analyte was qualified as estimated J in both the field sample and duplicate.

Several field samples in this SDG exhibited moisture levels greater than 50%. All reported positive and non-detect results for metals in these samples were qualified as estimated J/UJ in the samples.

Specific Evaluation of Data

Data Completeness

The data package was received complete and intact.

Technical Holding Times

According to chain of custody records, sampling was performed on 9/25/08 and samples were received at the laboratory 9/27/08. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Blanks

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
ICB	silver	0.021J ug/L	RL	U
	beryllium	0.018J ug/L		
CCB	antimony	0.093J ug/L	RL	U
ICB	mercury	0.13J ug/L	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 sample results >MDL but less than RL	silver	U
all sample results >MDL but less than RL	beryllium	U
all sample results >MDL but less than RL	antimony	U
all sample results >MDL but less than RL	mercury	U

Field Duplicates

Metals

The field duplicate pair of samples 56SD14 and 56SD14D exhibited an RPD greater than 35% but less than 120% for the analyte lead (45%). Therefore, lead was qualified as estimated J based on Region II guidelines in both samples.

Identification/Quantitation

Metals

Samples 56SD08, 56SD09, 56SD11, 56SD12, 56SD13, 56SD14 and 56SD14D exhibited %moisture levels that were above 50%. All reported positive and non-detect results in all sediment samples were qualified as estimated J/UJ based on Region II guidelines.

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

Sample ID	Analyte	Results	Q flag
all samples	silver	+J	U
	beryllium	+J	U
	antimony	+J	U
	mercury	+J	U
56SS14, 56SS14D	lead	+	J
56SD08, 56SD09, 56SD11, 56SD12, 56SD13, 56SD14 and 56SD14D	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)

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

DataQual
Environmental Services, LLC

Michael Baker Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

August 16, 2009

SDG# R0903519, Columbia Analytical Services
NAPR/56 BKG Freshwater Ditch, Ceiba, PR

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # R0903519. The data validation was performed in accordance with the SOP utilized by the laboratory. This site is in Region II. However, the region does not have a validation SOP for this method. Therefore, the validation was performed using method QC specifications and good professional judgement. Region II guidance and qualification conventions were used as applicable. The worksheets provided here are a substitute for the usual Region II checklist style SOP.

Sample ID	Lab ID	Matrix	AVS/SEM
56 SD 15	R0903519-001	sediment	X
56 SD 16	R0903519-002	sediment	X
56 SD 17	R0903519-003	sediment	X
56 SD 18	R0903519-004	sediment	X
56 SD 19	R0903519-005	sediment	X
56 SD 20	R0903519-006	sediment	X
56 SD 21	R0903519-007	sediment	X
56 SD 22	R0903519-008	sediment	X
56 SD 22D	R0903519-009	sediment	X
56 SD 22MS	R0903519-008MS	sediment	X
56 SD 22MSD	R0903519-008MSD	sediment	X

The following quality control samples were provided with this SDG: Sample 56 SD 22D–field duplicate of field sample 56 SD 22. There were no field QC blanks provided with the AVS/SEM data. The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- Initial/Continuing Calibrations *
- MRL Standards *
- Interference Check Sample *
- Blanks *
- Laboratory Control Samples *

- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Post Digestion Spike Recoveries *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation
- Reporting Limits *

- - indicates that no qualifications were required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

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. Information regarding all quality control issues is present in this report. In cases where more than one qualifier applies to a sample/analyte the qualifier that best indicates usability and bias is the final qualifier.

Major Problems

No issues requiring the rejection of analytical data were noted in the validation of these samples.

Minor Problems

Issues requiring qualification of the analytical data were found in the validation of this SDG. A summary of these issues is presented in the following paragraphs. All results qualified as estimated J/UJ should be considered usable but estimated.

AVS/SEM

The MS/MSD pair exhibited a high recovery for the analyte copper. All reported positive results for copper are qualified as estimated J.

The field duplicate pair exhibited a non-compliant RPD for silver and for acid volatile sulfide (AVS). Silver and AVS were flagged as estimated in the field duplicate pair only.

These sediment samples exhibited high moisture content (>50% but <90%). All reported results were qualified as estimated J.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. One clarification question regarding extraction volumes was asked and a response was received from the laboratory. A copy of the e-mail correspondence is included in the validation worksheets. Also, the EDD required correction. All non-detect values were entered as 0. This correction was made by the validator.

Technical Holding Times

According to chain of custody records, sampling was performed on 6/24/09 and samples were received at the laboratory 6/25/09. All sample preparation and analysis was performed within Region II holding time requirements.

Matrix Spikes

The submitted MS sample exhibited a non-compliant recovery for the analyte copper. Specific recovery information and required qualifications are noted in the following table.

MS	Analytes	Samples Affected	%Recovery	Q Flag
56 SD 22	copper	all samples	127%	J

Field Duplicates

The field duplicate pair of samples 56 SD 22 and 56 SD 22D exhibited RPD greater than 35% for the analyte silver (39%) and the parameter AVS (43%). For this reason the silver and AVS were qualified as estimated in the field duplicate pair only.

Compound Identification/Quantitation

Field sample moisture content was above 50% in all samples. Field sample moisture was not above 90% in any sample. For this reason all reported positive results in the sediment samples are qualified as estimated 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

AVS/SEM

Sample ID	Analyte	Results	Q Flag
all samples	copper	+	J
all samples	all analytes	+/-	J/UJ
56 SD 22, 56 SD 22D	silver AVS	+	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
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
J-	analyte present, biased low
UL	not detected, quantitation limit is probably higher
J+	analyte present, biased high
Q	estimated dioxin/furan concentration
I	interferences present which may cause the results to be biased high

Method 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 -	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.
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.

Glossary of Qualification Flags and Abbreviations, continued

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

IDL	Instrument Detection Limit
MDL	Method Detection Limit
MRL	Minimum Reporting Limit
+	positive result
-	non-detect result
AVS	acid volatile sulfide
SEM	simultaneously extracted metals

TEST AMERICA SAVANNAH SDG 0906174

DataQual
Environmental Services, LLC

Michael Baker, Jr., Inc.
Airside Business Park
100 Airside Drive
Moon Township, PA 15108

August 20, 2009
SDG# 0906174, Test America-Savannah
NAPR SWMU 56, Puerto Rico

Dear Mr. Kimes,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 0906174. 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, 8270D-Rev 3, October 2006-SOP #HW-22, 8081B-Rev. 1.0, October 2006-SOP HW-44, and 8082A-Rev. 1.0, October 2006-SOP HW-45),), 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 6010B 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	Pest	PCB	Metals App IX
JUNE09-FB01	0906174-01	water	X	X	X	X	X
JUNE09-ER01	0906174-02	water	X	X	X	X	X
JUNE09-TB01	0906174-04	water	X				
JUNE09-ER02	0906174-05	water	X	X	X	X	X
JUNE09-ER03	0906174-06	water	X	X	X	X	X
JUNE09-TB02	0906174-08	water	X				
JUNE09-ER04	0906174-07	water					X
JUNE09-ER05	0906174-09	water					X
JUNE09-FB02	0906174-03	water					X

The following quality control samples were provided with this SDG: samples JUNE09-TB01 and JUNE09-TB02-trip blanks; samples JUNE09-ER01, JUNE09-ER02, JUNE09-ER03, JUNE09-ER04, and JUNE09-ER05- equipment blanks; and samples JUNE09-FB01 and JUNE09-FB02- field blanks.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Sample Condition *
- Technical Holding Times *
- GC/MS Tuning *
- GC Performance *

5830 Amberway Drive • St. Louis, MO 63128 • 314-330-1327 • Fax 314-849-6264

• Initial/Continuing Calibrations	
• ICSA/ICSAB Standards	*
• CRDL Standards	*
• Blanks	*
• Internal Standards	*
• Surrogate Recoveries	*
• 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. 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

Due to low RRF values, in the initial calibrations, which resulted in qualifying non-detected values as rejected for these compounds

SVOA

Due to high %RSDs and %D values, in the initial and continuing calibrations, some compounds were qualified as estimated.

The LCS and LCSD exhibited low results for one compound that resulted in qualifications to the associated samples.

Pesticides/PCBs

Some results were reported with column quantitation percent differences (%Ds) greater than 25%. These results were flagged based on Region II guidance.

Metals

All B flagged results are qualified as estimated J.

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 6/23-27/09 and samples were received at the laboratory 6/25-30/09. All sample preparation and analysis was performed within Region II and/or method holding time requirements.

Initial/Continuing Calibration

VOA

Calibration standards exhibited RRF values 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 07/01/09	acrolein	0.0188	all samples	J/R
	acetone	0.0284		
	acrylonitrile	0.0318		
	2-butanone	0.0460		
	propionitrile	0.0133		
	isobutyl alcohol	0.0042		
	1,4-dioxane	0.0007		

SVOA

Calibration standards exhibited %RSDs and %Ds values 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 7/14/09	acenaphthene fluoranthene di-n-octylphthalate	20.626 20.609 24.930	all samples	J/UJ
CC 7/15/09	4-nitroquinoline-1-oxide	22.283	all samples	J/UJ

Laboratory Spike

SVOA

The LCS and LCSD associated with all samples exhibited low recoveries for 3&4-methylphenol at 17% and 17% (QC limit 30-110%); therefore the results for this compound were qualified as estimated (J/UJ).

Identification/Quantitation

Pesticides/PCBs

Several positive results were reported with P flags to indicate that the column quantitation %D was greater than 25%. These results were qualified based on Region II guidelines. Specific results and flags are noted in the following table.

Sample ID	Compound	%D	Flag
JUNE09-ER02	alpha-BHC	108.6	R
	delta-BHC	82.4	U at RL
	dieldrin	129.4	U at RL
	alpha-chlordane	84.6	U at RL
JUNE09-ER03	alpha-BHC	163.6	R
	delta-BHC	134.0	U at RL
	4,4'-DDE	150.9	R
	dieldrin	96.8	U at RL
	gamma-chlordane	160.6	R
	alpha-chlordane	138.7	U at RL

Metals

All results flagged B by the laboratory to indicate a result between the instrument detection limit and the reporting limit were qualified as estimated 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,

Laura Maschhoff

Laura Maschhoff
President

Jacqueline Cleveland

Jacqueline Cleveland
Vice President

Summary of Data Qualifications

VOA

Sample ID	Compound	Results	Q flag
all samples	acrolein acetone acrylonitrile 2-butanone propionitrile isobutyl alcohol 1,4-dioxane	+/-	J/R

SVOA

Sample ID	Compound	Results	Q flag
all samples	acenaphthene fluoranthene di-n-octylphthalate	+/-	J/UJ
all samples	4-nitroquinoline-1-oxide	+/-	J/UJ
all samples	3&4-methylphenol	+/-	J/UJ

Pesticides/PCBs

Sample ID	Compound	Results	Q flag
JUNE09-ER02	alpha-BHC	+P	R
	delta-BHC	+JP	U at RL
	dieldrin	+JP	U at RL
	alpha-chlordane	+JP	U at RL
JUNE09-ER03	alpha-BHC	+P	R
	delta-BHC	+JP	U at RL
	4,4'-DDE	+P	R
	dieldrin	+JP	U at RL
	gamma-chlordane	+P	R
	alpha-chlordane	+JP	U at RL

Metals

Sample ID	Analyte	Results	Q flag
all samples	all analytes	+B	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

QA-QC - Puerto Rico Certifications

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

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 **680-36517-5,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224396

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Charrez

Lic. 2314

QUIMICO LICENCIADO

SWMU 56 – Puerto Rico Certifications

SEVERN TRENT STL

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-40837-1,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00
A 1234672
ESTADO LIBRE ASOCIADO DE PUERTO RICO
QUIMICO LICENCIADO
Lic Abraham Ortiz Charriez

Jan 18, 09

SEVERN TRENT STL

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-40743-1,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1234664

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic Abraham Ortiz Charriez

QUIMICO LICENCIADO

Jan 18, 09

Daliz Ëstades Santalíz

Licensed Chemist

To Whom It May Concern:

I, Daliz M. Estades Santaliz, in my capacity as Puerto Rico Certified Chemist, hereby certify the attached Analytical Results of samples analyzed for Inorganics and General Chemistry following Methods 160.3 Modified, 821/R-91-100 and 6010B, from Project Name NAPR 56A, and Laboratory ID Numbers:

AVS/SEM sub data from CAS labs
Ø9Ø7ØIØ is the Compuchem WO#
RØ9Ø3519 is the CAS WO#
C Dore
10/28/10

0907010-01
0907010-02
0907010-03
0907010-04
0907010-05
0907010-06
0907010-07
0907010-08
0907010-09

Lcda. Daliz M. Estades Santaliz

ESTADO LIBRE ASOCIADO DE PUERTO RICO
Daliz M. Estades Santaliz
Lic. 4026
QUIMICO LICENCIADO

A 1294534

PO Box 727
Dorado, PR 00646-0727

Đaliz Ëstades Şantalíz

Licensed Chemist

To Whom It May Concern:

I, Daliz M. Estades Santaliz, in my capacity as Puerto Rico Certified Chemist, hereby certify the attached Analytical Results of samples analyzed for Semovolatile fraction following Method 8270C, from Project Name NAPR 56A, and Laboratory ID Numbers:

0906174-01
0906174-02
0906174-03
0906174-04
0906174-05
0906174-06
0906174-07
0906174-08
0906174-09

Lcda. Daliz M. Estades Santaliz

PO Box 727
Dorado, PR 00646-0727

Ðaliz Ëstades Santalíz

Licensed Chemist

To Whom It May Concern:

I, Daliz M. Estades Santaliz, in my capacity as Puerto Rico Certified Chemist, hereby certify the attached Analytical Results of samples analyzed for APPIX metals following Method SW846, from Project Name NAPR 56A, and Laboratory ID Numbers:

0906174-01
0906174-02
0906174-03
0906174-04
0906174-05
0906174-06
0906174-07
0906174-08
0906174-09

Lcda. Daliz M. Estades Santaliz

PO Box 727
Dorado, PR 00646-0727

Ðaliz Ëstades Santalíz

Licensed Chemist

To Whom It May Concern:

I, Daliz M. Estades Santaliz, in my capacity as Puerto Rico Certified Chemist, hereby certify the attached Analytical Results of samples analyzed for VOC following Method 8260B, from Project Name NAPR 56A, and Laboratory ID Numbers:

0906174-01
0906174-02
0906174-03
0906174-04
0906174-05
0906174-06
0906174-07
0906174-08
0906174-09

Lcda. Daliz M. Estades Santaliz

ASOCIADO DE ... LIBRE ... QUIMICO LICENCIADO
Daliz M. Estades Santaliz
Lic. 4026

A 1294549

PO Box 727
Dorado, PR 00646-0727

Đaliz Ëstades Santalíz

Licensed Chemist

To Whom It May Concern:

I, Daliz M. Estades Santaliz, in my capacity as Puerto Rico Certified Chemist, hereby certify the attached Analytical Results of samples analyzed for Pesticides/PCB following Methods 8081A and 8082, from Project Name NAPR 56A, and Laboratory ID Numbers:

0906174-01
0906174-02
0906174-03
0906174-04
0906174-05
0906174-06
0906174-07
0906174-08
0906174-09

Lcda. Daliz M. Estades Santaliz

Lic. 4026

A 1294550

PO Box 727
Dorado, PR 00646-0727

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36289-1,** 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 1202822

Lic. Abraham Ortiz Charriez

Lic 3314

Jun 4, 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 **680-36289-4,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

ESTADO LIBRE ASOCIADO DE PUERTO RICO

A 1202814

Lic. Abraham

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 **680-36360-6,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A 1224380

ESTADO LIBRE ASOCIADO DE PUERTO RICO

Lic. Abraham Ortiz Charne

Lic. 2314

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 **680-36360-7,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00
A 1224379
ESTADO LIBRE ASOCIADO DE PUERTO RICO
QUIMICO LICENCIADO
Ortiz Charriez
Jun 26, 08

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36419-1,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

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

ESTADO LIBRE ASOCIADO DE PUERTO RICO * QUIMICO LICENCIADO *

Lic. Abraham Ortiz Charriez

Jun 06, 08

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36426-5,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36426-6,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

$1.00 $1.00

A:1224388

ESTADO LIBRE ASOCIADO DE PUERTO RICO * QUIMICO LICENCIADO *

Lic. Abraham Ortiz Charriez Lic 2314

Jun 26, 08

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36517-3,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36517-4,** and to the best of my knowledge, the results are correct and reliable.

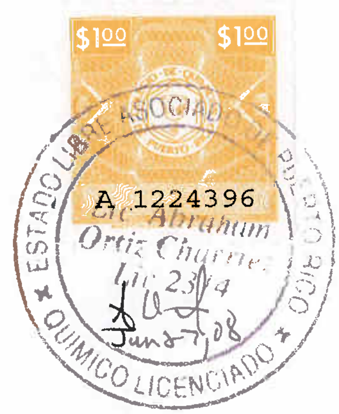
Abraham Ortiz

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PUERTO RICO CERTIFICATION

I Herby certify that I have reviewed the Quality Assurance Data for Project Number **680-36517-5,** and to the best of my knowledge, the results are correct and reliable.

Abraham Ortiz



APPENDIX D
DATA USED IN THE ECOLOGICAL RISK ASSESSMENT

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Volatile Organic Compounds (ug/kg										
1,1,1,2-Tetrachloroethane	0.62 U	0.62 U	0.56 U	0.64 U	0.64 U	0.65 U	0.59 U	0.75 U	NA	NA
1,1,1-Trichloroethane	0.56 U	0.56 U	0.51 U	0.58 U	0.58 U	0.59 U	0.53 U	0.68 U	NA	NA
1,1,2,2-Tetrachloroethane	1.3 U	1.4 U	1.2 U	1.4 U	1.4 U	1.4 U	1.3 U	1.7 U	NA	NA
1,1,2-Trichloroethane	1.2 U	1.2 U	1.1 U	1.2 U	1.2 U	1.2 U	1.1 U	1.4 U	NA	NA
1,1-Dichloroethane	0.48 U	0.48 U	0.44 U	0.5 U	0.5 U	0.5 U	0.46 U	0.59 U	NA	NA
1,1-Dichloroethene	0.52 U	0.52 U	0.48 U	0.54 U	0.54 U	0.54 U	0.5 U	0.64 U	NA	NA
1,2,3-Trichloropropane	1.3 U	1.4 U	1.2 U	1.4 U	1.4 U	1.4 U	1.3 U	1.7 U	NA	NA
1,2-Dibromo-3-Chloropropane	2.7 U	2.7 U	2.5 U	2.8 U	2.8 U	2.8 U	2.6 U	3.3 U	NA	NA
1,2-Dichloroethane	0.96 U	0.96 U	0.88 U	1 U	1 U	1 U	0.92 U	1.2 U	NA	NA
1,2-Dichloropropane	1.1 U	1.1 U	0.97 U	1.1 U	1.1 U	1.1 U	1 U	1.3 U	NA	NA
2-Butanone (MEK)	2.6 U	2.6 U	19 U	2.7 U	9.6 U	7.2 U	18 U	24 U	NA	NA
2-Chloro-1,3-butadiene	0.55 UJ	0.55 U	0.5 U	0.57 U	0.57 U	0.57 U	0.52 U	0.67 UJ	NA	NA
2-Hexanone	2 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	1.9 U	2.5 U	NA	NA
3-Chloro-1-propene	1.4 R	1.4 UJ	1.3 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.4 UJ	1.8 U	NA	NA
4-Methyl-2-pentanone (MIBK)	2.8 U	2.8 U	2.6 U	2.9 U	2.9 U	2.9 U	2.7 U	3.4 U	NA	NA
Acetone	50 J	89 J	270 J	23 J	86 U	110 J	260	280	NA	NA
Acetonitrile	43 UJ	43 U	40 U	45 U	45 U	45 U	41 U	53 R	NA	NA
Acrolein	18 R	18 R	17 R	19 R	19 R	19 R	17 R	22 R	NA	NA
Acrylonitrile	22 UJ	22 U	20 U	23 U	23 UJ	23 U	21 UJ	27 U	NA	NA
Benzene	0.76 U	0.76 U	0.7 U	0.79 U	0.95 J	0.8 U	0.73 U	0.99 J	NA	NA
Bromoform	1.1 U	1.1 U	0.97 U	1.1 U	1.1 U	1.1 U	1 U	1.3 U	NA	NA
Bromomethane	1.5 UJ	1.5 U	1.4 U	1.6 U	1.6 U	1.6 U	1.5 U	1.9 U	NA	NA
Carbon disulfide	0.49 U	0.49 U	0.45 U	0.51 U	0.51 U	0.51 U	1.9 J	0.6 U	NA	NA
Carbon tetrachloride	0.96 U	0.96 U	0.88 U	1 U	1 U	1 U	0.92 U	1.2 U	NA	NA
Chlorobenzene	0.7 U	0.7 U	0.64 U	0.73 U	0.73 U	0.74 U	0.67 U	0.86 U	NA	NA
Chlorodibromomethane	0.48 U	0.48 U	0.44 U	0.5 U	0.5 U	0.5 U	0.46 U	0.59 U	NA	NA
Chloroethane	1.2 U	1.2 U	1.1 U	1.2 U	1.2 U	1.2 U	1.1 U	1.4 U	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Volatile Organic Compounds (ug/kg										
Chloroform	0.48 U	0.48 U	0.44 U	0.5 U	0.5 U	0.5 U	0.46 U	0.59 U	NA	NA
Chloromethane	0.68 U	0.69 U	2.2 J	0.71 U	0.71 U	0.72 U	0.65 U	0.84 U	NA	NA
cis-1,3-Dichloropropene	0.84 U	0.84 U	0.77 U	0.87 U	0.87 U	0.88 U	0.8 U	1 U	NA	NA
Dibromomethane	1.2 U	1.2 U	1.1 U	1.2 U	1.2 U	1.2 U	1.1 U	1.4 U	NA	NA
Dichlorobromomethane	0.8 U	0.8 U	0.73 U	0.83 U	0.83 U	0.84 U	0.76 U	0.98 U	NA	NA
Dichlorodifluoromethane	0.86 U	0.86 U	0.78 U	0.89 U	0.89 U	0.9 U	0.82 U	1 U	NA	NA
Ethyl methacrylate	2.1 U	2.1 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U	2.6 U	NA	NA
Ethylbenzene	0.72 U	0.72 U	0.66 U	0.75 U	0.75 U	0.76 U	0.69 U	0.88 U	NA	NA
Ethylene Dibromide	1.4 U	1.4 U	1.3 U	1.5 U	1.5 U	1.5 U	1.4 U	1.8 U	NA	NA
Iodomethane	1 J	0.96 UJ	2.2 J	1 UJ	1 U	1.7 J	2.4 J	1.2 U	NA	NA
Isobutyl alcohol	66 U	67 U	61 R	69 U	69 R	70 R	63 R	81 R	NA	NA
Methacrylonitrile	23 U	23 U	21 UJ	24 U	24 U	24 UJ	22 U	28 UJ	NA	NA
Methyl methacrylate	3.6 U	3.6 U	3.3 UJ	3.7 U	3.7 U	3.7 UJ	3.4 U	4.4 U	NA	NA
Methylene Chloride	0.96 U	0.96 U	0.88 U	1 U	1 U	1 U	0.92 U	1.2 U	NA	NA
Pentachloroethane	2.1 U	2.1 U	1.9 UJ	2.2 U	2.2 UJ	2.2 UJ	2 UJ	2.6 UJ	NA	NA
Propionitrile	20 UJ	20 U	19 U	21 U	21 U	21 U	19 U	25 U	NA	NA
Styrene	0.63 U	0.64 U	0.58 U	0.66 U	0.66 U	0.67 U	0.61 U	0.78 U	NA	NA
Tetrachloroethene	0.7 U	0.7 U	0.64 U	0.73 U	0.73 U	0.74 U	0.67 U	0.86 U	NA	NA
Toluene	0.76 U	0.76 U	0.7 U	0.79 U	0.79 U	0.8 U	0.73 U	0.93 U	NA	NA
trans-1,2-Dichloroethene	0.93 U	0.94 U	0.85 U	0.97 U	0.97 U	0.98 U	0.89 U	1.1 U	NA	NA
trans-1,3-Dichloropropene	0.84 U	0.84 U	0.77 U	0.87 U	0.87 U	0.88 U	0.8 U	1 U	NA	NA
trans-1,4-Dichloro-2-butene	3 U	3 U	2.7 UJ	3.1 U	3.1 U	3.1 UJ	2.8 U	3.7 U	NA	NA
Trichloroethene	0.96 U	0.96 U	0.88 U	1 U	1 U	1 U	0.92 U	1.2 U	NA	NA
Trichlorofluoromethane	1.4 U	1.4 U	1.3 U	1.5 U	1.5 U	1.5 U	1.4 U	1.8 U	NA	NA
Vinyl acetate	1.4 UJ	1.4 U	1.3 U	1.5 U	1.5 U	1.5 U	1.4 U	1.8 U	NA	NA
Vinyl chloride	0.56 U	0.56 U	0.51 U	0.58 U	0.58 U	0.59 U	0.53 U	0.68 U	NA	NA
Xylenes, Total	2.2 U	2.2 U	2 U	2.3 U	2.3 U	2.3 U	2.1 U	2.7 U	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	9.6 U	9.5 U	8.9 UJ	9.9 U	9.3 UJ	9.8 UJ	9.4 U	9.9 U	NA	NA
1,2,4,5-Tetrachlorobenzene	8.2 U	8.1 U	7.6 UJ	8.4 U	7.9 UJ	8.4 UJ	8 U	8.5 U	NA	NA
1,2,4-Trichlorobenzene	9.6 U	9.5 U	8.9 UJ	9.9 U	9.3 UJ	9.8 UJ	9.4 U	9.9 U	NA	NA
1,2-Dichlorobenzene	9.1 U	9 U	8.5 UJ	9.3 U	8.8 UJ	9.3 UJ	8.8 U	9.4 U	NA	NA
1,3,5-Trinitrobenzene	22 U	22 U	21 UJ	23 U	21 UJ	23 UJ	21 U	23 U	NA	NA
1,3-Dichlorobenzene	7.8 U	7.7 U	7.3 UJ	8 U	7.5 UJ	8 UJ	7.6 U	8.1 U	NA	NA
1,3-Dinitrobenzene	5.1 U	5 U	4.7 UJ	5.2 U	4.9 UJ	5.2 UJ	4.9 U	5.2 U	NA	NA
1,4-Dichlorobenzene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
1,4-Dioxane	10 U	10 U	9.7 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
1,4-Naphthoquinone	5.1 U	5 U	4.7 UJ	5.2 U	4.9 UJ	5.2 UJ	4.9 U	5.2 U	NA	NA
2,2'-oxybis[1-chloropropane]	8.2 U	8.1 U	7.6 UJ	8.4 U	7.9 UJ	8.4 UJ	8 U	8.5 U	NA	NA
2,3,4,6-Tetrachlorophenol	5.5 U	5.4 U	5.1 UJ	5.6 U	5.3 UJ	5.6 UJ	5.3 U	5.6 U	NA	NA
2,4,5-Trichlorophenol	8.9 U	8.8 U	8.2 UJ	9.1 U	8.5 UJ	9 UJ	8.6 U	9.1 U	NA	NA
2,4,6-Trichlorophenol	10 U	10 U	9.5 UJ	11 U	9.9 UJ	10 UJ	10 U	11 U	NA	NA
2,4-Dichlorophenol	11 U	10 U	9.8 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
2,4-Dimethylphenol	22 U	22 U	21 UJ	23 U	21 UJ	23 UJ	21 U	23 U	NA	NA
2,4-Dinitrophenol	110 UJ	110 UJ	100 UJ	110 UJ	100 UJ	110 UJ	100 U	110 U	NA	NA
2,4-Dinitrotoluene	7.7 U	7.6 UJ	7.1 UJ	7.9 UJ	7.4 UJ	7.8 UJ	7.5 UJ	7.9 U	NA	NA
2,6-Dichlorophenol	8.3 U	8.2 U	7.7 UJ	8.5 U	8 UJ	8.5 UJ	8.1 U	8.6 U	NA	NA
2,6-Dinitrotoluene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
2-Acetylaminofluorene	6.6 U	6.6 U	6.2 UJ	6.8 U	6.4 UJ	6.8 UJ	6.4 UJ	6.8 U	NA	NA
2-Chloronaphthalene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
2-Chlorophenol	8.6 U	8.5 U	8 UJ	8.8 U	8.3 UJ	8.8 UJ	8.3 U	8.9 U	NA	NA
2-Methylnaphthalene	2.2 U	2.2 U	2.1 UJ	2.3 U	2.1 UJ	2.3 UJ	2.1 U	19	NA	NA
2-Methylphenol	11 U	10 U	9.8 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
2-Naphthylamine	26 UJ	26 U	24 UJ	27 U	25 UJ	27 UJ	25 U	27 U	NA	NA
2-Nitroaniline	8.5 U	8.4 U	7.9 UJ	8.7 U	8.2 UJ	8.6 UJ	8.2 U	8.7 U	NA	NA
2-Nitrophenol	9.5 U	9.4 U	8.8 UJ	9.7 U	9.2 UJ	9.7 UJ	9.2 U	9.8 U	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB04		56SB05		56SB06		56SB07		56SB08		56SS01	56SS02
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB04-00		56SB05-00		56SB06-00		56SB07-00		56SB08-00		56SS01	56SS02
Date	4/28/2008		4/28/2008		4/29/2008		4/28/2008		4/29/2008		4/30/2008		5/1/2008		5/5/2008		9/24/2008	9/24/2008
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		0.0-1.0		0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)																		
2-Picoline	16	U	15	U	15	UJ	16	U	15	UJ	16	UJ	15	U	16	U	NA	NA
2-Toluidine	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	U	NA	NA
3 & 4 Methylphenol	9.5	U	9.4	U	8.8	UJ	9.7	U	9.2	UJ	9.7	UJ	9.2	U	9.8	U	NA	NA
3,3'-Dichlorobenzidine	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	UJ	NA	NA
3,3'-Dimethylbenzidine	230	UJ	230	U	220	UJ	240	U	230	UJ	240	UJ	230	U	240	UJ	NA	NA
3-Methylcholanthrene	8	U	7.9	U	7.4	UJ	8.1	U	7.7	UJ	8.1	UJ	7.7	U	8.2	U	NA	NA
3-Nitroaniline	5.9	U	5.8	U	5.4	UJ	6	U	5.7	UJ	6	UJ	5.7	U	6	U	NA	NA
4,6-Dinitro-2-methylphenol	7.6	UJ	7.5	UJ	7	UJ	7.7	UJ	7.3	UJ	7.7	UJ	7.3	UJ	7.8	UJ	NA	NA
4-Aminobiphenyl	17	U	17	U	16	UJ	17	U	16	UJ	17	UJ	16	U	17	U	NA	NA
4-Bromophenyl phenyl ether	9.3	U	9.1	U	8.6	UJ	9.5	U	8.9	UJ	9.4	UJ	9	U	9.5	U	NA	NA
4-Chloro-3-methylphenol	9.8	U	9.7	U	9.1	UJ	10	U	9.4	UJ	10	UJ	9.5	U	10	U	NA	NA
4-Chloroaniline	7.8	U	7.7	U	7.3	UJ	8	U	7.5	UJ	8	UJ	7.6	U	8.1	U	NA	NA
4-Chlorophenyl phenyl ether	8.1	U	8	U	7.5	UJ	8.3	U	7.8	UJ	8.2	UJ	7.8	U	8.3	U	NA	NA
4-Nitroaniline	10	U	9.9	UJ	9.3	UJ	10	UJ	9.7	UJ	10	UJ	9.7	U	10	UJ	NA	NA
4-Nitrophenol	43	U	42	UJ	40	UJ	44	UJ	41	UJ	44	UJ	42	U	44	U	NA	NA
4-Nitroquinoline-1-oxide	14	R	14	R	13	R	15	R	14	R	15	R	14	R	15	R	NA	NA
7,12-Dimethylbenz(a)anthracene	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	U	NA	NA
Acenaphthene	0.74	U	0.73	U	0.69	UJ	0.76	U	0.72	UJ	0.76	UJ	0.72	U	0.76	U	NA	NA
Acenaphthylene	2.2	U	2.2	U	2.1	UJ	2.3	U	2.1	UJ	2.3	UJ	2.1	U	2.3	U	NA	NA
Acetophenone	11	U	11	U	10	UJ	11	U	11	UJ	11	UJ	11	U	12	U	NA	NA
alpha,alpha-Dimethyl phenethylamine	77	U	76	U	71	UJ	79	U	74	UJ	78	UJ	75	UJ	79	U	NA	NA
Aniline	8.2	U	8.1	U	7.6	UJ	8.4	U	7.9	UJ	8.4	UJ	8	U	8.5	U	NA	NA
Anthracene	2.2	U	2.2	U	2.1	UJ	2.3	U	2.1	UJ	2.3	UJ	2.1	U	2.3	U	NA	NA
Aramite, Total	14	UJ	14	U	13	UJ	15	U	14	UJ	15	UJ	14	UJ	15	U	NA	NA
Benzo[a]anthracene	2.2	U	2.2	U	9.2	J	2.3	U	2.1	UJ	2.3	UJ	2.4	J	2.9	J	NA	NA
Benzo[a]pyrene	0.86	U	0.85	U	20	J	0.88	U	0.83	UJ	0.88	UJ	2.8	J	3	J	NA	NA
Benzo[b]fluoranthene	0.99	U	0.98	U	44	J	1	U	0.96	UJ	1	UJ	3.1	J	8	J	NA	NA
Benzo[g,h,i]perylene	2.2	U	2.2	U	17	J	2.3	U	2.1	UJ	2.3	UJ	2.1	U	3.1	J	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Benzo[k]fluoranthene	1.3 U	1.3 U	1.2 UJ	1.3 U	1.3 UJ	1.3 UJ	1.5 J	1.3 U	NA	NA
Benzyl alcohol	10 U	10 U	9.7 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
Bis(2-chloroethoxy)methane	8.9 U	8.8 U	8.2 UJ	9.1 U	8.5 UJ	9 UJ	8.6 U	9.1 U	NA	NA
Bis(2-chloroethyl)ether	7.4 U	7.3 U	6.9 UJ	7.6 U	7.2 UJ	7.6 UJ	7.2 U	7.6 U	NA	NA
Bis(2-ethylhexyl) phthalate	14 U	9.9 U	80 UJ	25 U	14 UJ	7.9 UJ	61 U	24 U	NA	NA
Butyl benzyl phthalate	9.4 U	9.3 U	10 J	9.6 U	9 UJ	9.6 UJ	9.1 U	9.7 U	NA	NA
Chrysene	0.8 U	0.79 U	36 J	0.81 U	1.4 UJ	0.81 UJ	2.2 J	3.9 J	NA	NA
Diallate	13 U	12 U	12 UJ	13 U	12 UJ	13 UJ	12 U	13 U	NA	NA
Dibenz(a,h)anthracene	0.77 U	0.76 U	2.9 J	0.79 U	0.74 UJ	0.78 UJ	0.75 U	0.79 U	NA	NA
Dibenzofuran	5.5 U	5.4 U	5.1 UJ	5.6 U	5.3 UJ	5.6 UJ	5.3 U	5.6 U	NA	NA
Diethyl phthalate	14 U	14 U	13 UJ	15 U	14 UJ	15 UJ	14 U	15 U	NA	NA
Dimethyl phthalate	8.3 U	8.2 U	7.7 UJ	8.5 U	8 UJ	8.5 UJ	8.1 U	8.6 U	NA	NA
Di-n-butyl phthalate	33 U	32 U	30 UJ	33 U	31 UJ	33 UJ	97 U	34 U	NA	NA
Di-n-octyl phthalate	4.3 U	4.2 U	4 UJ	4.4 U	4.1 UJ	4.4 UJ	4.2 U	4.4 U	NA	NA
Dinoseb	22 U	22 U	21 UJ	23 U	21 UJ	23 UJ	21 U	23 UJ	NA	NA
Ethyl methanesulfonate	14 U	14 U	13 UJ	15 U	14 UJ	15 UJ	14 U	15 U	NA	NA
Fluoranthene	2.2 U	2.2 U	9.2 J	2.3 U	2.1 UJ	2.3 UJ	2.1 U	5 J	NA	NA
Fluorene	1 U	0.99 U	0.93 UJ	1 U	0.97 UJ	1 UJ	0.97 U	1 U	NA	NA
Hexachlorobenzene	8.9 U	8.8 U	8.2 UJ	9.1 U	8.5 UJ	9 UJ	8.6 U	9.1 U	NA	NA
Hexachlorobutadiene	12 U	12 U	11 UJ	12 U	11 UJ	12 UJ	12 U	12 U	NA	NA
Hexachlorocyclopentadiene	18 U	18 U	17 UJ	19 U	18 UJ	19 UJ	18 U	19 U	NA	NA
Hexachloroethane	9.6 U	9.5 U	8.9 UJ	9.9 U	9.3 UJ	9.8 UJ	9.4 U	9.9 U	NA	NA
Hexachlorophene	1100 R	1100 R	1000 UJ	1100 R	1000 UJ	1100 R	1000 R	1100 R	NA	NA
Hexachloropropene	9.4 UJ	9.3 UJ	8.7 UJ	9.6 UJ	9 UJ	9.6 UJ	9.1 UJ	9.7 U	NA	NA
Indeno[1,2,3-cd]pyrene	1.6 UJ	1.5 UJ	7.5 J	1.6 UJ	1.5 UJ	1.6 UJ	1.9 J	1.6 UJ	NA	NA
Isophorone	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
Isosafrole	9.3 U	9.1 U	8.6 UJ	9.5 U	8.9 UJ	9.4 UJ	9 U	9.5 U	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Methapyrilene	12 UJ	12 UJ	11 UJ	12 UJ	12 UJ	12 UJ	12 U	12 U	NA	NA
Methyl methanesulfonate	12 U	12 U	11 UJ	12 U	12 UJ	12 UJ	12 U	12 U	NA	NA
Naphthalene	0.78 U	0.77 U	0.73 UJ	0.8 U	0.75 UJ	0.8 UJ	1.9 J	4.3 J	NA	NA
Nitrobenzene	9 U	8.9 U	8.3 UJ	9.2 U	8.7 UJ	9.2 UJ	8.7 U	9.3 U	NA	NA
N-Nitro-o-toluidine	7.8 U	7.7 U	7.3 UJ	8 U	7.5 UJ	8 UJ	7.6 U	8.1 U	NA	NA
N-Nitrosodiethylamine	16 U	15 U	15 UJ	16 U	15 UJ	16 UJ	15 U	16 U	NA	NA
N-Nitrosodimethylamine	13 U	13 U	12 UJ	13 U	12 UJ	13 UJ	12 U	13 U	NA	NA
N-Nitrosodi-n-butylamine	12 UJ	12 UJ	11 UJ	12 UJ	11 UJ	12 UJ	12 UJ	12 U	NA	NA
N-Nitrosodi-n-propylamine	8.5 U	8.4 U	7.9 UJ	8.7 U	8.2 UJ	8.6 UJ	8.2 U	8.7 U	NA	NA
N-Nitrosodiphenylamine	9.3 U	9.1 U	8.6 UJ	9.5 U	8.9 UJ	9.4 UJ	9 U	9.5 U	NA	NA
N-Nitrosomethylethylamine	7.4 U	7.3 U	6.9 UJ	7.6 U	7.2 UJ	7.6 UJ	7.2 U	7.6 U	NA	NA
N-Nitrosomorpholine	8.6 UJ	8.5 UJ	8 UJ	8.8 UJ	8.3 UJ	8.8 UJ	8.3 UJ	8.9 U	NA	NA
N-Nitrosopiperidine	11 UJ	11 U	10 UJ	11 U	11 UJ	11 UJ	11 UJ	11 U	NA	NA
N-Nitrosopyrrolidine	12 UJ	11 U	11 UJ	12 U	11 UJ	12 UJ	11 U	12 U	NA	NA
p-Dimethylamino azobenzene	9.3 U	9.1 U	8.6 UJ	9.5 U	8.9 UJ	9.4 UJ	9 U	9.5 U	NA	NA
Pentachlorobenzene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
Pentachloronitrobenzene	7.7 U	7.6 U	7.1 UJ	7.9 U	7.4 UJ	7.8 UJ	7.5 U	7.9 U	NA	NA
Pentachlorophenol	11 U	11 U	10 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
Phenacetin	6.1 U	6.1 U	5.7 UJ	6.3 U	5.9 UJ	6.2 UJ	5.9 U	6.3 U	NA	NA
Phenanthrene	2.2 UJ	2.2 UJ	2.3 J	2.3 UJ	2.1 UJ	2.3 UJ	3.1 U	2.5 J	NA	NA
Phenol	6.3 U	6.2 U	5.8 UJ	6.4 U	6 UJ	6.4 UJ	6.1 U	6.4 U	NA	NA
p-Phenylene diamine	210 U	210 U	190 UJ	210 U	200 UJ	210 UJ	200 U	210 U	NA	NA
Pronamide	12 U	12 U	11 UJ	12 U	11 UJ	12 UJ	11 U	12 U	NA	NA
Pyrene	2.2 U	2.2 U	16 J	2.3 U	2.1 UJ	2.3 UJ	5.4 J	5.1 J	NA	NA
Pyridine	14 U	14 U	13 UJ	15 U	14 UJ	15 UJ	14 U	15 U	NA	NA
Safrole, Total	11 U	11 U	10 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Metals (mg/kg)										
Antimony	2	0.14 U	0.11 UJ	0.091 U	0.11 UJ	0.13 UJ	0.16 UJ	0.11 UJ	NA	NA
Arsenic	2.3	2.4	2.9	0.59 J	3.4	2.2	3	1.4	NA	NA
Barium	39 J	16 J	130 J	15 J	120 J	20 J	190 J	71	NA	NA
Beryllium	0.14	0.096 J	0.28	0.053 J	0.24	0.15	0.34	0.24	NA	NA
Cadmium	3.3 J	0.1 J	0.16 J	0.038 UJ	0.18 J	0.055 J	0.16 J	0.15	NA	NA
Chromium	33	21	19 J	6.3	22 J	48 J	54 J	24	NA	NA
Cobalt	12	4.2	29 J	2.6	27 J	6.8 J	50 J	24 J	NA	NA
Copper	81 J	50 J	67 J	31 J	72 J	56 J	130 J	100	NA	NA
Lead	210	6.1	10 J	0.88	4.8 J	6.3 J	5.5 J	5.3	83	5
Mercury	0.015 J	0.033	0.046 J	0.018 J	0.041 J	0.005 U	0.066 J	0.028	NA	NA
Nickel	12	4.4	8.9 J	1.1	13 J	7 J	14 J	8.7	NA	NA
Selenium	1.6	2.7	0.61 J	1.4	0.88 J	1.7 J	1.7 J	0.64	0.51	2
Silver	0.24 J	0.032 J	0.069 UJ	0.019 U	0.057 UJ	0.13 UJ	0.078 UJ	0.069 U	NA	NA
Thallium	0.15 U	0.14 U	0.17 J	0.15 U	0.15 J	0.15 U	0.25 J	0.15 U	NA	NA
Tin	5 U	4.8 U	4.7 U	4.9 U	4.6 U	4.8 U	4.6 U	4.8 U	NA	NA
Vanadium	170 J	250 J	200 J	170 J	190 J	320 J	360 J	180	NA	NA
Zinc	77 J	25 J	54 J	7.5 J	49 J	23 J	62 J	58	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	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
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Volatile Organic Compounds (ug/kg) (Cont)										
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	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
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg) (Cont)										
2-Picoline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Toluidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 & 4 Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aramite, Total	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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Benzo[k]fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl methanesulfonate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	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
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Methapyrilene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl methanesulfonate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitro-o-toluidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Phenylene diamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Safrole, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SURFACE SOIL ANALYTICAL DATA USED IN THE ECOLGOICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
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	0.0-1.0	0.0-1.0	0.0-1.0
Metals (mg/kg)										
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	8	5.9	7.2	3	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	2.2	3.5	0.86	1.4	0.86	0.62	2.3	1.2	1.7	0.33 J
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	160	55	430	190	280 J	140
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX D

SUBSURFACE SOIL ANALYTICAL DATA USED INT HE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB06		56SB08	
Sample ID	56SB01-01		56SB06-01		56SB08-01	
Date	4/28/2008		4/30/2008		5/5/2008	
Depth Range	1.0-3.0		1.0-3.0		1.0-3.0	
Volatile Organic Compounds (ug/kg)						
1,1,1,2-Tetrachloroethane	0.64	U	0.62	U	0.62	U
1,1,1-Trichloroethane	0.58	U	0.57	U	0.56	U
1,1,2,2-Tetrachloroethane	1.4	U	1.4	U	1.3	U
1,1,2-Trichloroethane	1.2	U	1.2	U	1.2	U
1,1-Dichloroethane	0.5	U	0.49	U	0.48	U
1,1-Dichloroethene	0.54	U	0.53	U	0.52	U
1,2,3-Trichloropropane	1.4	U	1.4	U	1.3	U
1,2-Dibromo-3-Chloropropane	2.8	U	2.7	U	2.7	U
1,2-Dichloroethane	1	U	0.97	U	0.96	U
1,2-Dichloropropane	1.1	U	1.1	U	1.1	U
2-Butanone (MEK)	3.9	U	3.5	U	2.6	U
2-Chloro-1,3-butadiene	0.57	U	0.56	U	0.55	U
2-Hexanone	2.1	U	2	U	2	U
3-Chloro-1-propene	1.5	UJ	1.5	UJ	1.4	U
4-Methyl-2-pentanone (MIBK)	2.9	U	2.8	U	2.8	U
Acetone	8.3	J	50	J	110	
Acetonitrile	45	U	44	U	43	R
Acrolein	19	R	19	R	18	U
Acrylonitrile	23	U	22	U	22	U
Benzene	0.79	U	0.77	U	0.76	U
Bromoform	1.1	U	1.1	U	1.1	U
Bromomethane	1.6	U	1.6	U	1.5	U
Carbon disulfide	0.51	U	0.5	U	0.49	U
Carbon tetrachloride	1	U	0.97	U	0.96	U
Chlorobenzene	0.73	U	0.71	U	0.7	U
Chlorodibromomethane	0.5	U	0.49	U	0.48	U
Chloroethane	1.2	U	1.2	U	1.2	U
Chloroform	0.5	U	0.49	U	0.48	U
Chloromethane	0.71	U	0.69	U	0.68	U
cis-1,3-Dichloropropene	0.87	U	0.85	U	0.84	U
Dibromomethane	1.2	U	1.2	U	1.2	U
Dichlorobromomethane	0.83	U	0.81	U	0.8	U
Dichlorodifluoromethane	0.89	U	0.87	U	0.86	U
Ethyl methacrylate	2.2	U	2.1	U	2.1	U
Ethylbenzene	0.75	U	0.73	U	0.72	U
Ethylene Dibromide	1.5	U	1.5	U	1.4	U
Iodomethane	1	UJ	0.97	UJ	2.6	J
Isobutyl alcohol	69	U	67	R	66	R
Methacrylonitrile	24	U	23	UJ	23	UJ
Methyl methacrylate	3.7	U	3.6	UJ	3.6	U
Methylene Chloride	1	U	0.97	U	0.96	U
Pentachloroethane	2.2	U	2.1	UJ	2.1	UJ

APPENDIX D

SUBSURFACE SOIL ANALYTICAL DATA USED INT HE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Site ID	56SB01		56SB06		56SB08	
	Sample ID	56SB01-01		56SB06-01		56SB08-01	
	Date	4/28/2008		4/30/2008		5/5/2008	
	Depth Range	1.0-3.0		1.0-3.0		1.0-3.0	
Propionitrile		21	U	20	U	20	U
Styrene		0.66	U	0.64	U	0.63	U
Tetrachloroethene		0.73	U	0.71	U	0.7	U
Toluene		0.79	U	0.77	U	0.76	U
Volatile Organic Compounds (ug/kg)							
trans-1,2-Dichloroethene		0.97	U	0.95	U	0.93	U
trans-1,3-Dichloropropene		0.87	U	0.85	U	0.84	U
trans-1,4-Dichloro-2-butene		3.1	U	3	UJ	3	U
Trichloroethene		1	U	0.97	U	0.96	U
Trichlorofluoromethane		1.5	U	1.5	U	1.4	U
Vinyl acetate		1.5	U	1.5	U	1.4	U
Vinyl chloride		0.58	U	0.57	U	0.56	U
Xylenes, Total		2.3	U	2.2	U	2.2	U
Semivolatile Organic Compounds (ug/kg)							
1,1'-Biphenyl		9.9	U	9.4	UJ	9.6	UJ
1,2,4,5-Tetrachlorobenzene		8.5	U	8	UJ	8.1	UJ
1,2,4-Trichlorobenzene		9.9	U	9.4	UJ	9.6	UJ
1,2-Dichlorobenzene		9.4	U	8.9	UJ	9.0	UJ
1,3,5-Trinitrobenzene		23	U	22	UJ	22	UJ
1,3-Dichlorobenzene		8.1	U	7.6	UJ	7.8	UJ
1,3-Dinitrobenzene		5.2	U	4.9	UJ	5.1	UJ
1,4-Dichlorobenzene		8.3	U	7.9	UJ	8.0	UJ
1,4-Dioxane		11	U	10	UJ	10	UJ
1,4-Naphthoquinone		5.2	U	4.9	UJ	5.0	UJ
2,2'-oxybis[1-chloropropane]		8.5	U	8	UJ	8.3	UJ
2,3,4,6-Tetrachlorophenol		5.6	U	5.3	UJ	5.4	UJ
2,4,5-Trichlorophenol		9.1	U	8.6	UJ	8.8	UJ
2,4,6-Trichlorophenol		11	U	10	UJ	10	UJ
2,4-Dichlorophenol		11	U	10	UJ	10	UJ
2,4-Dimethylphenol		23	U	22	UJ	22	UJ
2,4-Dinitrophenol		110	UJ	110	UJ	110	UJ
2,4-Dinitrotoluene		7.9	UJ	7.5	UJ	7.6	UJ
2,6-Dichlorophenol		8.6	U	8.1	UJ	8.3	UJ
2,6-Dinitrotoluene		8.3	U	7.9	UJ	8.0	UJ
2-Acetylaminofluorene		6.8	U	6.5	UJ	6.6	UJ
2-Chloronaphthalene		8.3	U	7.9	UJ	8.0	UJ
2-Chlorophenol		8.9	U	8.4	UJ	8.5	UJ
2-Methylnaphthalene		2.3	U	2.2	UJ	6.2	J
2-Methylphenol		11	U	10	UJ	10	UJ
2-Naphthylamine		27	U	25	UJ	26	UJ
2-Nitroaniline		8.7	U	8.2	UJ	8.4	UJ
2-Nitrophenol		9.8	U	9.2	UJ	9.4	UJ
2-Picoline		16	U	15	UJ	16	UJ

APPENDIX D

SUBSURFACE SOIL ANALYTICAL DATA USED INT HE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB06		56SB08	
Sample ID	56SB01-01		56SB06-01		56SB08-01	
Date	4/28/2008		4/30/2008		5/5/2008	
Depth Range	1.0-3.0		1.0-3.0		1.0-3.0	
2-Toluidine	12	U	12	UJ	12	UJ
3 & 4 Methylphenol	9.8	U	9.2	UJ	9.4	UJ
3,3'-Dichlorobenzidine	12	U	12	UJ	12	UJ
3,3'-Dimethylbenzidine	240	U	230	UJ	230	UJ
3-Methylcholanthrene	8.2	U	7.7	UJ	7.9	UJ
3-Nitroaniline	6	U	5.7	UJ	5.8	UJ
4,6-Dinitro-2-methylphenol	7.8	UJ	7.3	UJ	7.5	UJ
Semivolatile Organic Compounds (ug/kg)						
4-Aminobiphenyl	17	U	16	UJ	17	UJ
4-Bromophenyl phenyl ether	9.5	U	9	UJ	9.2	UJ
4-Chloro-3-methylphenol	10	U	9.5	UJ	9.7	UJ
4-Chloroaniline	8.1	U	7.6	UJ	7.8	UJ
4-Chlorophenyl phenyl ether	8.3	U	7.9	UJ	8	UJ
4-Nitroaniline	10	UJ	9.8	UJ	9.9	UJ
4-Nitrophenol	44	UJ	42	UJ	43	UJ
4-Nitroquinoline-1-oxide	15	R	14	R	14	R
7,12-Dimethylbenz(a)anthracene	12	U	12	UJ	12	UJ
Acenaphthene	0.77	U	0.72	UJ	0.74	UJ
Acenaphthylene	2.3	U	2.2	UJ	2.2	UJ
Acetophenone	12	U	11	UJ	11	UJ
alpha,alpha-Dimethyl phenethylamine	79	U	75	UJ	76	UJ
Aniline	8.5	U	8	UJ	8.1	UJ
Anthracene	2.3	U	2.2	UJ	2.2	UJ
Aramite, Total	15	U	14	UJ	14	UJ
Benzo[a]anthracene	2.3	U	2.2	UJ	2.2	UJ
Benzo[a]pyrene	0.89	U	0.84	UJ	0.85	UJ
Benzo[b]fluoranthene	1	U	0.96	UJ	0.98	UJ
Benzo[g,h,i]perylene	2.3	U	2.2	UJ	2.2	UJ
Benzo[k]fluoranthene	1.3	U	1.3	UJ	1.3	UJ
Benzyl alcohol	11	U	10	UJ	10	UJ
Bis(2-chloroethoxy)methane	9.1	U	8.6	UJ	8.8	UJ
Bis(2-chloroethyl)ether	7.7	U	7.2	UJ	7.4	UJ
Bis(2-ethylhexyl) phthalate	8.6	U	6.1	UJ	16	UJ
Butyl benzyl phthalate	9.7	U	9.1	UJ	9.5	UJ
Chrysene	0.82	U	0.77	UJ	0.79	UJ
Diallate	13	U	12	UJ	12	UJ
Dibenz(a,h)anthracene	0.79	U	0.75	UJ	0.76	UJ
Dibenzofuran	5.6	U	5.3	UJ	5.4	UJ
Diethyl phthalate	15	U	14	UJ	14	UJ
Dimethyl phthalate	8.6	U	8.1	UJ	8.4	UJ
Di-n-butyl phthalate	34	U	32	UJ	32	UJ
Di-n-octyl phthalate	4.4	U	4.2	UJ	4.3	UJ
Dinoseb	23	U	22	UJ	22	UJ

APPENDIX D

SUBSURFACE SOIL ANALYTICAL DATA USED INT HE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB06		56SB08	
Sample ID	56SB01-01		56SB06-01		56SB08-01	
Date	4/28/2008		4/30/2008		5/5/2008	
Depth Range	1.0-3.0		1.0-3.0		1.0-3.0	
Ethyl methanesulfonate	15	U	14	UJ	14	UJ
Fluoranthene	2.3	U	2.2	UJ	2.2	UJ
Fluorene	1	U	0.98	UJ	0.99	UJ
Hexachlorobenzene	9.1	U	8.6	UJ	8.8	UJ
Hexachlorobutadiene	12	U	12	UJ	12	UJ
Hexachlorocyclopentadiene	19	U	18	UJ	18	UJ
Hexachloroethane	9.9	U	9.4	UJ	9.6	UJ
Hexachlorophene	1100	R	1100	R	1100	R
Hexachloropropene	9.7	UJ	9.1	UJ	9.3	UJ
Semivolatile Organic Compounds (ug/kg)						
Indeno[1,2,3-cd]pyrene	1.6	UJ	1.5	UJ	1.6	UJ
Isophorone	8.3	U	7.9	UJ	8.0	UJ
Isosafrole	9.5	U	9	UJ	9.2	UJ
Methapyrilene	12	UJ	12	UJ	12	UJ
Methyl methanesulfonate	12	U	12	UJ	12	UJ
Naphthalene	0.81	U	0.76	UJ	0.78	UJ
Nitrobenzene	9.3	U	8.7	UJ	9.1	UJ
N-Nitro-o-toluidine	8.1	U	7.6	UJ	8.9	UJ
N-Nitrosodiethylamine	16	U	15	UJ	16	UJ
N-Nitrosodimethylamine	13	U	12	UJ	13	UJ
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	12	UJ
N-Nitrosodi-n-propylamine	8.7	U	8.2	UJ	8.4	UJ
N-Nitrosodiphenylamine	9.5	U	9	UJ	9.2	UJ
N-Nitrosomethylethylamine	7.7	U	7.2	UJ	7.4	UJ
N-Nitrosomorpholine	8.9	UJ	8.4	UJ	8.5	UJ
N-Nitrosopiperidine	11	U	11	UJ	11	UJ
N-Nitrosopyrrolidine	12	U	11	UJ	12	UJ
p-Dimethylamino azobenzene	9.5	U	9	UJ	9.3	UJ
Pentachlorobenzene	8.3	U	7.9	UJ	8.0	UJ
Pentachloronitrobenzene	7.9	U	7.5	UJ	7.6	UJ
Pentachlorophenol	11	U	11	UJ	11	UJ
Phenacetin	6.3	U	6	UJ	6.1	UJ
Phenanthrene	2.3	UJ	2.2	UJ	2.2	UJ
Phenol	6.4	U	6.1	UJ	6.2	UJ
p-Phenylene diamine	210	U	200	UJ	210	UJ
Pronamide	12	U	11	UJ	12	UJ
Pyrene	2.3	U	2.2	UJ	2.2	UJ
Pyridine	15	U	14	UJ	14	UJ
Safrole, Total	11	U	11	UJ	11	UJ
Metals (mg/kg)						
Antimony	0.094	U	0.33	UJ	0.092	UJ
Arsenic	1.1		4.9	R	1.2	
Barium	28	J	18	J	21	

APPENDIX D

SUBSURFACE SOIL ANALYTICAL DATA USED INT HE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Site ID	56SB01		56SB06		56SB08	
	Sample ID	56SB01-01		56SB06-01		56SB08-01	
	Date	4/28/2008		4/30/2008		5/5/2008	
	Depth Range	1.0-3.0		1.0-3.0		1.0-3.0	
Beryllium		0.13		0.17		0.071	U
Cadmium		0.039	UJ	0.037	UJ	0.048	U
Chromium		15		90	R	13	
Cobalt		2.3		2.1	J	4.3	J
Copper		45	J	75	J	40	J
Lead		1.4		19	R	1.2	
Mercury		0.078	J	0.025	J	0.056	
Nickel		4.1	J	2.8	J	2.6	
Selenium		2.9		2.3	J	0.72	
Silver		0.091	J	0.056	UJ	0.028	J
Thallium		0.15	U	0.14	U	0.15	U
Tin		5	U	4.8	U	4.9	U
Vanadium		110	J	940	R	120	
Zinc		8.8	J	8.7	J	8.9	

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Volatile Organic Compounds (ug/L)																
1,1,1,2-Tetrachloroethane	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
1,1,1-Trichloroethane	0.39	R	0.39	U	0.39	UJ	0.39	U	0.39	UJ	0.39	U	0.39	U	0.39	U
1,1,2,2-Tetrachloroethane	0.26	R	0.26	U	0.26	UJ	0.26	U	0.26	UJ	0.26	U	0.26	U	0.26	U
1,1,2-Trichloroethane	0.51	R	0.51	U	0.51	UJ	0.51	U	0.51	UJ	0.51	U	0.51	U	0.51	U
1,1-Dichloroethane	0.32	R	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
1,1-Dichloroethene	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
1,2,3-Trichloropropane	0.42	R	0.42	U	0.42	UJ	0.42	U	0.42	UJ	0.42	U	0.42	U	0.42	U
1,2-Dibromo-3-Chloropropane	0.48	R	0.48	U	0.48	UJ	0.48	U	0.48	UJ	0.48	U	0.48	U	0.48	U
1,2-Dichloroethane	0.31	R	0.31	U	0.31	UJ	0.31	U	0.31	UJ	0.31	U	0.31	U	0.31	U
1,2-Dichloropropane	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
2-Butanone (MEK)	0.6	R	0.6	U	0.6	UJ	0.6	U	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	UJ	0.35	UJ	0.35	UJ	0.35	U	0.35	U	0.35	U
2-Hexanone	0.68	R	0.68	U	0.68	UJ	0.68	U	0.68	UJ	0.68	U	0.68	U	0.68	U
3-Chloro-1-propene	0.46	R	0.46	U	0.46	UJ	0.46	U	0.46	UJ	0.46	U	0.46	U	0.46	U
4-Methyl-2-pentanone (MIBK)	0.6	R	0.6	U	0.6	UJ	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Acetone	5	R	5.2	J	5	UJ	5	UJ	7.1	J	5	U	5	U	5	U
Acetonitrile	15	R	15	UJ	15	UJ	15	UJ	15	UJ	15	U	15	U	15	U
Acrolein	18	R	18	U	18	UJ	18	U	18	UJ	18	R	18	R	18	R
Acrylonitrile	3.8	R	3.8	U	3.8	UJ	3.8	U	3.8	UJ	3.8	UJ	3.8	UJ	3.8	UJ
Benzene	0.32	R	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
Bromoform	0.41	R	0.41	U	0.41	UJ	0.41	U	0.41	UJ	0.41	U	0.41	U	0.41	U
Bromomethane	0.5	R	0.5	U	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ	0.5	UJ	0.5	UJ
Carbon disulfide	0.17	R	0.17	UJ	0.17	UJ	0.17	UJ	0.17	UJ	0.17	U	0.17	U	0.17	U
Carbon tetrachloride	0.27	R	0.27	U	0.27	UJ	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	U
Chlorobenzene	0.34	R	0.34	U	0.34	UJ	0.34	U	0.34	UJ	0.34	U	0.34	U	0.34	U
Chlorodibromomethane	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Chloroethane	1	R	1	UJ	1	UJ	1	UJ	1	UJ	1	U	1	U	1	U

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Sample ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Volatile Organic Compounds (ug/L)								
Chloroform	0.29 R	0.29 U	0.29 UJ	0.29 U	0.29 UJ	0.29 U	0.29 U	0.29 U
Chloromethane	0.28 R	0.28 U	1.8 J	0.28 U	0.28 UJ	0.28 U	0.28 U	0.28 U
cis-1,3-Dichloropropene	0.37 R	0.37 U	0.37 UJ	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 U
Dibromomethane	0.29 R	0.29 U	0.29 UJ	0.29 U	0.29 UJ	0.29 U	0.29 U	0.29 U
Dichlorobromomethane	0.34 R	0.34 U	0.34 UJ	0.34 U	0.34 UJ	0.34 U	0.34 U	0.34 U
Dichlorodifluoromethane	0.33 R	0.33 U	0.33 UJ	0.33 U	0.33 UJ	0.33 UJ	0.33 UJ	0.33 UJ
Ethyl methacrylate	1 R	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U
Ethylbenzene	0.3 R	0.3 U	0.3 UJ	0.3 U	0.3 UJ	0.3 U	0.3 U	0.3 U
Ethylene Dibromide	0.3 R	0.3 U	0.3 UJ	0.3 U	0.3 UJ	0.3 U	0.3 U	0.3 U
Iodomethane	1 R	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U
Isobutyl alcohol	19 R	19 R	19 R	19 R	19 R	19 U	19 U	19 U
Methacrylonitrile	6.6 R	6.6 U	6.6 UJ	6.6 U	6.6 UJ	6.6 U	6.6 U	6.6 U
Methyl methacrylate	0.38 R	0.38 U	0.38 UJ	0.38 U	0.38 UJ	0.38 U	0.38 U	0.38 U
Methylene Chloride	1 R	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U
Pentachloroethane	1.3 R	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
Propionitrile	9.2 R	9.2 U	9.2 UJ	9.2 U	9.2 UJ	9.2 U	9.2 U	9.2 U
Styrene	0.36 R	0.36 U	0.36 UJ	0.36 U	0.36 UJ	0.36 U	0.36 U	0.36 U
Tetrachloroethene	0.28 R	0.28 U	0.28 UJ	0.28 U	0.28 UJ	0.28 U	0.28 U	0.28 U
Toluene	0.31 R	0.31 U	0.31 UJ	0.31 U	0.31 UJ	0.31 U	0.31 U	0.31 U
trans-1,2-Dichloroethene	0.3 R	0.3 U	0.3 UJ	0.3 U	0.3 UJ	0.3 U	0.3 U	0.3 U
trans-1,3-Dichloropropene	0.27 R	0.27 U	0.27 UJ	0.27 U	0.27 UJ	0.27 U	0.27 U	0.27 UJ
trans-1,4-Dichloro-2-butene	0.83 R	0.83 UJ	0.83 UJ	0.83 UJ	0.83 UJ	0.83 U	0.83 U	0.83 U
Trichloroethene	0.4 R	0.4 U	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U
Trichlorofluoromethane	0.29 R	0.29 UJ	0.29 UJ	0.29 UJ	0.29 UJ	0.29 U	0.29 U	0.29 U
Vinyl acetate	0.62 R	0.62 U	0.62 UJ	0.62 U	0.62 UJ	0.62 UJ	0.62 UJ	0.62 UJ
Vinyl chloride	0.2 R	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U
Xylenes, Total	0.87 R	0.87 U	0.87 UJ	0.87 U	0.87 UJ	0.87 U	0.87 U	0.87 U

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Sample ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Semivolatile Organic Compounds (ug/L)								
1,1'-Biphenyl	0.17 U	0.17 U	0.17 UJ	0.17 U	0.17 UJ	0.17 U	0.17 U	0.17 U
1,2,4,5-Tetrachlorobenzene	0.23 U	0.23 U	0.23 UJ	0.23 U	0.23 UJ	0.23 U	0.23 U	0.23 U
1,2,4-Trichlorobenzene	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
1,2-Dichlorobenzene	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
1,3,5-Trinitrobenzene	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	0.12 U	0.12 U	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
1,3-Dinitrobenzene	0.22 U	0.22 U	0.22 UJ	0.22 U	0.22 UJ	0.22 U	0.22 U	0.22 U
1,4-Dichlorobenzene	0.12 U	0.16 J	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
1,4-Dioxane	0.49 U	0.49 U	0.49 UJ	0.49 U	0.49 UJ	0.49 U	0.49 U	0.49 U
1,4-Naphthoquinone	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
2,2'-oxybis[1-chloropropane]	0.097 U	0.097 U	0.097 UJ	0.097 U	0.097 UJ	0.097 U	0.097 U	0.097 U
2,3,4,6-Tetrachlorophenol	0.29 U	0.29 U	0.29 UJ	0.29 U	0.29 UJ	0.29 U	0.29 U	0.29 U
2,4,5-Trichlorophenol	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
2,4,6-Trichlorophenol	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
2,4-Dichlorophenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2,4-Dimethylphenol	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U
2,4-Dinitrophenol	2.4 U	2.4 U	2.4 UJ	2.4 U	2.4 UJ	2.4 U	2.4 U	2.4 U
2,4-Dinitrotoluene	0.17 UJ	0.17 U	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 U
2,6-Dichlorophenol	0.21 U	0.21 U	0.21 UJ	0.21 U	0.21 UJ	0.21 U	0.21 U	0.21 U
2,6-Dinitrotoluene	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2-Acetylaminofluorene	0.19 U	0.19 U	0.19 UJ	0.19 U	0.19 UJ	0.19 U	0.19 U	0.19 U
2-Chloronaphthalene	0.12 U	0.12 U	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
2-Chlorophenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2-Methylnaphthalene	0.022 U	0.022 UJ	0.022 UJ	0.022 U	0.022 UJ	0.022 U	0.022 U	0.022 U
2-Methylphenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2-Naphthylamine	1.1 U	1.1 U	1.1 UJ	1.1 U	1.1 UJ	1.1 U	1.1 U	1.1 U
2-Nitroaniline	0.14 U	0.14 U	0.14 UJ	0.14 U	0.14 UJ	0.14 U	0.14 U	0.14 U

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L) (Cont)																
2-Nitrophenol	0.17	U	0.17	U	0.17	UJ	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
2-Picoline	0.57	U	0.57	U	0.57	UJ	0.57	U	0.57	UJ	0.57	U	0.57	U	0.57	U
2-Toluidine	0.32	U	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
3 & 4 Methylphenol	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.63	J
3,3'-Dichlorobenzidine	3.7	U	3.7	U	3.7	UJ	3.7	U	3.7	UJ	3.7	U	3.7	U	3.7	UJ
3,3'-Dimethylbenzidine	3.7	U	3.7	UJ	3.7	UJ	3.7	U	3.7	UJ	3.7	U	3.7	U	3.7	UJ
3-Methylcholanthrene	0.2	U	0.2	U	0.2	UJ	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
3-Nitroaniline	0.28	U	0.28	U	0.28	UJ	0.28	U	0.28	UJ	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	0.49	UJ	0.49	UJ	0.49	U
4-Aminobiphenyl	0.68	U	0.68	U	0.68	UJ	0.68	U	0.68	UJ	0.68	U	0.68	U	0.68	U
4-Bromophenyl phenyl ether	0.16	U	0.16	U	0.16	UJ	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
4-Chloro-3-methylphenol	0.16	U	0.16	U	0.16	UJ	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
4-Chloroaniline	0.4	U	0.4	U	0.4	UJ	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
4-Chlorophenyl phenyl ether	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
4-Nitroaniline	0.26	U	0.26	U	0.26	UJ	0.26	U	0.26	UJ	0.26	U	0.26	U	0.26	UJ
4-Nitrophenol	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	U
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	0.26	R
7,12-Dimethylbenz(a)anthracene	0.2	U	0.2	U	0.2	UJ	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
Acenaphthene	0.019	U	0.019	U	0.019	UJ	0.019	U	0.019	UJ	0.019	U	0.019	U	0.019	U
Acenaphthylene	0.049	U	0.049	U	0.049	UJ	0.049	U	0.049	UJ	0.049	U	0.049	U	0.049	U
Acetophenone	0.19	U	0.19	U	0.19	UJ	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
alpha,alpha-Dimethyl phenethylamine	1.3	U	1.3	U	1.3	UJ	1.3	U	1.3	UJ	1.3	U	1.3	U	1.3	U
Aniline	0.4	U	0.4	U	0.4	UJ	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
Anthracene	0.021	U	0.021	U	0.021	UJ	0.021	U	0.021	UJ	0.021	U	0.033	J	0.021	U
Aramite, Total	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	U
Benzo[a]anthracene	0.025	U	0.025	U	0.025	UJ	0.025	U	0.025	UJ	0.025	U	0.025	U	0.025	U
Benzo[a]pyrene	0.024	U	0.024	U	0.024	UJ	0.024	U	0.024	UJ	0.024	U	0.024	U	0.024	U

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Sample ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Semivolatile Organic Compounds (ug/L) (Cont)								
Benzo[b]fluoranthene	0.036 U	0.036 U	0.036 UJ	0.036 U	0.036 UJ	0.036 U	0.036 U	0.036 U
Benzo[g,h,i]perylene	0.023 UJ	0.023 U	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 UJ	0.019 U	0.019 UJ	0.019 U	0.019 U	0.019 U
Benzyl alcohol	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
Bis(2-chloroethoxy)methane	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
Bis(2-chloroethyl)ether	0.14 U	0.14 U	0.14 UJ	0.14 U	0.14 UJ	0.14 U	0.14 U	0.14 U
Bis(2-ethylhexyl) phthalate	0.34 U	0.98	0.34 UJ	0.34 U	0.73 UJ	0.71 U	0.66 U	0.34 U
Butyl benzyl phthalate	0.17 U	0.17 U	0.17 UJ	0.17 U	0.17 UJ	0.17 U	0.17 U	0.17 U
Chrysene	0.027 U	0.027 U	0.027 UJ	0.027 U	0.027 UJ	0.027 U	0.027 U	0.027 U
Diallate	0.19 U	0.19 U	0.19 UJ	0.19 U	0.19 UJ	0.19 U	0.19 U	0.19 U
Dibenz(a,h)anthracene	0.023 UJ	0.023 U	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ	0.023 UJ	0.023 U
Dibenzofuran	0.097 U	0.097 U	0.097 UJ	0.097 U	0.097 UJ	0.097 U	0.097 U	0.097 U
Diethyl phthalate	0.18 U	0.32 J	0.18 UJ	0.18 U	0.18 UJ	0.18 U	0.18 U	0.18 U
Dimethyl phthalate	0.17 U	0.17 U	0.17 UJ	0.17 U	0.17 UJ	0.17 U	0.17 U	0.17 U
Di-n-butyl phthalate	0.18 U	0.3 U	0.17 UJ	0.21 U	0.13 UJ	0.16 U	0.11 U	0.16 U
Di-n-octyl phthalate	0.097 U	0.097 U	0.097 UJ	0.097 U	0.097 UJ	0.097 U	0.097 U	0.097 U
Dinoseb	0.49 U	0.49 U	0.49 UJ	0.49 U	0.49 UJ	0.49 U	0.49 U	0.49 U
Ethyl methanesulfonate	0.23 U	0.23 U	0.23 UJ	0.23 U	0.23 UJ	0.23 U	0.23 U	0.23 U
Fluoranthene	0.049 U	0.049 U	0.049 UJ	0.049 U	0.049 UJ	0.049 U	0.056 J	0.049 U
Fluorene	0.018 U	0.018 U	0.018 UJ	0.018 U	0.018 UJ	0.018 U	0.055 J	0.018 U
Hexachlorobenzene	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
Hexachlorobutadiene	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
Hexachlorocyclopentadiene	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 U	0.49 U	0.49 U
Hexachloroethane	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
Hexachlorophene	49 R	49 R	49 R	49 R	49 R	49 R	49 R	49 R
Hexachloropropene	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 U
Indeno[1,2,3-cd]pyrene	0.022 U	0.022 U	0.022 UJ	0.022 U	0.022 UJ	0.022 U	0.022 U	0.022 U

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L) (Cont)																
Isophorone	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Isosafrole	0.3	U	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Methapyrilene	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	U
Methyl methanesulfonate	0.46	U	0.46	U	0.46	UJ	0.46	U	0.46	UJ	0.46	U	0.46	U	0.46	U
Naphthalene	0.049	U	0.049	U	0.049	UJ	0.049	U	0.049	UJ	0.049	U	0.049	U	0.049	U
Nitrobenzene	0.14	U	0.14	U	0.14	UJ	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
N-Nitro-o-toluidine	0.24	U	0.24	U	0.24	UJ	0.24	U	0.24	UJ	0.24	U	0.24	U	0.24	U
N-Nitrosodiethylamine	0.32	U	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
N-Nitrosodimethylamine	0.19	U	0.19	U	0.19	UJ	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
N-Nitrosodi-n-butylamine	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	U
N-Nitrosodi-n-propylamine	0.13	U	0.13	U	0.13	UJ	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
N-Nitrosodiphenylamine	0.17	U	0.17	U	0.17	UJ	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
N-Nitrosomethylethylamine	0.28	U	0.28	U	0.28	UJ	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
N-Nitrosomorpholine	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	U
N-Nitrosopiperidine	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	U
N-Nitrosopyrrolidine	0.25	U	0.25	U	0.25	UJ	0.25	U	0.25	UJ	0.25	U	0.25	U	0.25	U
p-Dimethylamino azobenzene	0.6	U	0.6	U	0.6	UJ	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Pentachlorobenzene	0.27	U	0.27	U	0.27	UJ	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	U
Pentachloronitrobenzene	0.3	U	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Pentachlorophenol	0.18	U	0.18	U	0.18	UJ	0.18	U	0.18	UJ	0.18	U	0.18	U	0.18	U
Phenacetin	0.2	U	0.2	U	0.2	UJ	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
Phenanthrene	0.017	U	0.017	U	0.017	UJ	0.017	U	0.017	UJ	0.05	J	0.39		0.017	U
Phenol	0.14	U	0.14	U	0.14	UJ	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
p-Phenylene diamine	2.4	U	2.4	U	2.4	UJ	2.4	U	2.4	UJ	2.4	U	2.4	U	2.4	U
Pronamide	0.25	U	0.25	U	0.25	UJ	0.25	U	0.25	UJ	0.25	U	0.25	U	0.25	U
Pyrene	0.026	U	0.026	U	0.026	UJ	0.026	U	0.026	UJ	0.026	U	0.026	U	0.026	U
Pyridine	0.22	U	0.22	U	0.22	UJ	0.22	U	0.22	UJ	0.22	U	0.22	U	0.22	U
Safrole, Total	0.23	U	0.23	U	0.23	UJ	0.23	U	0.23	UJ	0.23	U	0.23	U	0.23	U

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Total Metals (ug/L)																
Antimony	0.36	U	0.36	U	0.36	UJ	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Arsenic	1.8	U	1.9	U	0.52	J	1.7	U	0.42	J	0.31	U	0.7	U	1.2	U
Barium	7.1		24		21	J	23		16	J	18		100		170	
Beryllium	0.065	U	0.065	U	0.065	UJ	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	U
Chromium	1.3	U	2.4	U	0.6	UJ	1.7	U	0.6	UJ	0.6	U	0.6	U	2.3	J
Cobalt	0.18	R	0.42	R	1.6	J	6.6		1.2	J	0.29	U	1.5	J	38	
Copper	1.2	U	1.7	U	1.8	UJ	2.5	U	1.2	UJ	2.7	U	1.2	U	8.3	
Lead	0.15	U	0.16	U	0.16	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.3	U
Mercury	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ	0.08	U	0.08	U	0.08	U
Nickel	0.32	U	0.88	J	0.32	UJ	0.82	J	0.35	J	0.38	J	0.32	U	3.9	
Selenium	0.6	U	0.6	U	0.6	UJ	0.79	J	0.6	UJ	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	0.09	U
Thallium	0.55	U	0.55	U	0.55	UJ	0.55	U	0.55	UJ	0.55	U	0.55	U	0.55	U
Tin	0.9	U	3.4	U	2.4	UJ	0.9	U	0.9	UJ	0.9	U	0.9	U	0.9	U
Vanadium	9.3		17		16	J	20		8.8	J	7.9		2.7	U	13	
Zinc	6.5	U	6.5	U	6.5	UJ	8.7	J	6.5	UJ	6.5	U	6.5	U	18	J

APPENDIX D

GROUNDWATER ANALYTCIAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Dissolved Metals (ug/L)																
Antimony	0.36	U	0.39	U	0.38	J	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Arsenic	1.1	U	1.6	U	0.5	J	0.99	U	0.28	UJ	0.28	U	0.54	U	0.86	U
Barium	7.1		22		20	J	14		15	J	15		100		140	
Beryllium	0.065	U	0.065	U	0.065	UJ	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	U	0.12	U	0.12	U
Chromium	1.1	U	1.7	U	0.6	UJ	1.2	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Cobalt	1.6	R	1.6	R	1.8	J	2.1		1.4	J	0.45	UJ	1.9	J	31	
Copper	1.2	U	1.3	U	1.9	UJ	1.2	U	1.2	UJ	1.2	U	1.2	U	2.5	U
Lead	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Mercury	0.08	U	0.08	U	0.08	UJ	0.098	J	0.08	UJ	0.08	U	0.08	U	0.08	U
Nickel	0.82	J	0.69	J	0.55	J	0.58	J	0.4	J	0.32	U	0.4	J	2.6	
Selenium	0.6	U	0.6	U	0.6	UJ	0.65	J	0.7	J	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	U	0.09	U	0.09	U
Thallium	0.55	U	0.55	U	0.55	UJ	0.55	U	0.55	UJ	0.55	U	0.55	U	0.55	U
Tin	0.9	U	2.4	U	0.9	UJ	0.9	U	0.9	UJ	0.9	U	0.9	U	0.9	U
Vanadium	8		14		14	J	9.8		5.8	J	3.6	U	2.5	U	1.7	J
Zinc	6.5	U	6.5	U	7.4	J	6.5	U	6.5	UJ	6.5	U	6.5	U	8	J

APPENDIX D

DRAINAGE DITCH SURFACE WATER ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Low-level PAHs (ug/L)										
2-Methylnaphthalene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ
Acenaphthene	0.019	U	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Acenaphthylene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.047	UJ
Anthracene	0.021	U	0.021	UJ	0.021	UJ	0.021	UJ	0.021	UJ
Benzo[a]anthracene	0.025	U	0.025	UJ	0.025	UJ	0.025	UJ	0.025	UJ
Benzo[a]pyrene	0.024	U	0.024	UJ	0.024	UJ	0.024	UJ	0.024	UJ
Benzo[b]fluoranthene	0.036	U	0.036	UJ	0.035	UJ	0.036	UJ	0.035	UJ
Benzo[g,h,i]perylene	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ
Benzo[k]fluoranthene	0.019	U	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Chrysene	0.027	U	0.027	UJ	0.026	UJ	0.027	UJ	0.026	UJ
Dibenz(a,h)anthracene	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ
Fluoranthene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.047	UJ
Fluorene	0.018	U	0.018	UJ	0.018	UJ	0.018	UJ	0.018	UJ
Indeno[1,2,3-cd]pyrene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ
Naphthalene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.047	UJ
Phenanthrene	0.017	U	0.017	UJ	0.017	UJ	0.017	UJ	0.017	UJ
Pyrene	0.026	U	0.026	UJ	0.025	UJ	0.026	UJ	0.025	UJ

APPENDIX D

DRAINAGE DITCH SURFACE WATER ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Total Metals (ug/L)										
Antimony	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U
Arsenic	3.2		1.4	U	1.4	U	1.7	U	2.4	U
Barium	60		15		13		35		86	
Beryllium	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
Cadmium	1.1	J	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	6.3		1.6	U	1.5	U	1.5	U	1.7	U
Cobalt	3.1		0.37	R	0.27	R	0.37	R	1.7	R
Copper	13		2.3	J	3.1	J	1.4	J	2.4	J
Lead	16		0.25	J	0.43	J	0.73	J	0.21	J
Mercury	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ
Nickel	3.8		0.52	J	0.53	J	0.43	J	1.3	
Selenium	0.71	J	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
Thallium	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
Vanadium	22		5.2		6		5	U	5.3	
Zinc	46		6.5	U	6.6	J	8.6	J	6.5	J

APPENDIX D

DRAINAGE DITCH SURFACE WATER ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Dissolved Metals (ug/L)										
Antimony	0.42	U	0.38	U	0.37	U	0.36	U	0.36	U
Arsenic	1.8	U	1.4	U	1.1	U	1.5	U	2.3	U
Barium	33		14		12		33		84	
Beryllium	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	1.2	U	1.3	U	1.2	U	1.3	U	1.5	U
Cobalt	3.7		3.7	R	2.3	R	2.1	R	3.8	R
Copper	1.5	U	2	J	2.6	J	1.2	U	1.9	J
Lead	0.43	U	0.17	J	0.15	U	0.47	J	0.15	U
Mercury	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
Nickel	2.1		1		1.2		0.82	J	1.6	
Selenium	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
Thallium	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
Tin	0.9	U	1.7	U	1.2	U	4.3	U	0.9	U
Vanadium	4.6	U	4.6	U	4.9	U	4	U	4.2	U
Zinc	8.8	J	6.7	J	6.5	U	6.5	U	6.5	U

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)												
1,1,1,2-Tetrachloroethane	0.37	UJ	1.8	UJ	1.7	UJ	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	0.33	UJ	1.7	UJ	1.5	UJ	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.81	UJ	4	UJ	3.7	UJ	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.69	UJ	3.4	UJ	3.1	UJ	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	0.29	UJ	1.4	UJ	1.3	UJ	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	0.31	UJ	1.6	UJ	1.4	UJ	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.81	UJ	4	UJ	3.7	UJ	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	1.6	UJ	8	UJ	7.3	UJ	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.58	UJ	2.9	UJ	2.6	UJ	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.63	UJ	3.2	UJ	2.9	UJ	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	65	J	35	UJ	110	UJ	NA	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	0.33	UJ	1.6	UJ	1.5	UJ	NA	NA	NA	NA	NA	NA
2-Hexanone	1.2	UJ	6	UJ	5.5	UJ	NA	NA	NA	NA	NA	NA
3-Chloro-1-propene	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	1.7	UJ	8.3	UJ	7.6	UJ	NA	NA	NA	NA	NA	NA
Acetone	200	J	250	J	1200	J	NA	NA	NA	NA	NA	NA
Acetonitrile	26	UJ	130	UJ	120	UJ	NA	NA	NA	NA	NA	NA
Acrolein	11	R	55	R	50	R	NA	NA	NA	NA	NA	NA
Acrylonitrile	13	UJ	66	UJ	60	UJ	NA	NA	NA	NA	NA	NA
Benzene	0.46	UJ	2.3	UJ	2.1	UJ	NA	NA	NA	NA	NA	NA
Bromoform	0.63	UJ	3.2	UJ	2.9	UJ	NA	NA	NA	NA	NA	NA
Bromomethane	0.92	UJ	4.6	UJ	4.2	UJ	NA	NA	NA	NA	NA	NA
Carbon disulfide	0.29	UJ	19	J	800	J	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.58	UJ	2.9	UJ	2.6	UJ	NA	NA	NA	NA	NA	NA
Chlorobenzene	0.42	UJ	2.1	UJ	1.9	UJ	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	0.29	UJ	1.4	UJ	1.3	UJ	NA	NA	NA	NA	NA	NA
Chloroethane	0.69	UJ	3.4	UJ	3.1	UJ	NA	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)												
Chloroform	0.29	UJ	1.4	UJ	1.3	UJ	NA	NA	NA	NA	NA	NA
Chloromethane	0.41	UJ	2	UJ	1.9	UJ	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	0.5	UJ	2.5	UJ	2.3	UJ	NA	NA	NA	NA	NA	NA
Dibromomethane	0.69	UJ	3.4	UJ	3.1	UJ	NA	NA	NA	NA	NA	NA
Dichlorobromomethane	0.48	UJ	2.4	UJ	2.2	UJ	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	0.51	UJ	2.6	UJ	2.3	UJ	NA	NA	NA	NA	NA	NA
Ethyl methacrylate	1.3	UJ	6.3	UJ	5.8	UJ	NA	NA	NA	NA	NA	NA
Ethylbenzene	0.43	UJ	2.2	UJ	2	UJ	NA	NA	NA	NA	NA	NA
Ethylene Dibromide	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
Iodomethane	0.58	UJ	2.9	UJ	36	J	NA	NA	NA	NA	NA	NA
Isobutyl alcohol	40	UJ	200	UJ	180	UJ	NA	NA	NA	NA	NA	NA
Methacrylonitrile	14	UJ	69	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Methyl methacrylate	2.1	UJ	11	UJ	9.7	UJ	NA	NA	NA	NA	NA	NA
Methylene Chloride	0.58	UJ	2.9	UJ	2.6	UJ	NA	NA	NA	NA	NA	NA
Pentachloroethane	1.3	UJ	6.3	UJ	5.8	UJ	NA	NA	NA	NA	NA	NA
Propionitrile	12	UJ	60	UJ	55	UJ	NA	NA	NA	NA	NA	NA
Styrene	0.38	UJ	1.9	UJ	1.7	UJ	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.42	UJ	2.1	UJ	1.9	UJ	NA	NA	NA	NA	NA	NA
Toluene	0.46	UJ	2.3	UJ	2.1	UJ	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	0.56	UJ	2.8	UJ	2.5	UJ	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	0.5	UJ	2.5	UJ	2.3	UJ	NA	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	1.8	UJ	8.9	UJ	8.1	UJ	NA	NA	NA	NA	NA	NA
Trichloroethene	0.58	UJ	2.9	UJ	2.6	UJ	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
Vinyl acetate	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.33	UJ	1.7	UJ	1.5	UJ	NA	NA	NA	NA	NA	NA
Xylenes, Total	1.3	UJ	6.6	UJ	6	UJ	NA	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg)									
1,1'-Biphenyl	15 UJ	30 UJ	43 UJ	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	15 UJ	30 UJ	43 UJ	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	14 UJ	28 UJ	40 UJ	NA	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	35 UJ	68 UJ	98 UJ	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	12 UJ	24 UJ	34 UJ	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	8.1 UJ	16 UJ	22 UJ	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
1,4-Dioxane	17 UJ	32 UJ	46 UJ	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	8.1 UJ	16 UJ	22 UJ	NA	NA	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	8.7 UJ	17 UJ	24 UJ	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	14 UJ	27 UJ	39 UJ	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	16 UJ	32 UJ	45 UJ	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	17 UJ	33 UJ	47 UJ	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	35 UJ	68 UJ	98 UJ	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	170 UJ	330 UJ	480 UJ	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 UJ	24 UJ	34 UJ	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	13 UJ	26 UJ	37 UJ	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	11 UJ	20 UJ	29 UJ	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
2-Chlorophenol	14 UJ	27 UJ	38 UJ	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	3.5 UJ	6.8 UJ	9.8 UJ	NA	NA	NA	NA	NA	NA
2-Methylphenol	17 UJ	33 UJ	47 UJ	NA	NA	NA	NA	NA	NA
2-Naphthylamine	41 UJ	80 UJ	110 UJ	NA	NA	NA	NA	NA	NA
2-Nitroaniline	13 UJ	26 UJ	37 UJ	NA	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)												
2-Nitrophenol	15	UJ	29	UJ	42	UJ	NA	NA	NA	NA	NA	NA
2-Picoline	25	UJ	48	UJ	69	UJ	NA	NA	NA	NA	NA	NA
2-Toluidine	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
3 & 4 Methylphenol	15	UJ	29	UJ	42	UJ	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	370	UJ	720	UJ	1000	UJ	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	13	UJ	25	UJ	35	UJ	NA	NA	NA	NA	NA	NA
3-Nitroaniline	9.3	UJ	18	UJ	26	UJ	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	12	UJ	23	UJ	33	UJ	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	27	UJ	52	UJ	75	UJ	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	15	UJ	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	16	UJ	30	UJ	43	UJ	NA	NA	NA	NA	NA	NA
4-Chloroaniline	12	UJ	24	UJ	34	UJ	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	13	UJ	25	UJ	36	UJ	NA	NA	NA	NA	NA	NA
4-Nitroaniline	16	UJ	31	UJ	44	UJ	NA	NA	NA	NA	NA	NA
4-Nitrophenol	68	UJ	130	UJ	190	UJ	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	23	R	44	R	63	UJ	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
Acenaphthene	1.2	UJ	2.3	UJ	3.3	UJ	NA	NA	NA	NA	NA	NA
Acenaphthylene	3.5	UJ	6.8	UJ	9.8	UJ	NA	NA	NA	NA	NA	NA
Acetophenone	18	UJ	35	UJ	49	UJ	NA	NA	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	120	UJ	240	UJ	340	UJ	NA	NA	NA	NA	NA	NA
Aniline	13	UJ	25	UJ	36	UJ	NA	NA	NA	NA	NA	NA
Anthracene	3.5	UJ	6.8	UJ	9.8	UJ	NA	NA	NA	NA	NA	NA
Aramite, Total	23	UJ	44	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	270	J	58	J	9.8	UJ	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	300	J	85	J	3.8	UJ	NA	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)												
Benzo[b]fluoranthene	1.6	UJ	77	J	4.4	UJ	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	150	J	46	J	9.8	UJ	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	630	J	160	J	5.7	UJ	NA	NA	NA	NA	NA	NA
Benzyl alcohol	17	UJ	32	UJ	47	J	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	14	UJ	27	UJ	39	UJ	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	12	UJ	23	UJ	33	UJ	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	260	J	79	U	160	U	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	22	J	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
Chrysene	410	J	87	J	7.1	J	NA	NA	NA	NA	NA	NA
Diallate	20	UJ	39	UJ	55	UJ	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	52	J	2.4	UJ	3.4	UJ	NA	NA	NA	NA	NA	NA
Dibenzofuran	8.7	UJ	17	UJ	24	UJ	NA	NA	NA	NA	NA	NA
Diethyl phthalate	23	UJ	44	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	13	UJ	26	UJ	37	UJ	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	52	UJ	100	UJ	610	UJ	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	6.8	UJ	13	UJ	19	UJ	NA	NA	NA	NA	NA	NA
Dinoseb	35	UJ	68	UJ	98	UJ	NA	NA	NA	NA	NA	NA
Ethyl methanesulfonate	23	UJ	44	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Fluoranthene	350	J	79	J	9.8	UJ	NA	NA	NA	NA	NA	NA
Fluorene	1.6	UJ	3.1	UJ	4.4	UJ	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	14	UJ	27	UJ	39	UJ	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	19	UJ	37	UJ	52	UJ	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	29	UJ	56	UJ	80	UJ	NA	NA	NA	NA	NA	NA
Hexachloroethane	15	UJ	30	UJ	43	UJ	NA	NA	NA	NA	NA	NA
Hexachlorophene	1700	R	3300	R			NA	NA	NA	NA	NA	NA
Hexachloropropene	15	UJ	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	110	J	32	J	6.9	UJ	NA	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)												
Isophorone	13	UJ	25	UJ	36	UJ	NA	NA	NA	NA	NA	NA
Isosafrole	15	UJ	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
Methapyrilene	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
Methyl methanesulfonate	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
Naphthalene	1.2	UJ	2.4	UJ	3.4	UJ	NA	NA	NA	NA	NA	NA
Nitrobenzene	14	UJ	28	UJ	40	UJ	NA	NA	NA	NA	NA	NA
N-Nitro-o-toluidine	12	UJ	24	UJ	34	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	25	UJ	48	UJ	69	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	20	UJ	39	UJ	56	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	19	UJ	37	UJ	52	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	13	UJ	26	UJ	37	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	15	UJ	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	12	UJ	23	UJ	33	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	14	UJ	27	UJ	38	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	18	UJ	34	UJ	49	UJ	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	18	UJ	36	UJ	51	UJ	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	15	UJ	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	13	UJ	25	UJ	36	UJ	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	12	UJ	24	UJ	34	UJ	NA	NA	NA	NA	NA	NA
Pentachlorophenol	17	UJ	33	UJ	48	UJ	NA	NA	NA	NA	NA	NA
Phenacetin	9.7	UJ	19	UJ	27	UJ	NA	NA	NA	NA	NA	NA
Phenanthrene	21	J	19	J	9.8	UJ	NA	NA	NA	NA	NA	NA
Phenol	9.9	UJ	19	J	28	UJ	NA	NA	NA	NA	NA	NA
p-Phenylene diamine	330	UJ	640	UJ	920	UJ	NA	NA	NA	NA	NA	NA
Pronamide	19	UJ	36	UJ	52	UJ	NA	NA	NA	NA	NA	NA
Pyrene	570	J	110	J	9.8	UJ	NA	NA	NA	NA	NA	NA
Pyridine	23	UJ	44	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Safrole, Total	17	UJ	33	UJ	48	UJ	NA	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12		56SD13		56SD14		56SD15		56SD16		56SD17	
Sample ID	56SD03		56SD04		56SD05		56SD12		56SD13		56SD14		56SD15		56SD16		56SD17	
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008		9/25/2008		9/25/2008		6/24/2009		6/24/2009		6/24/2009	
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5	
Total Metals (mg/kg)																		
Antimony	0.59	UJ	1.4	UJ	0.66	UJ	0.42	UJ	0.97	UJ	0.66	UJ	0.57	UJ	0.64	UJ	0.66	UJ
Arsenic	3.9	J	4.2	J	3.8	J	2.6	J	3.2	J	4	J	1.5	J	0.96	J	2.2	J
Barium	54	J	78	J	160	J	78	J	110	J	51	J	93	J	67.3	J	140	J
Beryllium	0.21	J	0.29	J	0.27	J	0.26	UJ	0.25	UJ	0.3	J	0.45	UJ	0.5	UJ	0.5	UJ
Cadmium	2.6	J	3.9	J	0.54	J	0.54	J	0.72	J	0.39	J	0.09	UJ	0.1	UJ	0.1	UJ
Chromium	39	J	46	J	34	J	29	J	38	J	51	J	28.7	J	27.7	J	29.7	J
Cobalt	18	J	24	J	40	J	29	J	29	J	59	J	27.5	J	23.6	J	41.9	J
Copper	130	J	130	J	110	J	100	J	110	J	100	J	107	J	100	J	96.6	J
Lead	280	J	160	J	25	J	13	J	48	J	54	J	32.4	J	39.4	J	45.7	J
Mercury	0.052	J	0.11	J	0.069	J	0.039	UJ	0.086	J	0.064	J	0.092	J	0.38	J	0.068	J
Nickel	13	J	19	J	16	J	11	J	14	J	19	J	9.5	J	9.6	J	11.5	J
Selenium	1.2	J	4.2	J	2	J	1.3	J	1.2	J	0.99	J	0.92	UJ	2	J	1.1	UJ
Silver	0.18	J	0.21	J	0.23	J	0.074	UJ	0.72	J	0.14	UJ	4.6	J	0.31	J	0.12	UJ
Thallium	0.23	UJ	0.46	UJ	0.68	UJ	0.41	UJ	0.39	UJ	0.28	UJ	1.2	UJ	1.3	UJ	1.3	UJ
Tin	7.8	UJ	15	UJ	23	UJ	14	UJ	13	UJ	9.5	UJ	8.2	J	7.7	J	13.6	J
Vanadium	220	J	250	J	190	J	240	J	180	J	260	J	184	J	172	J	189	J
Zinc	89	J	140	J	110	J	86	J	100	J	120	J	93.3	J	90.5	J	98.1	J

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)					
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg) (Cont)					
Chloroform	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg)					
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

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)					
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
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

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)					
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
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
Ethyl methanesulfonate	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
Hexachlorophene	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	NA	NA	NA

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)					
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
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
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
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

APPENDIX D

DRAINAGE DITCH SEDIMENT ANALYTICAL DATA USED IN THE ECOLOGICAL RISK ASSESSMENT
SWMU 56 - HANGER 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18		56SD19		56SD20		56SD21		56SD22	
Sample ID	56SD18		56SD19		56SD20		56SD21		56SD22	
Sampling Date	6/24/2009		6/24/2009		6/24/2009		6/24/2009		6/24/2009	
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5		0-0.5	
Total Metals (mg/kg)										
Antimony	0.92	J	0.29	UJ	0.81	UJ	0.72	UJ	0.86	UJ
Arsenic	3.4	J	2		1.1	UJ	1	J	10.4	J
Barium	101	J	42		109	J	105	J	571	J
Beryllium	0.56	UJ	0.4	U	0.44	UJ	0.57	UJ	1.2	UJ
Cadmium	0.13	UJ	0.04	U	0.12	UJ	0.11	UJ	0.13	UJ
Chromium	25.1	J	29.2		19.8	J	24.4	J	34.4	J
Cobalt	58.8	J	33		50.8	J	36.7	J	91.4	J
Copper	89.3	J	77.3		75.1	J	85.7	J	92.8	J
Lead	23.3	J	73.1		16.7	J	19.7	J	22	J
Mercury	0.11	J	0.11		0.15	J	0.1	J	0.088	J
Nickel	10.5	J	11.9		8.7	J	9.9	J	19.1	J
Selenium	1.8	J	0.46	UJ	1.3	UJ	1.4	J	1.4	UJ
Silver	0.16	UJ	0.05	U	0.15	UJ	0.13	UJ	0.16	UJ
Thallium	1.8	UJ	0.59	U	1.7	UJ	1.5	UJ	1.8	UJ
Tin	10.7	J	4.6	J	14.6	J	10.1	J	16	J
Vanadium	201	J	167		147	J	176	J	171	J
Zinc	104	J	86		69.2	J	75.5	J	98.2	J

APPENDIX E
EqP APPROACH

APPENDIX E

EQUILIBRIUM PARTITIONING APPROACH

The United States Environmental Protection Agency (USEPA, 1993) has chosen the equilibrium partitioning (EqP) approach for developing sediment quality criteria for nonionic organic chemicals. This approach was used in the screening level ecological risk assessment (SERA) for SWMU 56 to derive freshwater sediment screening values for organic chemicals lacking literature-based, bulk sediment screening values.

There are three underlying assumptions to the derivation of sediment quality criteria using EqP. First, it is assumed that sediment toxicity correlates with the concentration of the chemical in the sediment pore water and not the bulk sediment concentration (i.e., the pore water concentration represents the bioavailable fraction). Second, partitioning between sediment pore water and bulk sediment is assumed to be dependent on the organic content of the sediment with little dependence upon other chemical or physical properties. Third, the EqP approach assumes that equilibrium has been attained between the sediment pore water concentration and the bulk sediment concentration.

The relationship between the concentration of a nonionic organic chemical in sediment pore water and bulk sediment is described by the partitioning coefficient, K_p (USEPA, 1993):

$$K_p = (C_s)/(C_{pw}) \quad \text{(Equation E-1)}$$

Where C_s is the concentration in bulk sediment and C_{pw} is the concentration in sediment pore water. For a given organic chemical, the partition coefficient can be derived by multiplying the fraction of organic carbon (f_{oc}) present in the sediment by the chemical's organic carbon partition coefficient (K_{oc}) (USEPA, 1993):

$$K_p = (f_{oc})(K_{oc}) \quad \text{(Equation E-2)}$$

Combining Equations E-1 and E-2 yields the following:

$$C_s = (K_{oc})(f_{oc})(C_{PW}) \quad \text{(Equation E-3)}$$

If the organic carbon content of the sediment is known, a site-specific sediment screening value (SSV) can be calculated for a given organic chemical by setting C_{pw} equivalent to a conservative surface water screening value for that chemical (SWSV):

$$SSV = (K_{oc})(f_{oc})(SWSV) \quad \text{(Equation E-4)}$$

In this equation, SSV represents the concentration of the chemical in bulk sediment that, at equilibrium, will result in a sediment pore water concentration equal to the surface water screening value. Sediment concentrations less than SSV would be protective of sediment-associated biota. The use of surface water screening values (i.e., criteria and toxicological benchmarks) in Equation E-4 assumes that the sensitivities of sediment-associated biota and the species typically tested to derive surface water screening values such as USEPA NAWQC (predominantly water column species) are similar. Furthermore, it assumes that levels of protection afforded by the surface water screening values are appropriate for sediment-associated biota. It is noted that the EqP approach can only be used if the total organic carbon (TOC) content in sediment is greater than 0.2 percent (i.e., 2,000 mg/kg). At TOC concentrations less than 0.2 percent, other factors (e.g., particle size, sorption to nonorganic mineral fractions) become relatively more important (USEPA, 1993).

Although the EqP approach was developed by the USEPA for nonionic organic chemicals (e.g. semi-volatile organic chemicals [SVOCs]), this method was used to derive sediment screening values for all organic chemicals lacking literature-based, bulk sediment screening values, including ionic organic chemicals (e.g., volatile organic chemicals [VOCs]). Application of the EqP approach to ionic organic chemicals likely overestimates their pore water concentrations since adsorption mechanisms other than hydrophobicity may significantly increase the fraction of the chemical sorbed to sediment particles (Jones et al., 1997). The overly conservative nature of sediment quality benchmarks derived using EqP is documented in the literature (Fuschman, 2003). Regardless, application of the EqP approach to the development of sediment screening values for ionic chemicals is documented in the literature (USEPA, 1996 and Jones et al., 1997).

Sediment screening values derived using EqP (see Table 7-7) are based on a f_{oc} of 0.036. This value represents the minimum f_{oc} measured in drainage ditch sediment collected at SWMU 56. K_{oc} values used in the derivation of EqP-based sediment screening values are those listed in Table 7-3. The K_{oc} values listed in Table 7-3 were estimated from the following equation (USEPA, 1993 and 1996):

$$Log\ K_{oc} = 0.00028 + (0.983)(Log\ K_{ow}) \quad \text{(Equation E-5)}$$

In this equation, log K_{ow} represented the log octanol-water partition coefficient. The surface water screening values used to derive EqP-based sediment screening values for organic chemicals lacking bulk sediment screening values are listed within Table E-1. They were identified from the literature using the sources and procedures presented in Section 7.4.1.3. It is noted that EqP-based sediment screening values could not be calculated for those organic chemicals lacking a surface water screening value.

Appendix E References

Fuchsman, P.C. 2003. Modification of the Equilibrium Partitioning Approach for Volatile Organic Compounds in Sediment. Environ. Toxicol. Chem. 22(7):1532-1534.

U.S. Environmental Protection Agency (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.

USEPA. 1996. Ecotox Thresholds. Eco Update, Volume 3, Number 2. Office of Solid Waste and Emergency Response, Washington, D.C. EPA 540/F-95/038.

Jones, D.S., G.W. Suter II., and R.N. Hull. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-95/R4.

TABLE E-1
SURFACE WATER SCREENING VALUES USED IN THE DERIVATION OF EQUILIBRIUM-PARTITIONING-BASED SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical (1)	Surface Water Screening Value (2)	Reference	Comment (3)
Volatile Organics (ug/L):			
1,1,1,2-Tetrachloroethane	200	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Lepomis macrochirus* [bluegill]) with a safety factor of 100
1,1,1-Trichloroethane	76.0	USEPA 2003	USEPA Region 5 ecological screening level
1,1,2,2-Tetrachloroethane	240	USEPA 2001	USEPA Region 4 chronic screening value
1,1,2-Trichloroethane	500	USEPA 2003	USEPA Region 5 ecological screening level
1,1-Dichloroethane	47.0	USEPA 2003	USEPA Region 5 ecological screening level
1,1-Dichloroethene	65.0	USEPA 2003	USEPA Region 5 ecological screening level
1,2,3-Trichloropropane	274	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	200	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Micropterus salmoides* [largemouth bass]) with a safety factor of 100
1,2-Dichloroethane	910	USEPA 2003	USEPA Region 5 ecological screening level
1,2-Dichloropropane	360	USEPA 2003	USEPA Region 5 ecological screening level
2-Butanone (MEK)	2,200	USEPA 2003	USEPA Region 5 ecological screening level
2-Chloro-1,3-butadiene	NA	---	---
2-Hexanone	99.0	USEPA 2003	USEPA Region 5 ecological screening level
3-Chloro-1-propene	3.40	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Xenopus laevis* [African clawed frog]) with a safety factor of 100
4-Methyl-2-pentanone (MIBK)	170	USEPA 2003	USEPA Region 5 ecological screening level
Acetone	1,700	USEPA 2003	USEPA Region 5 ecological screening level
Acetonitrile	12,000	USEPA 2003	USEPA Region 5 ecological screening level
Acrolein	0.19	USEPA 2003	USEPA Region 5 ecological screening level
Acrylonitrile	66.0	USEPA 2003	USEPA Region 5 ecological screening level
Benzene	53.0	USEPA 2001	USEPA Region 4 chronic screening value
Bromoform	230	USEPA 2003	USEPA Region 5 ecological screening level
Bromomethane	16.0	USEPA 2003	USEPA Region 5 ecological screening level
Carbon disulfide	15.0	USEPA 2003	USEPA Region 5 ecological screening level
Carbon tetrachloride	240	USEPA 2003	USEPA Region 5 ecological screening level
Chlorobenzene	47.0	USEPA 2003	USEPA Region 5 ecological screening level
Chlorodibromomethane	340	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Cyprinus carpio* [common carp]) with a safety factor of 100
Chloroform	140	USEPA 2003	USEPA Region 5 ecological screening level
Chloromethane	5,500	USEPA 2001	USEPA Region 4 chronic screening value
cis-1,3-Dichloropropene	24.4	USEPA 2001	USEPA Region 4 chronic screening value
Dibromomethane	220	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50
Dichlorobromomethane	2,400	USEPA 2007a	Minimum acute value (24-hr LC_{50} for *Tetrahymena pyriformis* [ciliate]) with a safety factor of 100
Dichlorodifluoromethane	220	---	Value for trichlorofluoromethane used as a surrogate
Ethylene dibromide	150	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Micropterus salmoides* [largemouth bass]) with a safety factor of 100
Ethyl methacrylate	18,000	USEPA 2007a	Minimum chronic value (21-day NOEC for *Daphnia magna* [cladoceron] based on reproduction [progeny counts])
Iodomethane	NA	---	---
Isobutyl alcohol	4,000	USEPA 2007a	Minimum chronic value (21-day NOEC for *Daphnia magna* [cladoceron] based on reproduction)
Methacrylonitrile	NA	---	---
Methylene chloride	159	USEPA 2003	USEPA Region 5 ecological screening level
Methyl methacrylate	2,800	USEPA 2003	USEPA Region 5 ecological screening level
Pentachloroethane	56.4	USEPA 2003	USEPA Region 5 ecological screening level
Propionitrile	15,200	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
Styrene	32.0	USEPA 2003	USEPA Region 5 ecological screening level
Toluene	175	USEPA 2001	USEPA Region 4 chronic screening value
trans-1,2-dichloroethene	970	USEPA 2003	USEPA Region 5 ecological screening level
trans-1,3-Dichloropropene	24.4	USEPA 2001	USEPA Region 4 chronic screening value
trans-1,4-Dichloro-2-butene	NA	---	---
Trichloroethene	47.0	USEPA 2003	USEPA Region 5 ecological screening level

TABLE
SURFACE WATER SCREENING VALUES USED IN THE DERIVATION OF EQUILIBRIUM-PARTITIONING-BASED SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical (1)	Surface Water Screening Value (2)	Reference	Comment (3)
Volatile Organics (ug/L):			
Trichlorofluoromethane	220	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50
Vinyl acetate	248	USEPA 2003	USEPA Region 5 ecological screening level
Vinyl chloride	930	USEPA 2003	USEPA Region 5 ecological screening level
Semi-Volatile Organics (ug/L):			
1,2,4,5-Tetrachlorobenzene	3.00	USEPA 2003	USEPA Region 5 ecological screening level
1,3,5-Trinitrobenzene	80.0	USEPA 2007a	Minimum chronic value (71-day NOEC for *Oncorhynchus mykiss* [rainbow trout] based on reproduction)
1,1-Biphenyl	230	USEPA 2007a	Minimum acute value (21-day MATC for *Daphnia magna* [cladoceron] based on reproduction)
1,3-Dichlorobenzene	38.0	USEPA 2003	USEPA Region 5 ecological screening level
1,3-Dinitrobenzene	22.0	USEPA 2003	USEPA Region 5 ecological screening level
1,4-Dioxane	22,000	USEPA 2003	USEPA Region 5 ecological screening level
2,2'-Oxybis(1-chloropropane)	NA	---	---
1,4-Naphthoquinone	0.40	USEPA 2007a	Minimum acute value (14-day LC_{50} for *Oscillatoria* sp. [blue-green algae] based on population growth rates) with a safety factor of 100
2,3,4,6-Tetrachlorophenol	1.20	USEPA 2003	USEPA Region 5 ecological screening level
2,4-Dinitrophenol	6.20	USEPA 2001	USEPA Region 4 chronic screening value
2,4-Dinitrotoluene	44.0	USEPA 2003	USEPA Region 5 ecological screening level
2,6-Dichlorophenol	34.0	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) based on immobilization) with a safety factor of 100
2,6-Dinitrotoluene	81.0	USEPA 2003	USEPA Region 5 ecological screening level
2-Acetylaminofluorene	20.0	USEPA 2007a	Minimum acute value (96-hr LOEC for *Xenopus laevis* [African clawed frog] based on growth [length]) with a safety factor of 50
2-Chloronaphthalene	32.0	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50
2-Naphthylamine	NA	---	---
2-Nitroaniline	48.9	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) based on immobilization) with a safety factor of 100
2-Nitrophenol	3,500	USEPA 2001	USEPA Region 4 chronic screening value
2-Picoline	8,970	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
2-Toluidine	5.2	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Daphnia magna* [cladoceron]) with a safety factor of 100
3,3'-Dichlorobenzidine	4.5	USEPA 2003	USEPA Region 5 ecological screening level
3,3'-Dimethylbenzidine	160	USEPA 2007a	Minimum chronic value (21-day NOEC for *Daphnia magna* [cladoceron] based on reproduction)
3-Methylcholanthrene	NA	---	---
3-Nitroaniline	9.80	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) based on immobilization) with a safety factor of 100
4,6-Dinitro-2-methylphenol	23.0	USEPA 2003	USEPA Region 5 ecological screening level
4-Aminobiphenyl	NA	---	---
4-Chloro-3-methylphenol	0.30	USEPA 2001	USEPA Region 4 chronic screening value
4-Chloroaniline	232	USEPA 2003	USEPA Region 5 ecological screening level
4-Nitroaniline	170	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) based on immobilization) with a safety factor of 100
4-Nitrophenol	60.0	USEPA 2003	USEPA Region 5 ecological screening level
4-Nitroquinoline-1-oxide	NA	---	---
7,12-Dimethylbenz(a)anthracene	6.00 (4)	Buchman 2008	Acute LOEL for chemical class with a safety factor of 50 (value for high molecular weight PAHs)
Acetophenone	1,550	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	4.10	USEPA 2003	USEPA Region 5 ecological screening level
Aramite (total)	3.09	USEPA 2003	USEPA Region 5 ecological screening level
bis(2-Chloroethoxy)methane	1,840	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	USEPA 2001	USEPA Region 4 chronic screening value
bis(2-Ethylhexyl)phthalate	0.30	USEPA 2003	USEPA Region 5 ecological screening level
Diallate	82.0	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Rasbora heteromorpha* [harlequinfish]) with a safety factor of 100
Diethyl phthalate	110	USEPA 2003	USEPA Region 5 ecological screening level
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	0.48	USEPA 2003	USEPA Region 5 ecological screening level
Ethyl methanesulfonate	40.0	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Clarias batrachus* [walking catfish]) with a safety factor of 100

TABLE
SURFACE WATER SCREENING VALUES USED IN THE DERIVATION OF EQUILIBRIUM-PARTITIONING-BASED SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical (1)	Surface Water Screening Value (2)	Reference	Comment (3)
Semi-Volatile Organics (ug/L):			
Hexachlorocyclopentadiene	0.07	USEPA 2001	USEPA Region 4 chronic screening value
Hexachlorophene	8.80	USEPA 2007a	Minimum chronic value (34-day NOEC for *Pimephales promelas* [fathead minnow] based on growth)
Hexachloropropene	NA	---	---
Isophorone	920	USEPA 2003	USEPA Region 5 ecological screening level
Isosafrole	NA	---	---
Methapyrilene	NA	---	---
Methyl methanesulfonate	NA	---	---
N-Nitro-o-toluidine	220	USEPA 2007a	Minimum acute value (48-hr EC_{50} for *Daphnia magna* [cladoceron]) based on immobilization) with a safety factor of 100
N-Nitrosodimethylamine	25.0	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitroso-di-n-butylamine	25.0	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitroso-di-n-propylamine	25.0	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitrosodiphenylamine	25.0	USEPA 2007b	Indiana Department of Environmental Management Great Lakes Basin Tier II chronic criterion
N-Nitrosomethylethylamine	25.0	---	Value for N-nitrosodiphenylamine used as a surrogate
N-Nitrosomorpholine	NA	---	---
N-Nitrosopiperidine	NA	---	---
N-Nitrosopyrrolidine	NA	---	---
p-Dimethylamino azobenzene	NA	---	---
Pentachlorobenzene	0.019	USEPA 2003	USEPA Region 5 ecological screening level
Pentachloronitrobenzene	1.00	USEPA 2007a	Minimum acute value (96-hr LC_{50} for *Lepomis macrochirus* [bluegill]) with a safety factor of 100
Phenacetin	NA	---	---
p-Phenylene diamine	200	USEPA 2007a	Minimum acute value (48-hr LC_{50} for *Oryzias latipes* [medaka, high-eyes]) with a safety factor of 100
Pronamide	7.60	USEPA 2007a	Minimum acute value (120-hr EC_{50} for *Pseudokirchneriella subcapitata* [green algae] based on abundance) with a safety factor of 100
Pyridine	2,380	USEPA 2003	USEPA Region 5 ecological screening level
Safrole	NA	---	---

Notes:

NA = Not Available
LOEL = Lowest Observed Effect Level
NOEC = No Observed Effect Concentration
MATC = Maximum Acceptable Toxicant Concentration
PAH = Polynuclear Aromatic Hydrocarbon
USEPA = United States Environmental Protection Agency
EC_{50} = Median Effective Concentration
LC_{50} = Median Lethal Concentration
ug/L = microgram per liter

(1) The chemicals shown are limited to those with sediment screeing values calculated using the USEPA (1993 and 1996)equilibrium-partitioning approach.
(2) The values shown are freshwater screening values unless otherwise noted.
(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).
(4) The chemical lacks a freshwater toxicological benchmark and literature-based toxicity test data. The value shown is a marine/estuarine screening value.

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.

USEPA. 2007a. ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. http:/www.epa.gov/ecotox/. Assessed June 10, 2008, June 11, 2008, January 8, 2009, And August 28, 2009.

TABLE
SURFACE WATER SCREENING VALUES USED IN THE DERIVATION OF EQUILIBRIUM-PARTITIONING-BASED SEDIMENT SCREENING VALUES
SWMU 56 - HANGAR 200 APRON
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table References (continued):

USEPA 2007b. Great Lakes Inititiative Toxicity Data Clearinghouse. http://www.epa.gov/gliclearinghouse/. Accessed January 8, 2009.

USEPA. 2003. USEPA Region 5 Ecological Screening Levels Table. http://www.epa.gov/reg5rcra/ca/ESL.pdf.

USEPA. 2001. Region 4 Ecological Risk Assessment Bulletins - Supplement to RQGS. Waste Management Division, Atlanta, GA. http://www.epa.gov/region04/waste/ots/ecolbul.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.

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.

APPENDIX F
IDENTIFICATION OF BIOACCUMULATIVE CHEMICALS

APPENDIX F

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.

$$Log\ BCF = [(0.79)(log\ K_{ow}) - 0.40] \qquad \text{(Equation F-1)}$$

- 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 F-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 at SWMU 56. 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 F References

Connell, D.W. 1990. Bioaccumulation of Xenobiotic Compounds. CRC Press, Inc., Boca Raton, Florida. 219 pp.

U.S. Environmental Protection Agency (USEPA). 2000. Defining Persistent, Bioaccumulative and Toxic Great Lakes Contaminants and Research Need. EPA Region 5 web page. http://www.epa.gov/grtlakes/toxteam/pbtrept/index.html.

USEPA. 1998. Waste Minimization Prioritization Tool Spreadsheet Document for the RCRA Waste Minimization PBT Chemical List. Docket Number F-98-MMLP-FFFFF. November 9, 1998. http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist/index.htm.

USEPA. 1996. Superfund Chemical Data Matrix. EPA/540/R-96/028.

USEPA. 1995a. Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors. EPA/820/B-95/005.

USEPA. 1995b. Water Quality Guidance for the Great Lakes System: Supplementary Information Document (SID). Office of Water. EPA/820/B-95/001.

USEPA. 1995c. Internal Report on Summary of Measured, Calculated and Recommended log K_{ow} Values. Environmental Research Laboratory, Athens, GA.

USEPA. 1985. Technical Support Document for Water Quality-Based Toxics Control. EPA/440/4-85/032.
USEPA. 1980. Proceedings of the EPA Workshop on the Environmental Scoring of Chemicals. EPA/560/11-80/010.

USEPA/ACOE. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual). EPA/823/B-98/004.

Garten, C.T. Jr. and J.R. Trabalka. 1983. Evaluation of Models for Predicting Terrestrial Food Chain Behavior of Xenobiotics. Environ. Sci. Technol. 17:590-595.

Gobas, F. and D. Mackay. 1990. Biosorption, Bioaccumulation and Food Chain Transfer of Organic Chemicals. Ontario Ministry of the Environment. ISBN 0-7729-6823-3.

Maki, A.W. and J.R. Duthie. 1978. Summary of Proposed Procedures for the Evaluation of Aquatic Hazard. Pages 153-163 *In* Cairns, J., Jr., K.L. Dickson, and A.W. Maki (eds.), Estimating the Hazard of Chemical Substances to Aquatic Life. ASTM STP 657.

Suter, G.W. II. 1993. Ecological Risk Assessment. Lewis Publishers, Boca Raton, FL. 538 pp.

APPENDIX G
ProUCL COPC CALCULATIONS

Drainage Ditch Sediment: Arsenic

General Statistics

Number of Valid Data	14	Number of Detected Data	13
Number of Distinct Detected Data	13	Number of Non-Detect Data	1
		Percent Non-Detects	7.14%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.96	Minimum Detected	-0.0408
Maximum Detected	10.4	Maximum Detected	2.342
Mean of Detected	3.32	Mean of Detected	1.004
SD of Detected	2.411	SD of Detected	0.648
Minimum Non-Detect	1.1	Minimum Non-Detect	0.0953
Maximum Non-Detect	1.1	Maximum Non-Detect	0.0953

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.758	Shapiro Wilk Test Statistic	0.943
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
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	3.122	Mean	0.889
SD	2.431	SD	0.755
95% DL/2 (t) UCL	4.273	95% H-Stat (DL/2) UCL	4.588
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.818	Mean in Log Scale	0.934
SD	2.76	SD in Log Scale	0.675
95% MLE (t) UCL	4.124	Mean in Original Scale	3.156
95% MLE (Tiku) UCL	4.146	SD in Original Scale	2.396
		95% Percentile Bootstrap UCL	4.221
		95% BCA Bootstrap UCL	4.74
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.13	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1.559		
nu star	55.38	Nonparametric Statistics	
		Kaplan-Meier (KM) Method	
A-D Test Statistic	0.418	Mean	3.153
5% A-D Critical Value	0.74	SD	2.312
K-S Test Statistic	0.74	SE of Mean	0.643
5% K-S Critical Value	0.239	95% KM (t) UCL	4.292
Data appear Gamma Distributed at 5% Significance Level		95% KM (z) UCL	4.211
		95% KM (jackknife) UCL	4.288
Assuming Gamma Distribution		95% KM (bootstrap t) UCL	4.968
Gamma ROS Statistics using Extrapolated Data		**95% KM (BCA) UCL**	**4.343**
Minimum	0.621	95% KM (Percentile Bootstrap) UCL	4.261
Maximum	10.4	95% KM (Chebyshev) UCL	5.956
Mean	3.127	97.5% KM (Chebyshev) UCL	7.169
Median	2.9	99% KM (Chebyshev) UCL	9.551
SD	2.426		
k star	1.79	**Potential UCL to use:**	
Theta star	1.747	**95% KM (BCA) UCL**	**4.343**
Nu star	50.11		
AppChi2	34.86		
95% Gamma Approximate UCL	4.496		
95% Adjusted Gamma UCL	4.724		

Note: DL/2 is not a recommended method.

Drainage Ditch Sediment: Barium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	13

Raw Statistics

Minimum	42
Maximum	571
Mean	125.7
Median	97
SD	132.4
Coefficient of Variation	1.054
Skewness	3.343

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.534
Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	188.3

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	217.7
95% Modified-t UCL	193.6

Gamma Distribution Test

k star (bias corrected)	1.724
Theta Star	72.89
MLE of Mean	125.7
MLE of Standard Deviation	95.7
nu star	48.27
Approximate Chi Square Value (.05)	33.33
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	31.68
Anderson-Darling Test Statistic	1.168
Anderson-Darling 5% Critical Value	0.745
Kolmogorov-Smirnov Test Statistic	0.269
Kolmogorov-Smirnov 5% Critical Value	0.231

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	182
95% Adjusted Gamma UCL	191.5

Log-transformed Statistics

Minimum of Log Data	3.738
Maximum of Log Data	6.347
Mean of log Data	4.581
SD of log Data	0.636

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.87
Shapiro Wilk Critical Value	0.874

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	178
95% Chebyshev (MVUE) UCL	208.3
97.5% Chebyshev (MVUE) UCL	247.5
99% Chebyshev (MVUE) UCL	324.7

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	183.9
95% Jackknife UCL	188.3
95% Standard Bootstrap UCL	181.9
95% Bootstrap-t UCL	323.1
95% Hall's Bootstrap UCL	426.1
95% Percentile Bootstrap UCL	194.3
95% BCA Bootstrap UCL	224.2
95% Chebyshev(Mean, Sd) UCL	**279.9**
97.5% Chebyshev(Mean, Sd) UCL	346.7
99% Chebyshev(Mean, Sd) UCL	477.8

Potential UCL to use:	
Use 95% Chebyshev (Mean, Sd) UCL	**279.9**

Drainage Ditch Sediment: Chromium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	19.8	Minimum of Log Data	2.986
Maximum	51	Maximum of Log Data	3.932
Mean	32.57	Mean of log Data	3.453
Median	29.45	SD of log Data	0.255
SD	8.562		
Coefficient of Variation	0.263		
Skewness	0.828		

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.939
Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	36.62

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	36.88
95% Modified-t UCL	36.71

Gamma Distribution Test

k star (bias corrected)	13.03
Theta Star	2.5
MLE of Mean	32.57
MLE of Standard Deviation	9.024
nu star	364.8
Approximate Chi Square Value (.05)	321.5
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	316.1
Anderson-Darling Test Statistic	0.289
Anderson-Darling 5% Critical Value	0.734
Kolmogorov-Smirnov Test Statistic	0.184
Kolmogorov-Smirnov 5% Critical Value	0.228

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	36.95
95% Adjusted Gamma UCL	37.58

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.975
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	37.21
95% Chebyshev (MVUE) UCL	42.29
97.5% Chebyshev (MVUE) UCL	46.5
99% Chebyshev (MVUE) UCL	54.78

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	36.34
95% Jackknife UCL	36.62
95% Standard Bootstrap UCL	36.11
95% Bootstrap-t UCL	37.88
95% Hall's Bootstrap UCL	37.34
95% Percentile Bootstrap UCL	36.33
95% BCA Bootstrap UCL	36.7
95% Chebyshev(Mean, Sd) UCL	42.55
97.5% Chebyshev(Mean, Sd) UCL	46.86
99% Chebyshev(Mean, Sd) UCL	55.34

Potential UCL to use:	
Use 95% Student's-t UCL	**36.62**

Drainage Ditch Sediment: Cobalt

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	13

Raw Statistics		**Log-transformed Statistics**	
Minimum	18	Minimum of Log Data	2.89
Maximum	91.4	Maximum of Log Data	4.515
Mean	40.19	Mean of log Data	3.6
Median	34.85	SD of log Data	0.438
SD	19.5		
Coefficient of Variation	0.485	**Lognormal Distribution Test**	
Skewness	1.495	Shapiro Wilk Test Statistic	0.974
		Shapiro Wilk Critical Value	0.874
Relevant UCL Statistics		Data appear Lognormal at 5% Significance Level	
Normal Distribution Test			
Shapiro Wilk Test Statistic	0.869	**Assuming Lognormal Distribution**	
Shapiro Wilk Critical Value	0.874	95% H-UCL	51.38
Data not Normal at 5% Significance Level		95% Chebyshev (MVUE) UCL	60.86
		97.5% Chebyshev (MVUE) UCL	69.89
Assuming Normal Distribution		99% Chebyshev (MVUE) UCL	87.63
95% Student's-t UCL	49.42		
95% UCLs (Adjusted for Skewness)		**Data Distribution**	
95% Adjusted-CLT UCL	50.99	Data appear Gamma Distributed at 5% Significance Level	
95% Modified-t UCL	49.77		
		Nonparametric Statistics	
Gamma Distribution Test		95% CLT UCL	48.77
k star (bias corrected)	4.357	95% Jackknife UCL	49.42
Theta Star	9.225	95% Standard Bootstrap UCL	48.54
MLE of Mean	40.19	95% Bootstrap-t UCL	54.53
MLE of Standard Deviation	19.26	95% Hall's Bootstrap UCL	55.29
nu star	122	95% Percentile Bootstrap UCL	48.61
Approximate Chi Square Value (.05)	97.49	95% BCA Bootstrap UCL	50.48
Adjusted Level of Significance	0.0312	95% Chebyshev(Mean, Sd) UCL	62.91
Adjusted Chi Square Value	94.59	97.5% Chebyshev(Mean, Sd) UCL	72.74
		99% Chebyshev(Mean, Sd) UCL	92.05
Anderson-Darling Test Statistic	0.317		
Anderson-Darling 5% Critical Value	0.738	**Potential UCL to use:**	
Kolmogorov-Smirnov Test Statistic	0.147	**Use 95% Approximate Gamma UCL**	**50.3**
Kolmogorov-Smirnov 5% Critical Value	0.229		
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution			
95% Approximate Gamma UCL	**50.3**		
95% Adjusted Gamma UCL	51.84		

Drainage Ditch Sediment: Copper

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	75.1	Minimum of Log Data	4.319
Maximum	130	Maximum of Log Data	4.868
Mean	100.3	Mean of log Data	4.595
Median	100	SD of log Data	0.164
SD	16.56		
Coefficient of Variation	0.165	**Lognormal Distribution Test**	
Skewness	0.43	Shapiro Wilk Test Statistic	0.958
		Shapiro Wilk Critical Value	0.874
Relevant UCL Statistics		Data appear Lognormal at 5% Significance Level	
Normal Distribution Test			
Shapiro Wilk Test Statistic	0.944	**Assuming Lognormal Distribution**	
Shapiro Wilk Critical Value	0.874	95% H-UCL	108.9
Data appear Normal at 5% Significance Level		95% Chebyshev (MVUE) UCL	119.5
		97.5% Chebyshev (MVUE) UCL	127.8
Assuming Normal Distribution		99% Chebyshev (MVUE) UCL	144.2
95% Student's-t UCL	**108.1**		
95% UCLs (Adjusted for Skewness)		**Data Distribution**	
95% Adjusted-CLT UCL	108.1	Data appear Normal at 5% Significance Level	
95% Modified-t UCL	108.2		
		Nonparametric Statistics	
Gamma Distribution Test		95% CLT UCL	107.6
k star (bias corrected)	31.5	95% Jackknife UCL	108.1
Theta Star	3.183	95% Standard Bootstrap UCL	107.3
MLE of Mean	100.3	95% Bootstrap-t UCL	109.1
MLE of Standard Deviation	17.86	95% Hall's Bootstrap UCL	108.9
nu star	882.1	95% Percentile Bootstrap UCL	107.7
Approximate Chi Square Value (.05)	814.2	95% BCA Bootstrap UCL	107.3
Adjusted Level of Significance	0.0312	95% Chebyshev(Mean, Sd) UCL	119.6
Adjusted Chi Square Value	805.5	97.5% Chebyshev(Mean, Sd) UCL	127.9
		99% Chebyshev(Mean, Sd) UCL	144.3
Anderson-Darling Test Statistic	0.264		
Anderson-Darling 5% Critical Value	0.733	**Potential UCL to use:**	
Kolmogorov-Smirnov Test Statistic	0.129	**Use 95% Student's-t UCL**	**108.1**
Kolmogorov-Smirnov 5% Critical Value	0.228		
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution			
95% Approximate Gamma UCL	108.6		
95% Adjusted Gamma UCL	109.8		

Drainage Ditch Sediment: Lead

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	13	Minimum of Log Data	2.565
Maximum	280	Maximum of Log Data	5.635
Mean	60.88	Mean of log Data	3.69
Median	35.9	SD of log Data	0.862
SD	73.3		
Coefficient of Variation	1.204		
Skewness	2.514		

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.922
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	107.3
95% Chebyshev (MVUE) UCL	116.3
97.5% Chebyshev (MVUE) UCL	142.4
99% Chebyshev (MVUE) UCL	193.6

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	93.1
95% Jackknife UCL	95.57
95% Standard Bootstrap UCL	91.27
95% Bootstrap-t UCL	177.3
95% Hall's Bootstrap UCL	247.5
95% Percentile Bootstrap UCL	95.92
95% BCA Bootstrap UCL	107.6
95% Chebyshev(Mean, Sd) UCL	146.3
97.5% Chebyshev(Mean, Sd) UCL	183.2
99% Chebyshev(Mean, Sd) UCL	255.8

Potential UCL to use:	
Use 95% Approximate Gamma UCL	**98.14**

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.64
Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	95.57

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	107.2
95% Modified-t UCL	97.77

Gamma Distribution Test

k star (bias corrected)	1.096
Theta Star	55.53
MLE of Mean	60.88
MLE of Standard Deviation	58.14
nu star	30.7
Approximate Chi Square Value (.05)	19.04
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	17.83
Anderson-Darling Test Statistic	0.915
Anderson-Darling 5% Critical Value	0.754
Kolmogorov-Smirnov Test Statistic	0.223
Kolmogorov-Smirnov 5% Critical Value	0.234

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	**98.14**
95% Adjusted Gamma UCL	104.8

Drainage Ditch Sediment: Mercury

General Statistics

Number of Valid Data	14
Number of Distinct Detected Data	11
Number of Detected Data	13
Number of Non-Detect Data	1
Percent Non-Detects	7.14%

Raw Statistics

Minimum Detected	0.052
Maximum Detected	0.38
Mean of Detected	0.114
SD of Detected	0.084
Minimum Non-Detect	0.039
Maximum Non-Detect	0.039

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.596
5% Shapiro Wilk Critical Value	0.866

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.107
SD	0.0846
95% DL/2 (t) UCL	0.147

Maximum Likelihood Estimate(MLE) Method

Mean	0.105
SD	0.0847
95% MLE (t) UCL	0.145
95% MLE (Tiku) UCL	0.143

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.847
Theta Star	0.04
nu star	74.03
A-D Test Statistic	1.093
5% A-D Critical Value	0.738
K-S Test Statistic	0.738
5% K-S Critical Value	0.238

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.0023
Maximum	0.38
Mean	0.106
Median	0.09
SD	0.0861
k star	1.32
Theta star	0.0802
Nu star	36.95
AppChi2	24.04
95% Gamma Approximate UCL	0.163
95% Adjusted Gamma UCL	0.173

Note: DL/2 is not a recommended method.

Log-transformed Statistics

Minimum Detected	-2.957
Maximum Detected	-0.968
Mean of Detected	-2.317
SD of Detected	0.494
Minimum Non-Detect	-3.244
Maximum Non-Detect	-3.244

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.85
5% Shapiro Wilk Critical Value	0.866

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-2.433
SD	0.643
95% H-Stat (DL/2) UCL	0.15

Log ROS Method

Mean in Log Scale	-2.398
SD in Log Scale	0.562
Mean in Original Scale	0.108
SD in Original Scale	0.0836
95% Percentile Bootstrap UCL	0.148
95% BCA Bootstrap UCL	0.17

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.109
SD	0.0794
SE of Mean	0.0221
95% KM (t) UCL	0.148
95% KM (z) UCL	0.146
95% KM (jackknife) UCL	0.148
95% KM (bootstrap t) UCL	0.213
95% KM (BCA) UCL	0.154
95% KM (Percentile Bootstrap) UCL	0.147
95% KM (Chebyshev) UCL	**0.206**
97.5% KM (Chebyshev) UCL	0.247
99% KM (Chebyshev) UCL	0.329

Potential UCLs to use:	
95% KM (Chebyshev) UCL	**0.206**

Drainage Ditch Sediment: Nickel

General Statistics

Number of Valid Observations	14
Number of Distinct Observations	13

Raw Statistics

Minimum	8.7
Maximum	19.1
Mean	13.05
Median	11.7
SD	3.77
Coefficient of Variation	0.289
Skewness	0.736

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	14.83

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	14.92
95% Modified-t UCL	14.87

Gamma Distribution Test

k star (bias corrected)	10.94
Theta Star	1.192
MLE of Mean	13.05
MLE of Standard Deviation	3.945
nu star	306.4
Approximate Chi Square Value (.05)	266.9
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	262
Anderson-Darling Test Statistic	0.623
Anderson-Darling 5% Critical Value	0.734
Kolmogorov-Smirnov Test Statistic	0.169
Kolmogorov-Smirnov 5% Critical Value	0.229

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	**14.98**
95% Adjusted Gamma UCL	15.26

Log-transformed Statistics

Minimum of Log Data	2.163
Maximum of Log Data	2.95
Mean of log Data	2.532
SD of log Data	0.276

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.902
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	15.09
95% Chebyshev (MVUE) UCL	17.27
97.5% Chebyshev (MVUE) UCL	19.1
99% Chebyshev (MVUE) UCL	22.7

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	14.71
95% Jackknife UCL	14.83
95% Standard Bootstrap UCL	14.64
95% Bootstrap-t UCL	15.13
95% Hall's Bootstrap UCL	14.62
95% Percentile Bootstrap UCL	14.62
95% BCA Bootstrap UCL	14.89
95% Chebyshev(Mean, Sd) UCL	17.44
97.5% Chebyshev(Mean, Sd) UCL	19.34
99% Chebyshev(Mean, Sd) UCL	23.08

Potential UCL to use:	
Use 95% Approximate Gamma UCL	**14.98**

Drainage Ditch Sediment: Selenium

General Statistics

Number of Valid Data	14	Number of Detected Data	9
Number of Distinct Detected Data	7	Number of Non-Detect Data	5
		Percent Non-Detects	35.71%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.99	Minimum Detected	-0.0101
Maximum Detected	4.2	Maximum Detected	1.435
Mean of Detected	1.788	Mean of Detected	0.485
SD of Detected	0.976	SD of Detected	0.433
Minimum Non-Detect	0.46	Minimum Non-Detect	-0.777
Maximum Non-Detect	1.4	Maximum Non-Detect	0.336

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	9
Number treated as Detected	5
Single DL Non-Detect Percentage	64.29%

Warning: There are only 9 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

Shapiro Wilk Test Statistic	0.727
5% Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Assuming Normal Distribution
DL/2 Substitution Method

Mean	1.334
SD	0.998
95% DL/2 (t) UCL	1.807

Maximum Likelihood Estimate(MLE) Method

Mean	0.77
SD	1.516
95% MLE (t) UCL	1.487
95% MLE (Tiku) UCL	1.878

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.645
Theta Star	0.49
nu star	65.61
A-D Test Statistic	0.647
5% A-D Critical Value	0.723
K-S Test Statistic	0.723
5% K-S Critical Value	0.28

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution
Gamma ROS Statistics using Extrapolated Data

Minimum	0.99
Maximum	4.2
Mean	1.712
Median	1.474
SD	0.782
k star	6.101
Theta star	0.281
Nu star	170.8
AppChi2	141.6
95% Gamma Approximate UCL	2.065
95% Adjusted Gamma UCL	2.118

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.879
5% Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution
DL/2 Substitution Method

Mean	0.0522
SD	0.734
95% H-Stat (DL/2) UCL	1.437

Log ROS Method

Mean in Log Scale	0.192
SD in Log Scale	0.542
Mean in Original Scale	1.408
SD in Original Scale	0.934
95% Percentile Bootstrap UCL	1.848
95% BCA Bootstrap UCL	1.959

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics
Kaplan-Meier (KM) Method

Mean	1.515
SD	0.825
SE of Mean	0.234
95% KM (t) UCL	1.93
95% KM (z) UCL	1.9
95% KM (jackknife) UCL	1.893
95% KM (bootstrap t) UCL	2.353
95% KM (BCA) UCL	2.064
95% KM (Percentile Bootstrap) UCL	**1.943**
95% KM (Chebyshev) UCL	2.536
97.5% KM (Chebyshev) UCL	2.978
99% KM (Chebyshev) UCL	3.846

Potential UCLs to use:	
95% KM (Percentile Bootstrap) UCL	**1.943**

Note: DL/2 is not a recommended method.

Drainage Ditch Sediment: Tin

General Statistics

Number of Valid Data	14
Number of Distinct Detected Data	8
Number of Detected Data	8
Number of Non-Detect Data	6
Percent Non-Detects	42.86%

Raw Statistics

Minimum Detected	4.6
Maximum Detected	16
Mean of Detected	10.69
SD of Detected	3.864
Minimum Non-Detect	7.8
Maximum Non-Detect	23

Log-transformed Statistics

Minimum Detected	1.526
Maximum Detected	2.773
Mean of Detected	2.302
SD of Detected	0.41
Minimum Non-Detect	2.054
Maximum Non-Detect	3.135

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	14
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 8 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

Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution
DL/2 Substitution Method

Mean	9.046
SD	3.824
95% DL/2 (t) UCL	10.86

Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	4.86
Theta Star	2.199
nu star	77.77
A-D Test Statistic	0.233
5% A-D Critical Value	0.717
K-S Test Statistic	0.717
5% K-S Critical Value	0.295

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution
Gamma ROS Statistics using Extrapolated Data

Minimum	4.6
Maximum	16
Mean	10.79
Median	10.92
SD	3.088
k star	8.995
Theta star	1.2
Nu star	251.9
AppChi2	216.1
95% Gamma Approximate UCL	12.58
95% Adjusted Gamma UCL	12.84

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.936
5% Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution
DL/2 Substitution Method

Mean	2.115
SD	0.442
95% H-Stat (DL/2) UCL	17.29

Log ROS Method

Mean in Log Scale	2.18
SD in Log Scale	0.345
Mean in Original Scale	9.351
SD in Original Scale	3.315
95% Percentile Bootstrap UCL	10.79
95% BCA Bootstrap UCL	11.01

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics
Kaplan-Meier (KM) Method

Mean	9.49
SD	3.586
SE of Mean	1.201
95% KM (t) UCL	**11.62**
95% KM (z) UCL	11.47
95% KM (jackknife) UCL	11.78
95% KM (bootstrap t) UCL	11.71
95% KM (BCA) UCL	11.62
95% KM (Percentile Bootstrap) UCL	**11.53**
95% KM (Chebyshev) UCL	14.72
97.5% KM (Chebyshev) UCL	16.99
99% KM (Chebyshev) UCL	21.44

Potential UCLs to use:	
95% KM (t) UCL	**11.62**
95% KM (Percentile Bootstrap) UCL	**11.53**

Drainage Ditch Sediment: Vanadium

General Statistics

Number of Valid Observations	14
Number of Distinct Observations	14

Raw Statistics

Minimum	147
Maximum	260
Mean	196.2
Median	186.5
SD	33.83
Coefficient of Variation	0.172
Skewness	0.75

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.911
Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**212.2**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	213
95% Modified-t UCL	212.5

Gamma Distribution Test

k star (bias corrected)	30
Theta Star	6.542
MLE of Mean	196.2
MLE of Standard Deviation	35.83
nu star	839.9
Approximate Chi Square Value (.05)	773.6
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	765.2
Anderson-Darling Test Statistic	0.513
Anderson-Darling 5% Critical Value	0.733
Kolmogorov-Smirnov Test Statistic	0.2
Kolmogorov-Smirnov 5% Critical Value	0.228

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	213
95% Adjusted Gamma UCL	215.4

Log-transformed Statistics

Minimum of Log Data	4.99
Maximum of Log Data	5.561
Mean of log Data	5.266
SD of log Data	0.167

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.938
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	213.4
95% Chebyshev (MVUE) UCL	234.4
97.5% Chebyshev (MVUE) UCL	250.9
99% Chebyshev (MVUE) UCL	283.4

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	211.1
95% Jackknife UCL	212.2
95% Standard Bootstrap UCL	210.2
95% Bootstrap-t UCL	216.6
95% Hall's Bootstrap UCL	212.7
95% Percentile Bootstrap UCL	211
95% BCA Bootstrap UCL	211.4
95% Chebyshev(Mean, Sd) UCL	235.6
97.5% Chebyshev(Mean, Sd) UCL	252.7
99% Chebyshev(Mean, Sd) UCL	286.2

Potential UCL to use:	
Use 95% Student's-t UCL	**212.2**

Drainage Ditch Sediment: Zinc

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	13

Raw Statistics			
Minimum	69.2		
Maximum	140		
Mean	97.13		
Median	95.7		
SD	17.98		
Coefficient of Variation	0.185		
Skewness	0.89		

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.948
Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**105.6**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	106.3
95% Modified-t UCL	105.8

Gamma Distribution Test

k star (bias corrected)	26.04
Theta Star	3.73
MLE of Mean	97.13
MLE of Standard Deviation	19.04
nu star	729
Approximate Chi Square Value (.05)	667.4
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	659.5
Anderson-Darling Test Statistic	0.233
Anderson-Darling 5% Critical Value	0.734
Kolmogorov-Smirnov Test Statistic	0.125
Kolmogorov-Smirnov 5% Critical Value	0.228

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	106.1
95% Adjusted Gamma UCL	107.4

Log-transformed Statistics

Minimum of Log Data	4.237
Maximum of Log Data	4.942
Mean of log Data	4.561
SD of log Data	0.179

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.979
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	106.4
95% Chebyshev (MVUE) UCL	117.5
97.5% Chebyshev (MVUE) UCL	126.3
99% Chebyshev (MVUE) UCL	143.6

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	105
95% Jackknife UCL	105.6
95% Standard Bootstrap UCL	104.7
95% Bootstrap-t UCL	107.2
95% Hall's Bootstrap UCL	111
95% Percentile Bootstrap UCL	105
95% BCA Bootstrap UCL	105.9
95% Chebyshev(Mean, Sd) UCL	118.1
97.5% Chebyshev(Mean, Sd) UCL	127.1
99% Chebyshev(Mean, Sd) UCL	145

Potential UCL to use:	
Use 95% Student's-t UCL	**105.6**

Surface Soil: Beryllium

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	0.053	Minimum of Log Data	-2.937
Maximum	0.34	Maximum of Log Data	-1.079
Mean	0.192	Mean of log Data	-1.794
Median	0.195	SD of log Data	0.621
SD	0.098		
Coefficient of Variation	0.51		
Skewness	0.0574		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.962
Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**0.258**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.25
95% Modified-t UCL	0.258

Gamma Distribution Test

k star (bias corrected)	2.331
Theta Star	0.0825
MLE of Mean	0.192
MLE of Standard Deviation	0.126
nu star	37.29
Approximate Chi Square Value (.05)	24.31
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	21.69
Anderson-Darling Test Statistic	0.275
Anderson-Darling 5% Critical Value	0.72
Kolmogorov-Smirnov Test Statistic	0.229
Kolmogorov-Smirnov 5% Critical Value	0.296

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.295
95% Adjusted Gamma UCL	0.331

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.928
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	0.369
95% Chebyshev (MVUE) UCL	0.387
97.5% Chebyshev (MVUE) UCL	0.469
99% Chebyshev (MVUE) UCL	0.631

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.249
95% Jackknife UCL	0.258
95% Standard Bootstrap UCL	0.246
95% Bootstrap-t UCL	0.259
95% Hall's Bootstrap UCL	0.246
95% Percentile Bootstrap UCL	0.245
95% BCA Bootstrap UCL	0.246
95% Chebyshev(Mean, Sd) UCL	0.343
97.5% Chebyshev(Mean, Sd) UCL	0.409
99% Chebyshev(Mean, Sd) UCL	0.537

Potential UCL to use:	
Use 95% Student's-t UCL	**0.258**

Surface Soil: Cadmium

General Statistics

Number of Valid Data	8	Number of Detected Data	7
Number of Distinct Detected Data	6	Number of Non-Detect Data	1
		Percent Non-Detects	12.50%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.055	Minimum Detected	-2.9
Maximum Detected	3.3	Maximum Detected	1.194
Mean of Detected	0.586	Mean of Detected	-1.612
SD of Detected	1.197	SD of Detected	1.304
Minimum Non-Detect	0.038	Minimum Non-Detect	-3.27
Maximum Non-Detect	0.038	Maximum Non-Detect	-3.27

Warning: There are only 7 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

Shapiro Wilk Test Statistic	0.488
5% Shapiro Wilk Critical Value	0.803

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.516
SD	1.127
95% DL/2 (t) UCL	1.27

Maximum Likelihood Estimate(MLE) Method

Mean	0.419
SD	1.149
95% MLE (t) UCL	1.189
95% MLE (Tiku) UCL	1.142

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.425
Theta Star	1.381
nu star	5.944
A-D Test Statistic	1.436
5% A-D Critical Value	0.747
K-S Test Statistic	0.747
5% K-S Critical Value	0.326

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1.00E-09
Maximum	3.3
Mean	0.513
Median	0.155
SD	1.128
k star	0.219
Theta star	2.338
Nu star	3.511
AppChi2	0.539
95% Gamma Approximate UCL	3.344
95% Adjusted Gamma UCL	5.661

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.736
5% Shapiro Wilk Critical Value	0.803

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-1.906
SD	1.466
95% H-Stat (DL/2) UCL	3.679

Log ROS Method	
Mean in Log Scale	-1.962
SD in Log Scale	1.56
Mean in Original Scale	0.515
SD in Original Scale	1.127
95% Percentile Bootstrap UCL	1.298
95% BCA Bootstrap UCL	1.71

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.52
SD	1.052
SE of Mean	0.402
95% KM (t) UCL	1.281
95% KM (z) UCL	1.181
95% KM (jackknife) UCL	1.269
95% KM (bootstrap t) UCL	15.51
95% KM (BCA) UCL	1.336
95% KM (Percentile Bootstrap) UCL	1.318
95% KM (Chebyshev) UCL	2.271
97.5% KM (Chebyshev) UCL	**3.028**
99% KM (Chebyshev) UCL	4.516

Potential UCLs to use:	
97.5% KM (Chebyshev) UCL	**3.028**

Surface Soil: Chromium

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	6.3	Minimum of Log Data	1.841
Maximum	54	Maximum of Log Data	3.989
Mean	28.41	Mean of log Data	3.182
Median	23	SD of log Data	0.666
SD	15.82		
Coefficient of Variation	0.557		
Skewness	0.575		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**39.01**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	38.83
95% Modified-t UCL	39.2

Gamma Distribution Test

k star (bias corrected)	2.076
Theta Star	13.68
MLE of Mean	28.41
MLE of Standard Deviation	19.72
nu star	33.22
Approximate Chi Square Value (.05)	21.04
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	18.63
Anderson-Darling Test Statistic	0.326
Anderson-Darling 5% Critical Value	0.721
Kolmogorov-Smirnov Test Statistic	0.191
Kolmogorov-Smirnov 5% Critical Value	0.296

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	44.86
95% Adjusted Gamma UCL	50.66

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.905
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	58.86
95% Chebyshev (MVUE) UCL	59.52
97.5% Chebyshev (MVUE) UCL	72.67
99% Chebyshev (MVUE) UCL	98.49

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	37.61
95% Jackknife UCL	39.01
95% Standard Bootstrap UCL	36.88
95% Bootstrap-t UCL	44.63
95% Hall's Bootstrap UCL	45.64
95% Percentile Bootstrap UCL	37.63
95% BCA Bootstrap UCL	38.25
95% Chebyshev(Mean, Sd) UCL	52.8
97.5% Chebyshev(Mean, Sd) UCL	63.35
99% Chebyshev(Mean, Sd) UCL	84.07

Potential UCL to use:	
Use 95% Student's-t UCL	**39.01**

Surface Soil: Cobalt

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	2.6	Minimum of Log Data	0.956
Maximum	50	Maximum of Log Data	3.912
Mean	19.45	Mean of log Data	2.568
Median	18	SD of log Data	1.046
SD	16.19		
Coefficient of Variation	0.832		
Skewness	0.859		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.904
Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**30.29**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	30.72
95% Modified-t UCL	30.58

Gamma Distribution Test

k star (bias corrected)	0.955
Theta Star	20.37
MLE of Mean	19.45
MLE of Standard Deviation	19.91
nu star	15.28
Approximate Chi Square Value (.05)	7.454
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	6.125
Anderson-Darling Test Statistic	0.284
Anderson-Darling 5% Critical Value	0.73
Kolmogorov-Smirnov Test Statistic	0.205
Kolmogorov-Smirnov 5% Critical Value	0.299

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	39.86
95% Adjusted Gamma UCL	48.51

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.937
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	91.42
95% Chebyshev (MVUE) UCL	54.45
97.5% Chebyshev (MVUE) UCL	69.11
99% Chebyshev (MVUE) UCL	97.91

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	28.86
95% Jackknife UCL	30.29
95% Standard Bootstrap UCL	28.41
95% Bootstrap-t UCL	33.12
95% Hall's Bootstrap UCL	30.64
95% Percentile Bootstrap UCL	27.9
95% BCA Bootstrap UCL	29.5
95% Chebyshev(Mean, Sd) UCL	44.4
97.5% Chebyshev(Mean, Sd) UCL	55.19
99% Chebyshev(Mean, Sd) UCL	76.39

Potential UCL to use:	
Use 95% Student's-t UCL	**30.29**

Surface Soil: Copper

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	31	Minimum of Log Data	3.434
Maximum	130	Maximum of Log Data	4.868
Mean	73.38	Mean of log Data	4.215
Median	69.5	SD of log Data	0.439
SD	30.84		
Coefficient of Variation	0.42		
Skewness	0.691		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**94.04**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	94.16
95% Modified-t UCL	94.48

Gamma Distribution Test

k star (bias corrected)	4.062
Theta Star	18.06
MLE of Mean	73.38
MLE of Standard Deviation	36.41
nu star	64.99
Approximate Chi Square Value (.05)	47.44
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	43.67
Anderson-Darling Test Statistic	0.133
Anderson-Darling 5% Critical Value	0.718
Kolmogorov-Smirnov Test Statistic	0.1
Kolmogorov-Smirnov 5% Critical Value	0.295

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	100.5
95% Adjusted Gamma UCL	109.2

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.987
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	108.4
95% Chebyshev (MVUE) UCL	123.9
97.5% Chebyshev (MVUE) UCL	145.6
99% Chebyshev (MVUE) UCL	188.3

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	91.31
95% Jackknife UCL	94.04
95% Standard Bootstrap UCL	90.23
95% Bootstrap-t UCL	99.09
95% Hall's Bootstrap UCL	110.6
95% Percentile Bootstrap UCL	90.88
95% BCA Bootstrap UCL	92.25
95% Chebyshev(Mean, Sd) UCL	120.9
97.5% Chebyshev(Mean, Sd) UCL	141.5
99% Chebyshev(Mean, Sd) UCL	181.9

Potential UCL to Use	
Use 95% Student's-t UCL	**94.04**

Surface Soil: Lead

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	0.88	Minimum of Log Data	-0.128
Maximum	210	Maximum of Log Data	5.347
Mean	25.78	Mean of log Data	2.076
Median	6	SD of log Data	1.332
SD	56.92		
Coefficient of Variation	2.208		
Skewness	3.083		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.455	Shapiro Wilk Test Statistic	0.798
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	52.73	95% H-UCL	67.34
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	47.71
95% Adjusted-CLT UCL	64.2	97.5% Chebyshev (MVUE) UCL	60.8
95% Modified-t UCL	54.82	99% Chebyshev (MVUE) UCL	86.51

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Gamma Distribution Test		Nonparametric Statistics	
k star (bias corrected)	0.468	95% CLT UCL	50.81
Theta Star	55.05	95% Jackknife UCL	52.73
MLE of Mean	25.78	95% Standard Bootstrap UCL	50.25
MLE of Standard Deviation	37.67	95% Bootstrap-t UCL	553
nu star	13.12	95% Hall's Bootstrap UCL	308.4
Approximate Chi Square Value (.05)	5.971	95% Percentile Bootstrap UCL	51.5
Adjusted Level of Significance	0.0312	95% BCA Bootstrap UCL	70.37
Adjusted Chi Square Value	5.343	95% Chebyshev(Mean, Sd) UCL	92.1
		97.5% Chebyshev(Mean, Sd) UCL	120.8
		99% Chebyshev(Mean, Sd) UCL	**177.2**
Anderson-Darling Test Statistic	2.398		
Anderson-Darling 5% Critical Value	0.79	**Potential UCL to use:**	
Kolmogorov-Smirnov Test Statistic	0.405	**Use 99% Chebyshev (Mean, Sd) UCL**	**177.2**
Kolmogorov-Smirnov 5% Critical Value	0.241		
Data not Gamma Distributed at 5% Significance Level			

Assuming Gamma Distribution

95% Approximate Gamma UCL	56.64
95% Adjusted Gamma UCL	63.29

Surface Soil: Mercury

General Statistics

Number of Valid Data	8	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	1
		Percent Non-Detects	12.50%

Raw Statistics

Minimum Detected	0.015	Log-transformed Statistics	
Maximum Detected	0.066	Minimum Detected	-4.2
Mean of Detected	0.0353	Maximum Detected	-2.718
SD of Detected	0.0176	Mean of Detected	-3.456
Minimum Non-Detect	0.0047	SD of Detected	0.523
Maximum Non-Detect	0.0047	Minimum Non-Detect	-5.36
		Maximum Non-Detect	-5.36

Warning: There are only 7 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	0.953	Shapiro Wilk Test Statistic	0.97
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
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	0.0312	Mean	-3.781
SD	0.02	SD	1.038
95% DL/2 (t) UCL	0.0446	95% H-Stat (DL/2) UCL	0.0777
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0302	Mean in Log Scale	-3.62
SD	0.0205	SD in Log Scale	0.67
95% MLE (t) UCL	0.044	Mean in Original Scale	0.0319
95% MLE (Tiku) UCL	0.0443	SD in Original Scale	0.0188
		95% Percentile Bootstrap UCL	0.0427
Gamma Distribution Test with Detected Values Only		95% BCA Bootstrap UCL	0.0428
k star (bias corrected)	2.733		
Theta Star	0.0129	Data Distribution Test with Detected Values Only	
nu star	38.27	Data appear Normal at 5% Significance Level	
A-D Test Statistic	0.178	Nonparametric Statistics	
5% A-D Critical Value	0.71	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.71	Mean	0.0328
5% K-S Critical Value	0.313	SD	0.0167
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.00636
		95% KM (t) UCL	**0.0448**
Assuming Gamma Distribution		95% KM (z) UCL	0.0432
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0446
Minimum	0.00684	95% KM (bootstrap t) UCL	0.0476
Maximum	0.066	95% KM (BCA) UCL	0.0439
Mean	0.0317	**95% KM (Percentile Bootstrap) UCL**	**0.0436**
Median	0.0305	95% KM (Chebyshev) UCL	0.0605
SD	0.0192	97.5% KM (Chebyshev) UCL	0.0725
k star	1.766	99% KM (Chebyshev) UCL	0.096
Theta star	0.018		
Nu star	28.25	**Potential UCLs to use:**	
AppChi2	17.12	**95% KM (t) UCL**	**0.0448**
95% Gamma Approximate UCL	0.0523	**95% KM (Percentile Bootstrap) UCL**	**0.0436**
95% Adjusted Gamma UCL	0.0599		

Note: DL/2 is not a recommended method.

Surface Soil: Nickel

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	14	Maximum of Log Data	2.639
Mean	8.638	Mean of log Data	1.945
Median	8.8	SD of log Data	0.837
SD	4.418		
Coefficient of Variation	0.511		
Skewness	-0.516		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.953	Shapiro Wilk Test Statistic	0.798
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
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	**11.6**	95% H-UCL	25.92
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	21.77
95% Adjusted-CLT UCL	10.9	97.5% Chebyshev (MVUE) UCL	27.13
95% Modified-t UCL	11.55	99% Chebyshev (MVUE) UCL	37.64

Gamma Distribution Test		Data Distribution	
		Data appear Normal at 5% Significance Level	
k star (bias corrected)	1.661		
Theta Star	5.2	Nonparametric Statistics	
MLE of Mean	8.638	95% CLT UCL	11.21
MLE of Standard Deviation	6.702	95% Jackknife UCL	11.6
nu star	26.57	95% Standard Bootstrap UCL	11.04
Approximate Chi Square Value (.05)	15.82	95% Bootstrap-t UCL	11.21
Adjusted Level of Significance	0.0195	95% Hall's Bootstrap UCL	10.86
Adjusted Chi Square Value	13.77	95% Percentile Bootstrap UCL	10.94
Anderson-Darling Test Statistic	0.5	95% BCA Bootstrap UCL	10.83
Anderson-Darling 5% Critical Value	0.723	95% Chebyshev(Mean, Sd) UCL	15.45
Kolmogorov-Smirnov Test Statistic	0.213	97.5% Chebyshev(Mean, Sd) UCL	18.39
Kolmogorov-Smirnov 5% Critical Value	0.297	99% Chebyshev(Mean, Sd) UCL	24.18
Data appear Gamma Distributed at 5% Significance Level			

Assuming Gamma Distribution	
95% Approximate Gamma UCL	14.51
95% Adjusted Gamma UCL	16.67

Potential UCL to use:	
Use 95% Student's-t UCL	**11.6**

Surface Soil: Selenium

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	16

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.33	Minimum of Log Data	-1.109
Maximum	3.5	Maximum of Log Data	1.253
Mean	1.436	Mean of log Data	0.192
Median	1.4	SD of log Data	0.622
SD	0.822		
Coefficient of Variation	0.573	**Lognormal Distribution Test**	
Skewness	0.825	Shapiro Wilk Test Statistic	0.968
		Shapiro Wilk Critical Value	0.905
Relevant UCL Statistics		Data appear Lognormal at 5% Significance Level	
Normal Distribution Test			
Shapiro Wilk Test Statistic	0.937	**Assuming Lognormal Distribution**	
Shapiro Wilk Critical Value	0.905	95% H-UCL	1.998
Data appear Normal at 5% Significance Level		95% Chebyshev (MVUE) UCL	2.384
		97.5% Chebyshev (MVUE) UCL	2.787
Assuming Normal Distribution		99% Chebyshev (MVUE) UCL	3.577
95% Student's-t UCL	**1.753**		
95% UCLs (Adjusted for Skewness)		**Data Distribution**	
95% Adjusted-CLT UCL	1.774	Data appear Normal at 5% Significance Level	
95% Modified-t UCL	1.759		
		Nonparametric Statistics	
Gamma Distribution Test		95% CLT UCL	1.738
k star (bias corrected)	2.679	95% Jackknife UCL	1.753
Theta Star	0.536	95% Standard Bootstrap UCL	1.734
MLE of Mean	1.436	95% Bootstrap-t UCL	1.79
MLE of Standard Deviation	0.877	95% Hall's Bootstrap UCL	1.816
nu star	107.2	95% Percentile Bootstrap UCL	1.746
Approximate Chi Square Value (.05)	84.28	95% BCA Bootstrap UCL	1.786
Adjusted Level of Significance	0.038	95% Chebyshev(Mean, Sd) UCL	2.237
Adjusted Chi Square Value	82.68	97.5% Chebyshev(Mean, Sd) UCL	2.583
		99% Chebyshev(Mean, Sd) UCL	3.264
Anderson-Darling Test Statistic	0.263		
Anderson-Darling 5% Critical Value	0.747	**Potential UCL to use:**	
Kolmogorov-Smirnov Test Statistic	0.126	**Use 95% Student's-t UCL**	**1.753**
Kolmogorov-Smirnov 5% Critical Value	0.195		
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution			
95% Approximate Gamma UCL	1.825		
95% Adjusted Gamma UCL	1.861		

Surface Soil: Vanadium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	12

Raw Statistics		Log-transformed Statistics	
Minimum	55	Minimum of Log Data	4.007
Maximum	430	Maximum of Log Data	6.064
Mean	221.1	Mean of log Data	5.297
Median	190	SD of log Data	0.498
SD	97.75		
Coefficient of Variation	0.442		
Skewness	0.697		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.933	Shapiro Wilk Test Statistic	0.905
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	**267.3**	95% H-UCL	298.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	357.5
95% Adjusted-CLT UCL	269.2	97.5% Chebyshev (MVUE) UCL	415.3
95% Modified-t UCL	268.1	99% Chebyshev (MVUE) UCL	528.9

Data Distribution

Data appear Normal at 5% Significance Level

Gamma Distribution Test		Nonparametric Statistics	
k star (bias corrected)	4.038	95% CLT UCL	264
Theta Star	54.74	95% Jackknife UCL	267.3
MLE of Mean	221.1	95% Standard Bootstrap UCL	261.9
MLE of Standard Deviation	110	95% Bootstrap-t UCL	280.6
nu star	113.1	95% Hall's Bootstrap UCL	283
Approximate Chi Square Value (.05)	89.52	95% Percentile Bootstrap UCL	263.2
Adjusted Level of Significance	0.0312	95% BCA Bootstrap UCL	266.1
Adjusted Chi Square Value	86.75	95% Chebyshev(Mean, Sd) UCL	334.9
		97.5% Chebyshev(Mean, Sd) UCL	384.2
		99% Chebyshev(Mean, Sd) UCL	481
Anderson-Darling Test Statistic	0.431		
Anderson-Darling 5% Critical Value	0.738		
Kolmogorov-Smirnov Test Statistic	0.172		
Kolmogorov-Smirnov 5% Critical Value	0.229		

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL	279.2
95% Adjusted Gamma UCL	288.2

Potential UCL to use:	
Use 95% Student's-t UCL	**267.3**

Surface Soil: Zinc

General Statistics

Number of Valid Observations	8
Number of Distinct Observations	8

Raw Statistics

Minimum	7.5
Maximum	77
Mean	44.44
Median	51.5
SD	23.5
Coefficient of Variation	0.529
Skewness	-0.355

Log-transformed Statistics

Minimum of Log Data	2.015
Maximum of Log Data	4.344
Mean of log Data	3.598
SD of log Data	0.77

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics
Normal Distribution Test

Shapiro Wilk Test Statistic	0.945
Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	**60.18**

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	56.99
95% Modified-t UCL	60.01

Gamma Distribution Test

k star (bias corrected)	1.771
Theta Star	25.09
MLE of Mean	44.44
MLE of Standard Deviation	33.39
nu star	28.34
Approximate Chi Square Value (.05)	17.19
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	15.04
Anderson-Darling Test Statistic	0.488
Anderson-Darling 5% Critical Value	0.722
Kolmogorov-Smirnov Test Statistic	0.268
Kolmogorov-Smirnov 5% Critical Value	0.297

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	73.25
95% Adjusted Gamma UCL	83.74

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.847
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	113.8
95% Chebyshev (MVUE) UCL	103.8
97.5% Chebyshev (MVUE) UCL	128.4
99% Chebyshev (MVUE) UCL	176.7

Data Distribution
Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	58.11
95% Jackknife UCL	60.18
95% Standard Bootstrap UCL	57.4
95% Bootstrap-t UCL	58.79
95% Hall's Bootstrap UCL	56.08
95% Percentile Bootstrap UCL	57.13
95% BCA Bootstrap UCL	55.75
95% Chebyshev(Mean, Sd) UCL	80.66
97.5% Chebyshev(Mean, Sd) UCL	96.33
99% Chebyshev(Mean, Sd) UCL	127.1

Potential UCL to use:	
Use 95% Student's-t UCL	**60.18**

APPENDIX H
HHRA DATA SETS

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB04		56SB05		56SB06		56SB07		56SB08		56SS01	56SS02
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB04-00		56SB05-00		56SB06-00		56SB07-00		56SB08-00		56SS01	56SS02
Date	4/28/2008		4/28/2008		4/29/2008		4/28/2008		4/29/2008		4/30/2008		5/1/2008		5/5/2008		9/24/2008	9/24/2008
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		0.0-1.0		0-0	0-0
Volatile Organic Compounds (ug/kg																		
1,1,1,2-Tetrachloroethane	0.62	U	0.62	U	0.56	U	0.64	U	0.64	U	0.65	U	0.59	U	0.75	U	NA	NA
1,1,1-Trichloroethane	0.56	U	0.56	U	0.51	U	0.58	U	0.58	U	0.59	U	0.53	U	0.68	U	NA	NA
1,1,2,2-Tetrachloroethane	1.3	U	1.4	U	1.2	U	1.4	U	1.4	U	1.4	U	1.3	U	1.7	U	NA	NA
1,1,2-Trichloroethane	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.4	U	NA	NA
1,1-Dichloroethane	0.48	U	0.48	U	0.44	U	0.5	U	0.5	U	0.5	U	0.46	U	0.59	U	NA	NA
1,1-Dichloroethene	0.52	U	0.52	U	0.48	U	0.54	U	0.54	U	0.54	U	0.5	U	0.64	U	NA	NA
1,2,3-Trichloropropane	1.3	U	1.4	U	1.2	U	1.4	U	1.4	U	1.4	U	1.3	U	1.7	U	NA	NA
1,2-Dibromo-3-Chloropropane	2.7	U	2.7	U	2.5	U	2.8	U	2.8	U	2.8	U	2.6	U	3.3	U	NA	NA
1,2-Dichloroethane	0.96	U	0.96	U	0.88	U	1	U	1	U	1	U	0.92	U	1.2	U	NA	NA
1,2-Dichloropropane	1.1	U	1.1	U	0.97	U	1.1	U	1.1	U	1.1	U	1	U	1.3	U	NA	NA
2-Butanone (MEK)	2.6	U	2.6	U	19	U	2.7	U	9.6	U	7.2	U	18	U	24	U	NA	NA
2-Chloro-1,3-butadiene	0.55	UJ	0.55	U	0.5	U	0.57	U	0.57	U	0.57	U	0.52	U	0.67	UJ	NA	NA
2-Hexanone	2	U	2	U	1.9	U	2.1	U	2.1	U	2.1	U	1.9	U	2.5	U	NA	NA
3-Chloro-1-propene	1.4	R	1.4	UJ	1.3	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.4	UJ	1.8	U	NA	NA
4-Methyl-2-pentanone (MIBK)	2.8	U	2.8	U	2.6	U	2.9	U	2.9	U	2.9	U	2.7	U	3.4	U	NA	NA
Acetone	50	J	89	J	270	J	23	J	86	U	110	J	260		280		NA	NA
Acetonitrile	43	UJ	43	U	40	U	45	U	45	U	45	U	41	U	53	R	NA	NA
Acrolein	18	R	18	R	17	R	19	R	19	R	19	R	17	R	22	R	NA	NA
Acrylonitrile	22	UJ	22	U	20	U	23	U	23	UJ	23	U	21	UJ	27	U	NA	NA
Benzene	0.76	U	0.76	U	0.7	U	0.79	U	0.95	J	0.8	U	0.73	U	0.99	J	NA	NA
Bromoform	1.1	U	1.1	U	0.97	U	1.1	U	1.1	U	1.1	U	1	U	1.3	U	NA	NA
Bromomethane	1.5	UJ	1.5	U	1.4	U	1.6	U	1.6	U	1.6	U	1.5	U	1.9	U	NA	NA
Carbon disulfide	0.49	U	0.49	U	0.45	U	0.51	U	0.51	U	0.51	U	1.9	J	0.6	U	NA	NA
Carbon tetrachloride	0.96	U	0.96	U	0.88	U	1	U	1	U	1	U	0.92	U	1.2	U	NA	NA
Chlorobenzene	0.7	U	0.7	U	0.64	U	0.73	U	0.73	U	0.74	U	0.67	U	0.86	U	NA	NA
Chlorodibromomethane	0.48	U	0.48	U	0.44	U	0.5	U	0.5	U	0.5	U	0.46	U	0.59	U	NA	NA
Chloroethane	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.4	U	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB04		56SB05		56SB06		56SB07		56SB08		56SS01	56SS02
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB04-00		56SB05-00		56SB06-00		56SB07-00		56SB08-00		56SS01	56SS02
Date	4/28/2008		4/28/2008		4/29/2008		4/28/2008		4/29/2008		4/30/2008		5/1/2008		5/5/2008		9/24/2008	9/24/2008
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		0.0-1.0		0-0	0-0
Volatile Organic Compounds (ug/kg																		
Chloroform	0.48	U	0.48	U	0.44	U	0.5	U	0.5	U	0.5	U	0.46	U	0.59	U	NA	NA
Chloromethane	0.68	U	0.69	U	2.2	J	0.71	U	0.71	U	0.72	U	0.65	U	0.84	U	NA	NA
cis-1,3-Dichloropropene	0.84	U	0.84	U	0.77	U	0.87	U	0.87	U	0.88	U	0.8	U	1	U	NA	NA
Dibromomethane	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.4	U	NA	NA
Dichlorobromomethane	0.8	U	0.8	U	0.73	U	0.83	U	0.83	U	0.84	U	0.76	U	0.98	U	NA	NA
Dichlorodifluoromethane	0.86	U	0.86	U	0.78	U	0.89	U	0.89	U	0.9	U	0.82	U	1	U	NA	NA
Ethyl methacrylate	2.1	U	2.1	U	1.9	U	2.2	U	2.2	U	2.2	U	2	U	2.6	U	NA	NA
Ethylbenzene	0.72	U	0.72	U	0.66	U	0.75	U	0.75	U	0.76	U	0.69	U	0.88	U	NA	NA
Ethylene Dibromide	1.4	U	1.4	U	1.3	U	1.5	U	1.5	U	1.5	U	1.4	U	1.8	U	NA	NA
Iodomethane	1	J	0.96	UJ	2.2	J	1	UJ	1	U	1.7	J	2.4	J	1.2	U	NA	NA
Isobutyl alcohol	66	U	67	U	61	R	69	U	69	R	70	R	63	R	81	R	NA	NA
Methacrylonitrile	23	U	23	U	21	UJ	24	U	24	U	24	UJ	22	U	28	UJ	NA	NA
Methyl methacrylate	3.6	U	3.6	U	3.3	UJ	3.7	U	3.7	U	3.7	UJ	3.4	U	4.4	U	NA	NA
Methylene Chloride	0.96	U	0.96	U	0.88	U	1	U	1	U	1	U	0.92	U	1.2	U	NA	NA
Pentachloroethane	2.1	U	2.1	U	1.9	UJ	2.2	U	2.2	UJ	2.2	UJ	2	UJ	2.6	UJ	NA	NA
Propionitrile	20	UJ	20	U	19	U	21	U	21	U	21	U	19	U	25	U	NA	NA
Styrene	0.63	U	0.64	U	0.58	U	0.66	U	0.66	U	0.67	U	0.61	U	0.78	U	NA	NA
Tetrachloroethene	0.7	U	0.7	U	0.64	U	0.73	U	0.73	U	0.74	U	0.67	U	0.86	U	NA	NA
Toluene	0.76	U	0.76	U	0.7	U	0.79	U	0.79	U	0.8	U	0.73	U	0.93	U	NA	NA
trans-1,2-Dichloroethene	0.93	U	0.94	U	0.85	U	0.97	U	0.97	U	0.98	U	0.89	U	1.1	U	NA	NA
trans-1,3-Dichloropropene	0.84	U	0.84	U	0.77	U	0.87	U	0.87	U	0.88	U	0.8	U	1	U	NA	NA
trans-1,4-Dichloro-2-butene	3	U	3	U	2.7	UJ	3.1	U	3.1	U	3.1	UJ	2.8	U	3.7	U	NA	NA
Trichloroethene	0.96	U	0.96	U	0.88	U	1	U	1	U	1	U	0.92	U	1.2	U	NA	NA
Trichlorofluoromethane	1.4	U	1.4	U	1.3	U	1.5	U	1.5	U	1.5	U	1.4	U	1.8	U	NA	NA
Vinyl acetate	1.4	UJ	1.4	U	1.3	U	1.5	U	1.5	U	1.5	U	1.4	U	1.8	U	NA	NA
Vinyl chloride	0.56	U	0.56	U	0.51	U	0.58	U	0.58	U	0.59	U	0.53	U	0.68	U	NA	NA
Xylenes, Total	2.2	U	2.2	U	2	U	2.3	U	2.3	U	2.3	U	2.1	U	2.7	U	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	9.6 U	9.5 U	8.9 UJ	9.9 U	9.3 UJ	9.8 UJ	9.4 U	9.9 U	NA	NA
1,2,4,5-Tetrachlorobenzene	8.2 U	8.1 U	7.6 UJ	8.4 U	7.9 UJ	8.4 UJ	8 U	8.5 U	NA	NA
1,2,4-Trichlorobenzene	9.6 U	9.5 U	8.9 UJ	9.9 U	9.3 UJ	9.8 UJ	9.4 U	9.9 U	NA	NA
1,2-Dichlorobenzene	9.1 U	9 U	8.5 UJ	9.3 U	8.8 UJ	9.3 UJ	8.8 U	9.4 U	NA	NA
1,3,5-Trinitrobenzene	22 U	22 U	21 UJ	23 U	21 UJ	23 UJ	21 U	23 U	NA	NA
1,3-Dichlorobenzene	7.8 U	7.7 U	7.3 UJ	8 U	7.5 UJ	8 UJ	7.6 U	8.1 U	NA	NA
1,3-Dinitrobenzene	5.1 U	5 U	4.7 UJ	5.2 U	4.9 UJ	5.2 UJ	4.9 U	5.2 U	NA	NA
1,4-Dichlorobenzene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
1,4-Dioxane	10 U	10 U	9.7 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
1,4-Naphthoquinone	5.1 U	5 U	4.7 UJ	5.2 U	4.9 UJ	5.2 UJ	4.9 U	5.2 U	NA	NA
2,2'-oxybis[1-chloropropane]	8.2 U	8.1 U	7.6 UJ	8.4 U	7.9 UJ	8.4 UJ	8 U	8.5 U	NA	NA
2,3,4,6-Tetrachlorophenol	5.5 U	5.4 U	5.1 UJ	5.6 U	5.3 UJ	5.6 UJ	5.3 U	5.6 U	NA	NA
2,4,5-Trichlorophenol	8.9 U	8.8 U	8.2 UJ	9.1 U	8.5 UJ	9 UJ	8.6 U	9.1 U	NA	NA
2,4,6-Trichlorophenol	10 U	10 U	9.5 UJ	11 U	9.9 UJ	10 UJ	10 U	11 U	NA	NA
2,4-Dichlorophenol	11 U	10 U	9.8 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
2,4-Dimethylphenol	22 U	22 U	21 UJ	23 U	21 UJ	23 UJ	21 U	23 U	NA	NA
2,4-Dinitrophenol	110 UJ	110 UJ	100 UJ	110 UJ	100 UJ	110 UJ	100 U	110 U	NA	NA
2,4-Dinitrotoluene	7.7 U	7.6 UJ	7.1 UJ	7.9 UJ	7.4 UJ	7.8 UJ	7.5 UJ	7.9 U	NA	NA
2,6-Dichlorophenol	8.3 U	8.2 U	7.7 UJ	8.5 U	8 UJ	8.5 UJ	8.1 U	8.6 U	NA	NA
2,6-Dinitrotoluene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
2-Acetylaminofluorene	6.6 U	6.6 U	6.2 UJ	6.8 U	6.4 UJ	6.8 UJ	6.4 UJ	6.8 U	NA	NA
2-Chloronaphthalene	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
2-Chlorophenol	8.6 U	8.5 U	8 UJ	8.8 U	8.3 UJ	8.8 UJ	8.3 U	8.9 U	NA	NA
2-Methylnaphthalene	2.2 U	2.2 U	2.1 UJ	2.3 U	2.1 UJ	2.3 UJ	2.1 U	19	NA	NA
2-Methylphenol	11 U	10 U	9.8 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
2-Naphthylamine	26 UJ	26 U	24 UJ	27 U	25 UJ	27 UJ	25 U	27 U	NA	NA
2-Nitroaniline	8.5 U	8.4 U	7.9 UJ	8.7 U	8.2 UJ	8.6 UJ	8.2 U	8.7 U	NA	NA
2-Nitrophenol	9.5 U	9.4 U	8.8 UJ	9.7 U	9.2 UJ	9.7 UJ	9.2 U	9.8 U	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB04		56SB05		56SB06		56SB07		56SB08		56SS01	56SS02
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB04-00		56SB05-00		56SB06-00		56SB07-00		56SB08-00		56SS01	56SS02
Date	4/28/2008		4/28/2008		4/29/2008		4/28/2008		4/29/2008		4/30/2008		5/1/2008		5/5/2008		9/24/2008	9/24/2008
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		0.0-1.0		0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)																		
2-Picoline	16	U	15	U	15	UJ	16	U	15	UJ	16	UJ	15	U	16	U	NA	NA
2-Toluidine	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	U	NA	NA
3 & 4 Methylphenol	9.5	U	9.4	U	8.8	UJ	9.7	U	9.2	UJ	9.7	UJ	9.2	U	9.8	U	NA	NA
3,3'-Dichlorobenzidine	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	UJ	NA	NA
3,3'-Dimethylbenzidine	230	UJ	230	U	220	UJ	240	U	230	UJ	240	UJ	230	U	240	UJ	NA	NA
3-Methylcholanthrene	8	U	7.9	U	7.4	UJ	8.1	U	7.7	UJ	8.1	UJ	7.7	U	8.2	U	NA	NA
3-Nitroaniline	5.9	U	5.8	U	5.4	UJ	6	U	5.7	UJ	6	UJ	5.7	U	6	U	NA	NA
4,6-Dinitro-2-methylphenol	7.6	UJ	7.5	UJ	7	UJ	7.7	UJ	7.3	UJ	7.7	UJ	7.3	UJ	7.8	UJ	NA	NA
4-Aminobiphenyl	17	U	17	U	16	UJ	17	U	16	UJ	17	UJ	16	U	17	U	NA	NA
4-Bromophenyl phenyl ether	9.3	U	9.1	U	8.6	UJ	9.5	U	8.9	UJ	9.4	UJ	9	U	9.5	U	NA	NA
4-Chloro-3-methylphenol	9.8	U	9.7	U	9.1	UJ	10	U	9.4	UJ	10	UJ	9.5	U	10	U	NA	NA
4-Chloroaniline	7.8	U	7.7	U	7.3	UJ	8	U	7.5	UJ	8	UJ	7.6	U	8.1	U	NA	NA
4-Chlorophenyl phenyl ether	8.1	U	8	U	7.5	UJ	8.3	U	7.8	UJ	8.2	UJ	7.8	U	8.3	U	NA	NA
4-Nitroaniline	10	U	9.9	UJ	9.3	UJ	10	UJ	9.7	UJ	10	UJ	9.7	U	10	UJ	NA	NA
4-Nitrophenol	43	U	42	UJ	40	UJ	44	UJ	41	UJ	44	UJ	42	U	44	U	NA	NA
4-Nitroquinoline-1-oxide	14	R	14	R	13	R	15	R	14	R	15	R	14	R	15	R	NA	NA
7,12-Dimethylbenz(a)anthracene	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	U	NA	NA
Acenaphthene	0.74	U	0.73	U	0.69	UJ	0.76	U	0.72	UJ	0.76	UJ	0.72	U	0.76	U	NA	NA
Acenaphthylene	2.2	U	2.2	U	2.1	UJ	2.3	U	2.1	UJ	2.3	UJ	2.1	U	2.3	U	NA	NA
Acetophenone	11	U	11	U	10	UJ	11	U	11	UJ	11	UJ	11	U	12	U	NA	NA
alpha,alpha-Dimethyl phenethylamine	77	U	76	U	71	UJ	79	U	74	UJ	78	UJ	75	UJ	79	U	NA	NA
Aniline	8.2	U	8.1	U	7.6	UJ	8.4	U	7.9	UJ	8.4	UJ	8	U	8.5	U	NA	NA
Anthracene	2.2	U	2.2	U	2.1	UJ	2.3	U	2.1	UJ	2.3	UJ	2.1	U	2.3	U	NA	NA
Aramite, Total	14	UJ	14	U	13	UJ	15	U	14	UJ	15	UJ	14	UJ	15	U	NA	NA
Benzo[a]anthracene	2.2	U	2.2	U	9.2	J	2.3	U	2.1	UJ	2.3	UJ	2.4	J	2.9	J	NA	NA
Benzo[a]pyrene	0.86	U	0.85	U	20	J	0.88	U	0.83	UJ	0.88	UJ	2.8	J	3	J	NA	NA
Benzo[b]fluoranthene	0.99	U	0.98	U	44	J	1	U	0.96	UJ	1	UJ	3.1	J	8	J	NA	NA
Benzo[g,h,i]perylene	2.2	U	2.2	U	17	J	2.3	U	2.1	UJ	2.3	UJ	2.1	U	3.1	J	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Benzo[k]fluoranthene	1.3 U	1.3 U	1.2 UJ	1.3 U	1.3 UJ	1.3 UJ	1.5 J	1.3 U	NA	NA
Benzyl alcohol	10 U	10 U	9.7 UJ	11 U	10 UJ	11 UJ	10 U	11 U	NA	NA
Bis(2-chloroethoxy)methane	8.9 U	8.8 U	8.2 UJ	9.1 U	8.5 UJ	9 UJ	8.6 U	9.1 U	NA	NA
Bis(2-chloroethyl)ether	7.4 U	7.3 U	6.9 UJ	7.6 U	7.2 UJ	7.6 UJ	7.2 U	7.6 U	NA	NA
Bis(2-ethylhexyl) phthalate	14 U	9.9 U	80 UJ	25 U	14 UJ	7.9 UJ	61 U	24 U	NA	NA
Butyl benzyl phthalate	9.4 U	9.3 U	10 J	9.6 U	9 UJ	9.6 UJ	9.1 U	9.7 U	NA	NA
Chrysene	0.8 U	0.79 U	36 J	0.81 U	1.4 UJ	0.81 UJ	2.2 J	3.9 J	NA	NA
Diallate	13 U	12 U	12 UJ	13 U	12 UJ	13 UJ	12 U	13 U	NA	NA
Dibenz(a,h)anthracene	0.77 U	0.76 U	2.9 J	0.79 U	0.74 UJ	0.78 UJ	0.75 U	0.79 U	NA	NA
Dibenzofuran	5.5 U	5.4 U	5.1 UJ	5.6 U	5.3 UJ	5.6 UJ	5.3 U	5.6 U	NA	NA
Diethyl phthalate	14 U	14 U	13 UJ	15 U	14 UJ	15 UJ	14 U	15 U	NA	NA
Dimethyl phthalate	8.3 U	8.2 U	7.7 UJ	8.5 U	8 UJ	8.5 UJ	8.1 U	8.6 U	NA	NA
Di-n-butyl phthalate	33 U	32 U	30 UJ	33 U	31 UJ	33 UJ	97 U	34 U	NA	NA
Di-n-octyl phthalate	4.3 U	4.2 U	4 UJ	4.4 U	4.1 UJ	4.4 UJ	4.2 U	4.4 U	NA	NA
Dinoseb	22 U	22 U	21 UJ	23 U	21 UJ	23 UJ	21 U	23 UJ	NA	NA
Ethyl methanesulfonate	14 U	14 U	13 UJ	15 U	14 UJ	15 UJ	14 U	15 U	NA	NA
Fluoranthene	2.2 U	2.2 U	9.2 J	2.3 U	2.1 UJ	2.3 UJ	2.1 U	5 J	NA	NA
Fluorene	1 U	0.99 U	0.93 UJ	1 U	0.97 UJ	1 UJ	0.97 U	1 U	NA	NA
Hexachlorobenzene	8.9 U	8.8 U	8.2 UJ	9.1 U	8.5 UJ	9 UJ	8.6 U	9.1 U	NA	NA
Hexachlorobutadiene	12 U	12 U	11 UJ	12 U	11 UJ	12 UJ	12 U	12 U	NA	NA
Hexachlorocyclopentadiene	18 U	18 U	17 UJ	19 U	18 UJ	19 UJ	18 U	19 U	NA	NA
Hexachloroethane	9.6 U	9.5 U	8.9 UJ	9.9 U	9.3 UJ	9.8 UJ	9.4 U	9.9 U	NA	NA
Hexachlorophene	1100 R	1100 R	1000 UJ	1100 R	1000 UJ	1100 R	1000 R	1100 R	NA	NA
Hexachloropropene	9.4 UJ	9.3 UJ	8.7 UJ	9.6 UJ	9 UJ	9.6 UJ	9.1 UJ	9.7 U	NA	NA
Indeno[1,2,3-cd]pyrene	1.6 UJ	1.5 UJ	7.5 J	1.6 UJ	1.5 UJ	1.6 UJ	1.9 J	1.6 UJ	NA	NA
Isophorone	8.1 U	8 U	7.5 UJ	8.3 U	7.8 UJ	8.2 UJ	7.8 U	8.3 U	NA	NA
Isosafrole	9.3 U	9.1 U	8.6 UJ	9.5 U	8.9 UJ	9.4 UJ	9 U	9.5 U	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB02		56SB03		56SB04		56SB05		56SB06		56SB07		56SB08		56SS01	56SS02
Sample ID	56SB01-00		56SB02-00		56SB03-00		56SB04-00		56SB05-00		56SB06-00		56SB07-00		56SB08-00		56SS01	56SS02
Date	4/28/2008		4/28/2008		4/29/2008		4/28/2008		4/29/2008		4/30/2008		5/1/2008		5/5/2008		9/24/2008	9/24/2008
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		0.0-1.0		0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)																		
Methapyrilene	12	UJ	12	UJ	11	UJ	12	UJ	12	UJ	12	UJ	12	U	12	U	NA	NA
Methyl methanesulfonate	12	U	12	U	11	UJ	12	U	12	UJ	12	UJ	12	U	12	U	NA	NA
Naphthalene	0.78	U	0.77	U	0.73	UJ	0.8	U	0.75	UJ	0.8	UJ	1.9	J	4.3	J	NA	NA
Nitrobenzene	9	U	8.9	U	8.3	UJ	9.2	U	8.7	UJ	9.2	UJ	8.7	U	9.3	U	NA	NA
N-Nitro-o-toluidine	7.8	U	7.7	U	7.3	UJ	8	U	7.5	UJ	8	UJ	7.6	U	8.1	U	NA	NA
N-Nitrosodiethylamine	16	U	15	U	15	UJ	16	U	15	UJ	16	UJ	15	U	16	U	NA	NA
N-Nitrosodimethylamine	13	U	13	U	12	UJ	13	U	12	UJ	13	UJ	12	U	13	U	NA	NA
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	11	UJ	12	UJ	11	UJ	12	UJ	12	UJ	12	U	NA	NA
N-Nitrosodi-n-propylamine	8.5	U	8.4	U	7.9	UJ	8.7	U	8.2	UJ	8.6	UJ	8.2	U	8.7	U	NA	NA
N-Nitrosodiphenylamine	9.3	U	9.1	U	8.6	UJ	9.5	U	8.9	UJ	9.4	UJ	9	U	9.5	U	NA	NA
N-Nitrosomethylethylamine	7.4	U	7.3	U	6.9	UJ	7.6	U	7.2	UJ	7.6	UJ	7.2	U	7.6	U	NA	NA
N-Nitrosomorpholine	8.6	UJ	8.5	UJ	8	UJ	8.8	UJ	8.3	UJ	8.8	UJ	8.3	UJ	8.9	U	NA	NA
N-Nitrosopiperidine	11	UJ	11	U	10	UJ	11	U	11	UJ	11	UJ	11	UJ	11	U	NA	NA
N-Nitrosopyrrolidine	12	UJ	11	U	11	UJ	12	U	11	UJ	12	UJ	11	U	12	U	NA	NA
p-Dimethylamino azobenzene	9.3	U	9.1	U	8.6	UJ	9.5	U	8.9	UJ	9.4	UJ	9	U	9.5	U	NA	NA
Pentachlorobenzene	8.1	U	8	U	7.5	UJ	8.3	U	7.8	UJ	8.2	UJ	7.8	U	8.3	U	NA	NA
Pentachloronitrobenzene	7.7	U	7.6	U	7.1	UJ	7.9	U	7.4	UJ	7.8	UJ	7.5	U	7.9	U	NA	NA
Pentachlorophenol	11	U	11	U	10	UJ	11	U	10	UJ	11	UJ	10	U	11	U	NA	NA
Phenacetin	6.1	U	6.1	U	5.7	UJ	6.3	U	5.9	UJ	6.2	UJ	5.9	U	6.3	U	NA	NA
Phenanthrene	2.2	UJ	2.2	UJ	2.3	J	2.3	UJ	2.1	UJ	2.3	UJ	3.1	U	2.5	J	NA	NA
Phenol	6.3	U	6.2	U	5.8	UJ	6.4	U	6	UJ	6.4	UJ	6.1	U	6.4	U	NA	NA
p-Phenylene diamine	210	U	210	U	190	UJ	210	U	200	UJ	210	UJ	200	U	210	U	NA	NA
Pronamide	12	U	12	U	11	UJ	12	U	11	UJ	12	UJ	11	U	12	U	NA	NA
Pyrene	2.2	U	2.2	U	16	J	2.3	U	2.1	UJ	2.3	UJ	5.4	J	5.1	J	NA	NA
Pyridine	14	U	14	U	13	UJ	15	U	14	UJ	15	UJ	14	U	15	U	NA	NA
Safrole, Total	11	U	11	U	10	UJ	11	U	10	UJ	11	UJ	10	U	11	U	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB02	56SB03	56SB04	56SB05	56SB06	56SB07	56SB08	56SS01	56SS02
Sample ID	56SB01-00	56SB02-00	56SB03-00	56SB04-00	56SB05-00	56SB06-00	56SB07-00	56SB08-00	56SS01	56SS02
Date	4/28/2008	4/28/2008	4/29/2008	4/28/2008	4/29/2008	4/30/2008	5/1/2008	5/5/2008	9/24/2008	9/24/2008
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	0.0-1.0	0-0	0-0
Metals (mg/kg)										
Antimony	2	0.14 U	0.11 UJ	0.091 U	0.11 UJ	0.13 UJ	0.16 UJ	0.11 UJ	NA	NA
Arsenic	2.3	2.4	2.9	0.59 J	3.4	2.2	3	1.4	NA	NA
Barium	39 J	16 J	130 J	15 J	120 J	20 J	190 J	71	NA	NA
Beryllium	0.14	0.096 J	0.28	0.053 J	0.24	0.15	0.34	0.24	NA	NA
Cadmium	3.3 J	0.1 J	0.16 J	0.038 UJ	0.18 J	0.055 J	0.16 J	0.15	NA	NA
Chromium	33	21	19 J	6.3	22 J	48 J	54 J	24	NA	NA
Cobalt	12	4.2	29 J	2.6	27 J	6.8 J	50 J	24 J	NA	NA
Copper	81 J	50 J	67 J	31 J	72 J	56 J	130 J	100	NA	NA
Lead	210	6.1	10 J	0.88	4.8 J	6.3 J	5.5 J	5.3	83	5
Mercury	0.015 J	0.033	0.046 J	0.018 J	0.041 J	0.005 U	0.066 J	0.028	NA	NA
Nickel	12	4.4	8.9 J	1.1	13 J	7 J	14 J	8.7	NA	NA
Selenium	1.6	2.7	0.61 J	1.4	0.88 J	1.7 J	1.7 J	0.64	0.51	2
Silver	0.24 J	0.032 J	0.069 UJ	0.019 U	0.057 UJ	0.13 UJ	0.078 UJ	0.069 U	NA	NA
Thallium	0.15 U	0.14 U	0.17 J	0.15 U	0.15 J	0.15 U	0.25 J	0.15 U	NA	NA
Tin	5 U	4.8 U	4.7 U	4.9 U	4.6 U	4.8 U	4.6 U	4.8 U	NA	NA
Vanadium	170 J	250 J	200 J	170 J	190 J	320 J	360 J	180	NA	NA
Zinc	77 J	25 J	54 J	7.5 J	49 J	23 J	62 J	58	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	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
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Volatile Organic Compounds (ug/kg) (Cont)										
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	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
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)										
2-Picoline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Toluidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3 & 4 Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aramite, Total	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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Benzo[k]fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl alcohol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl methanesulfonate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	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
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Semivolatile Organic Compounds (ug/kg) (Cont)										
Methapyrilene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl methanesulfonate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitro-o-toluidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Phenylene diamine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Safrole, Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Sample ID	56SS03	56SS04	56SS05	56SS06	56SS07	56SS08	56SS09	56SS10	56SS11	56SS12
Date	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008	9/24/2008
Depth Range	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0	0-0
Metals (mg/kg)										
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	8	5.9	7.2	3	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	2.2	3.5	0.86	1.4	0.86	0.62	2.3	1.2	1.7	0.33 J
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	160	55	430	190	280 J	140
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03		56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02		56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0		7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Volatile Organic Compounds (ug/kg)																				
1,1,1,2-Tetrachloroethane	0.64	U	0.66	U	0.58	U	0.65	U	0.67	U	0.71	U	0.63	U	0.63	U	0.65	U	0.71	U
1,1,1-Trichloroethane	0.58	U	0.6	U	0.52	U	0.59	U	0.61	U	0.65	U	0.57	U	0.57	U	0.58	U	0.65	U
1,1,2,2-Tetrachloroethane	1.4	U	1.5	U	1.3	U	1.4	U	1.5	U	1.6	U	1.4	U	1.4	U	1.4	U	1.6	U
1,1,2-Trichloroethane	1.2	U	1.2	U	1.1	U	1.2	U	1.3	U	1.3	U	1.2	U	1.2	U	1.2	U	1.3	U
1,1-Dichloroethane	0.5	U	0.52	U	0.45	U	0.51	U	0.52	U	0.56	U	0.49	U	0.5	U	0.5	U	0.56	U
1,1-Dichloroethene	0.54	U	0.56	U	0.49	U	0.55	U	0.57	U	0.6	U	0.53	U	0.53	U	0.54	U	0.6	U
1,2,3-Trichloropropane	1.4	U	1.5	U	1.3	U	1.4	U	1.5	U	1.6	U	1.4	U	1.4	U	1.4	U	1.6	U
1,2-Dibromo-3-Chloropropane	2.8	U	2.9	U	2.5	U	2.8	U	2.9	U	3.1	U	2.7	U	2.8	U	2.8	U	3.1	U
1,2-Dichloroethane	1	U	1	U	0.9	U	1	U	1	U	1.1	U	0.98	U	0.99	U	1	U	1.1	U
1,2-Dichloropropane	1.1	U	1.1	U	0.99	U	1.1	U	1.2	U	1.2	U	1.1	U	1.1	U	1.1	U	1.2	U
2-Butanone (MEK)	2.7	U	2.8	U	2.4	U	2.7	U	7	U	5.4	U	2.6	U	2.7	U	5	U	10	U
2-Chloro-1,3-butadiene	0.57	U	0.59	U	0.51	UJ	0.58	U	0.6	U	0.64	U	0.56	U	0.56	U	0.57	U	0.63	U
2-Hexanone	2.1	U	2.2	U	1.9	U	2.1	U	2.2	U	2.3	U	2.1	U	2.1	U	2.1	U	2.3	U
3-Chloro-1-propene	1.5	UJ	1.6	UJ	1.4	R	1.5	UJ	1.6	UJ	1.7	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.7	UJ
4-Methyl-2-pentanone (MIBK)	2.9	U	3	U	2.6	U	2.9	U	3	U	3.2	U	2.8	U	2.9	U	2.9	U	3.2	U
Acetone	8.3	J	9.7	J	22	J	25	J	120	J	49	J	17	J	11	J	99	J	95	J
Acetonitrile	45	U	47	U	41	UJ	46	U	47	U	50	U	44	U	45	U	45	U	50	U
Acrolein	19	R	20	R	17	R	19	R	20	R	21	R	19	R	19	R	19	R	21	R
Acrylonitrile	23	U	24	U	21	UJ	23	U	24	U	26	U	22	U	23	U	23	U	26	U
Benzene	0.79	U	0.82	U	0.71	U	0.8	U	0.83	U	0.88	U	0.77	U	0.78	U	0.8	U	0.88	U
Bromoform	1.1	U	1.1	U	0.99	U	1.1	U	1.2	U	1.2	U	1.1	U	1.1	U	1.1	U	1.2	U
Bromomethane	1.6	U	1.7	U	1.4	UJ	1.6	U	1.7	U	1.8	U	1.6	U	1.6	U	1.6	U	1.8	U
Carbon disulfide	0.51	U	0.53	U	0.46	U	0.52	U	0.53	U	0.57	U	0.5	U	0.51	U	0.51	U	0.57	U
Carbon tetrachloride	1	U	1	U	0.9	U	1	U	1	U	1.1	U	0.98	U	0.99	U	1	U	1.1	U
Chlorobenzene	0.73	U	0.76	U	0.66	U	0.74	U	0.76	U	0.82	U	0.71	U	0.72	U	0.74	U	0.81	U
Chlorodibromomethane	0.5	U	0.52	U	0.45	U	0.51	U	0.52	U	0.56	U	0.49	U	0.5	U	0.5	U	0.56	U
Chloroethane	1.2	U	1.2	U	1.1	U	1.2	U	1.3	U	1.3	U	1.2	U	1.2	U	1.2	U	1.3	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03		56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02		56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0		7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Volatile Organic Compounds (ug/kg) (Cont)																				
Chloroform	0.5	U	0.52	U	0.45	U	0.51	U	0.52	U	0.56	U	0.49	U	0.5	U	0.5	U	0.56	U
Chloromethane	0.71	U	0.74	U	0.64	U	0.72	U	0.74	U	0.79	U	0.69	U	0.7	U	0.72	U	0.79	U
cis-1,3-Dichloropropene	0.87	U	0.9	U	0.79	U	0.88	U	0.91	U	0.97	U	0.85	U	0.86	U	0.88	U	0.97	U
Dibromomethane	1.2	U	1.2	U	1.1	U	1.2	U	1.3	U	1.3	U	1.2	U	1.2	U	1.2	U	1.3	U
Dichlorobromomethane	0.83	U	0.86	U	0.75	U	0.84	U	0.87	U	0.93	U	0.81	U	0.82	U	0.84	U	0.92	U
Dichlorodifluoromethane	0.89	U	0.92	U	0.8	U	0.9	U	0.93	U	0.99	U	0.87	U	0.88	U	0.9	U	0.99	U
Ethyl methacrylate	2.2	U	2.3	U	2	U	2.2	U	2.3	U	2.5	U	2.2	U	2.2	U	2.2	U	2.4	U
Ethylbenzene	0.75	U	0.78	U	0.68	U	0.76	U	0.79	U	0.84	U	0.73	U	0.74	U	0.76	U	0.83	U
Ethylene Dibromide	1.5	U	1.6	U	1.4	U	1.5	U	1.6	U	1.7	U	1.5	U	1.5	U	1.5	U	1.7	U
Iodomethane	1	UJ	1	UJ	0.9	U	1	UJ	1	UJ	1.1	UJ	0.98	UJ	0.99	UJ	1	UJ	1.1	UJ
Isobutyl alcohol	69	U	72	U	62	U	70	U	72	R	77	U	67	U	68	U	70	R	77	R
Methacrylonitrile	24	U	25	U	22	U	24	U	25	UJ	27	UJ	23	U	24	U	24	UJ	27	UJ
Methyl methacrylate	3.7	U	3.8	U	3.3	U	3.7	U	3.9	UJ	4.1	UJ	3.6	U	3.7	U	3.7	UJ	4.1	UJ
Methylene Chloride	1	U	1	U	0.9	U	1	U	1	U	1.1	U	0.98	U	0.99	U	1	U	1.1	U
Pentachloroethane	2.2	U	2.3	U	2	U	2.2	U	2.3	UJ	2.5	UJ	2.2	U	2.2	U	2.2	UJ	2.4	UJ
Propionitrile	21	U	22	U	19	UJ	21	U	22	U	23	U	21	U	21	U	21	U	23	U
Styrene	0.66	U	0.69	U	0.6	U	0.67	U	0.69	U	0.74	U	0.65	U	0.65	U	0.67	U	0.73	U
Tetrachloroethene	0.73	U	0.76	U	0.66	U	0.74	U	0.76	U	0.82	U	0.71	U	0.72	U	0.74	U	0.81	U
Toluene	0.79	U	0.82	U	0.71	U	0.8	U	0.83	U	0.88	U	0.77	U	0.78	U	0.8	U	0.88	U
trans-1,2-Dichloroethene	0.97	U	1	U	0.88	U	0.98	U	1	U	1.1	U	0.95	U	0.96	U	0.98	U	1.1	U
trans-1,3-Dichloropropene	0.87	U	0.9	U	0.79	U	0.88	U	0.91	U	0.97	U	0.85	U	0.86	U	0.88	U	0.97	U
trans-1,4-Dichloro-2-butene	3.1	U	3.2	U	2.8	U	3.1	U	3.2	UJ	3.5	UJ	3	U	3.1	U	3.1	UJ	3.4	UJ
Trichloroethene	1	U	1	U	0.9	U	1	U	1	U	1.1	U	0.98	U	0.99	U	1	U	1.1	U
Trichlorofluoromethane	1.5	U	1.6	U	1.4	U	1.5	U	1.6	U	1.7	U	1.5	U	1.5	U	1.5	U	1.7	U
Vinyl acetate	1.5	U	1.6	U	1.4	UJ	1.5	U	1.6	U	1.7	U	1.5	U	1.5	U	1.5	U	1.7	U
Vinyl chloride	0.58	U	0.6	U	0.52	U	0.59	U	0.61	U	0.65	U	0.57	U	0.57	U	0.58	U	0.65	U
Xylenes, Total	2.3	U	2.4	U	2.1	U	2.3	U	2.4	U	2.6	U	2.2	U	2.3	U	2.3	U	2.6	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB01	56SB02	56SB02	56SB03	56SB03	56SB04	56SB04	56SB05	56SB05
Sample ID	56SB01-01	56SB01-04	56SB02-02	56SB02-04	56SB03-02	56SB03-04	56SB04-03	56SB04-04	56SB05-03	56SB05-05
Date	4/28/2008	4/28/2008	4/28/2008	4/28/2008	4/29/2008	4/29/2008	4/28/2008	4/28/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	7.0-9.0	3.0-5.0	7.0-9.0	3.0-5.0	7.0-9.0	5.0-7.0	7.0-9.0	5.0-7.0	9-10
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	9.9 U	10 U	9.2 U	9.6 U	10 UJ	9.9 UJ	9.7 U	9.5 U	9.7 UJ	10 UJ
1,2,4,5-Tetrachlorobenzene	8.5 U	8.6 U	7.8 U	8.2 U	8.5 UJ	8.4 UJ	8.2 U	8.1 U	8.2 UJ	8.6 UJ
1,2,4-Trichlorobenzene	9.9 U	10 U	9.2 U	9.6 U	10 UJ	9.9 UJ	9.7 U	9.5 U	9.7 UJ	10 UJ
1,2-Dichlorobenzene	9.4 U	9.6 U	8.7 U	9.1 U	9.4 UJ	9.3 UJ	9.2 U	9 U	9.2 UJ	9.6 UJ
1,3,5-Trinitrobenzene	23 U	23 U	21 U	22 U	23 UJ	23 UJ	22 U	22 U	22 UJ	23 UJ
1,3-Dichlorobenzene	8.1 U	8.2 U	7.5 U	7.8 U	8.1 UJ	8 UJ	7.8 U	7.7 U	7.8 UJ	8.2 UJ
1,3-Dinitrobenzene	5.2 U	5.3 U	4.9 U	5.1 U	5.3 UJ	5.2 UJ	5.1 U	5 U	5.1 UJ	5.3 UJ
1,4-Dichlorobenzene	8.3 U	8.5 U	7.7 U	8.1 U	8.4 UJ	8.3 UJ	8.1 U	8 U	8.1 UJ	8.5 UJ
1,4-Dioxane	11 U	11 U	10 U	10 U	11 UJ	11 UJ	10 U	10 U	10 UJ	11 UJ
1,4-Naphthoquinone	5.2 U	5.3 U	4.9 U	5.1 U	5.3 UJ	5.2 UJ	5.1 U	5 U	5.1 UJ	5.3 UJ
2,2'-oxybis[1-chloropropane]	8.5 U	8.6 U	7.8 U	8.2 U	8.5 UJ	8.4 UJ	8.2 U	8.1 UJ	8.2 UJ	8.6 UJ
2,3,4,6-Tetrachlorophenol	5.6 U	5.7 U	5.2 U	5.4 UJ	5.7 UJ	5.6 UJ	5.5 U	5.4 UJ	5.5 UJ	5.8 UJ
2,4,5-Trichlorophenol	9.1 U	9.3 U	8.5 U	8.8 UJ	9.2 UJ	9.1 UJ	8.9 U	8.7 UJ	8.9 UJ	9.3 UJ
2,4,6-Trichlorophenol	11 U	11 U	9.8 U	10 UJ	11 UJ	11 UJ	10 U	10 UJ	10 UJ	11 UJ
2,4-Dichlorophenol	11 U	11 U	10 U	10 UJ	11 UJ	11 UJ	11 U	10 UJ	11 UJ	11 UJ
2,4-Dimethylphenol	23 U	23 U	21 U	22 UJ	23 UJ	23 UJ	22 U	22 UJ	22 UJ	23 UJ
2,4-Dinitrophenol	110 UJ	110 UJ	100 R	110 UJ	110 UJ	110 UJ	110 UJ	110 UJ	110 UJ	110 UJ
2,4-Dinitrotoluene	7.9 UJ	8.1 UJ	7.4 UJ	7.7 U	7.9 UJ	7.9 UJ	7.7 UJ	7.6 U	7.7 UJ	8.1 UJ
2,6-Dichlorophenol	8.6 U	8.7 U	8 U	8.3 UJ	8.6 UJ	8.5 UJ	8.4 U	8.2 UJ	8.4 UJ	8.8 UJ
2,6-Dinitrotoluene	8.3 U	8.5 U	7.7 U	8.1 U	8.4 UJ	8.3 UJ	8.1 U	8 U	8.1 UJ	8.5 UJ
2-Acetylaminofluorene	6.8 U	7 U	6.4 U	6.6 U	6.9 UJ	6.8 UJ	6.7 U	6.6 U	6.7 UJ	7 UJ
2-Chloronaphthalene	8.3 U	8.5 U	7.7 U	8.1 U	8.4 UJ	8.3 UJ	8.1 U	8 U	8.1 UJ	8.5 UJ
2-Chlorophenol	8.9 U	9 U	8.2 U	8.6 U	8.9 UJ	8.8 UJ	8.6 U	8.5 UJ	8.6 UJ	9 UJ
2-Methylnaphthalene	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	2.2 U	2.2 U	2.2 UJ	2.3 UJ
2-Methylphenol	11 U	11 U	10 U	10 UJ	11 UJ	11 UJ	11 U	10 UJ	11 UJ	11 UJ
2-Naphthylamine	27 U	27 U	25 U	26 UJ	27 UJ	27 UJ	26 U	26 UJ	26 UJ	27 UJ
2-Nitroaniline	8.7 U	8.9 U	8.1 U	8.5 U	8.8 UJ	8.7 UJ	8.5 U	8.4 U	8.5 UJ	8.9 UJ
2-Nitrophenol	9.8 U	10 U	9.1 U	9.5 UJ	9.8 UJ	9.7 UJ	9.5 U	9.4 UJ	9.5 UJ	10 UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01	56SB01	56SB02	56SB02	56SB03	56SB03	56SB04	56SB04	56SB05	56SB05
Sample ID	56SB01-01	56SB01-04	56SB02-02	56SB02-04	56SB03-02	56SB03-04	56SB04-03	56SB04-04	56SB05-03	56SB05-05
Date	4/28/2008	4/28/2008	4/28/2008	4/28/2008	4/29/2008	4/29/2008	4/28/2008	4/28/2008	4/29/2008	4/29/2008
Depth Range	1.0-3.0	7.0-9.0	3.0-5.0	7.0-9.0	3.0-5.0	7.0-9.0	5.0-7.0	7.0-9.0	5.0-7.0	9-10
Semivolatile Organic Compounds (ug/kg) (Cont)										
2-Picoline	16 U	16 U	15 U	16 U	16 UJ	16 UJ	16 U	15 U	16 UJ	16 UJ
2-Toluidine	12 U	13 U	12 U	12 U	13 UJ	12 UJ	12 U	12 U	12 UJ	13 UJ
3 & 4 Methylphenol	9.8 U	10 U	9.1 U	9.5 UJ	9.8 UJ	9.7 UJ	9.5 U	9.4 UJ	9.5 UJ	10 UJ
3,3'-Dichlorobenzidine	12 U	13 U	11 U	12 U	12 UJ	12 UJ	12 U	12 U	12 UJ	13 UJ
3,3'-Dimethylbenzidine	240 U	250 U	220 U	230 UJ	240 UJ	240 UJ	240 U	230 UJ	240 UJ	250 UJ
3-Methylcholanthrene	8.2 U	8.3 U	7.6 U	7.9 U	8.2 UJ	8.1 UJ	8 U	7.8 U	8 UJ	8.4 UJ
3-Nitroaniline	6 U	6.1 U	5.6 U	5.9 U	6.1 UJ	6 UJ	5.9 U	5.8 U	5.9 UJ	6.2 UJ
4,6-Dinitro-2-methylphenol	7.8 UJ	7.9 UJ	7.2 UJ	7.5 UJ	7.8 UJ	7.7 UJ	7.6 UJ	7.4 UJ	7.6 UJ	7.9 UJ
4-Aminobiphenyl	17 U	18 U	16 U	17 U	18 UJ	17 UJ	17 U	17 U	17 UJ	18 UJ
4-Bromophenyl phenyl ether	9.5 U	9.7 U	8.8 U	9.2 U	9.6 UJ	9.5 UJ	9.3 U	9.1 U	9.3 UJ	9.7 UJ
4-Chloro-3-methylphenol	10 U	10 U	9.3 U	9.7 UJ	10 UJ	10 UJ	9.8 U	9.6 UJ	9.8 UJ	10 UJ
4-Chloroaniline	8.1 U	8.2 U	7.5 U	7.8 U	8.1 UJ	8 UJ	7.8 U	7.7 U	7.8 UJ	8.2 UJ
4-Chlorophenyl phenyl ether	8.3 U	8.5 U	7.7 U	8.1 U	8.4 UJ	8.3 UJ	8.1 U	8 U	8.1 UJ	8.5 UJ
4-Nitroaniline	10 UJ	11 UJ	9.6 UJ	10 U	10 UJ	10 UJ	10 UJ	9.9 U	10 UJ	11 UJ
4-Nitrophenol	44 UJ	45 UJ	41 UJ	43 UJ	44 UJ	44 UJ	43 UJ	42 UJ	43 UJ	45 UJ
4-Nitroquinoline-1-oxide	15 R	15 R	14 R	14 R	15 R	15 R	14 R	14 R	14 R	15 R
7,12-Dimethylbenz(a)anthracene	12 U	13 U	12 U	12 U	13 UJ	12 UJ	12 U	12 U	12 UJ	13 UJ
Acenaphthene	0.77 U	0.78 U	0.71 U	0.74 U	0.77 UJ	0.76 UJ	0.75 U	0.73 U	0.75 UJ	0.78 UJ
Acenaphthylene	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	2.2 U	2.2 U	2.2 UJ	2.3 UJ
Acetophenone	12 U	12 U	11 U	11 U	12 UJ	11 UJ	11 U	11 U	11 UJ	12 UJ
alpha,alpha-Dimethyl phenethylamine	79 U	81 U	74 U	77 U	79 UJ	79 UJ	77 U	76 U	77 UJ	81 UJ
Aniline	8.5 U	8.6 U	7.8 U	8.2 U	8.5 UJ	8.4 UJ	8.2 U	8.1 U	8.2 UJ	8.6 UJ
Anthracene	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	2.2 U	2.2 U	2.2 UJ	2.3 UJ
Aramite, Total	15 U	15 U	14 U	14 UJ	15 UJ	15 UJ	14 U	14 UJ	14 UJ	15 UJ
Benzo[a]anthracene	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	4 J	2.2 U	2.2 UJ	2.3 UJ
Benzo[a]pyrene	0.89 U	0.9 U	0.82 U	0.86 U	0.89 UJ	0.88 UJ	4.2 J	0.85 U	0.86 UJ	0.9 UJ
Benzo[b]fluoranthene	1 U	1 U	0.95 U	0.99 U	1 UJ	1 UJ	0.99 U	0.98 U	0.99 UJ	1 UJ
Benzo[g,h,i]perylene	2.3 U	2.3 U	2.1 U	2.2 U	2.3 UJ	2.3 UJ	2.2 U	2.2 U	2.2 UJ	2.3 UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03		56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02		56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0		7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Semivolatile Organic Compounds (ug/kg) (Cont)																				
Benzo[k]fluoranthene	1.3	U	1.4	U	1.2	U	1.3	U	1.3	UJ	1.3	UJ	8.6	J	1.3	U	1.3	UJ	1.4	UJ
Benzyl alcohol	11	U	11	U	10	U	10	UJ	11	UJ	11	UJ	10	U	10	UJ	10	UJ	11	UJ
Bis(2-chloroethoxy)methane	9.1	U	9.3	U	8.5	U	8.9	U	9.2	UJ	9.1	UJ	8.9	U	8.7	U	8.9	UJ	9.3	UJ
Bis(2-chloroethyl)ether	7.7	U	7.8	U	7.1	U	7.4	U	7.7	UJ	7.6	UJ	7.5	U	7.3	U	7.5	UJ	7.8	UJ
Bis(2-ethylhexyl) phthalate	8.6	U	8.9	U	11	U	36	U	20	UJ	16	UJ	19	U	8.8	U	14	UJ	42	UJ
Butyl benzyl phthalate	9.7	U	9.8	U	9	U	9.4	U	9.7	UJ	9.6	UJ	9.4	U	9.3	U	9.4	UJ	9.9	UJ
Chrysene	0.82	U	0.83	U	0.76	U	0.79	U	0.82	UJ	0.81	UJ	6.9	J	0.78	U	0.8	UJ	0.84	UJ
Diallate	13	U	13	U	12	U	13	U	13	UJ	13	UJ	13	U	12	U	13	UJ	13	UJ
Dibenz(a,h)anthracene	0.79	U	0.81	U	0.74	U	0.77	U	0.79	UJ	0.79	UJ	0.77	U	0.76	U	0.77	UJ	0.81	UJ
Dibenzofuran	5.6	U	5.7	U	5.2	U	5.5	U	5.7	UJ	5.6	UJ	5.5	U	5.4	U	5.5	UJ	5.8	UJ
Diethyl phthalate	15	U	15	U	14	U	14	U	15	UJ	15	UJ	14	U	14	U	14	UJ	15	UJ
Dimethyl phthalate	8.6	U	8.7	U	8	U	8.3	U	8.6	UJ	8.5	UJ	8.4	U	8.2	U	8.4	UJ	8.8	UJ
Di-n-butyl phthalate	34	U	34	U	31	U	33	U	34	UJ	33	UJ	35	U	32	U	33	UJ	41	J
Di-n-octyl phthalate	4.4	U	4.5	U	4.1	U	4.3	U	4.4	UJ	4.4	UJ	4.3	U	4.2	U	4.3	UJ	4.5	UJ
Dinoseb	23	U	23	U	21	U	22	U	23	UJ	23	UJ	22	U	22	U	22	UJ	23	UJ
Ethyl methanesulfonate	15	U	15	U	14	U	14	U	15	UJ	15	UJ	14	U	14	U	14	UJ	15	UJ
Fluoranthene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ	2.3	UJ	5.7	J	2.2	U	2.2	UJ	2.3	UJ
Fluorene	1	U	1.1	U	0.96	U	1	U	1	UJ	1	UJ	1	U	0.99	U	1	UJ	1.1	UJ
Hexachlorobenzene	9.1	U	9.3	U	8.5	U	8.9	U	9.2	UJ	9.1	UJ	8.9	U	8.7	U	8.9	UJ	9.3	UJ
Hexachlorobutadiene	12	U	12	U	11	U	12	U	12	UJ	12	UJ	12	U	12	U	12	UJ	12	UJ
Hexachlorocyclopentadiene	19	U	19	U	17	U	18	U	19	UJ	19	UJ	18	U	18	U	18	UJ	19	UJ
Hexachloroethane	9.9	U	10	U	9.2	U	9.6	U	10	UJ	9.9	UJ	9.7	U	9.5	U	9.7	UJ	10	UJ
Hexachlorophene	1100	R	1100	R	1000	R	1100	R	1100	UJ	1100	UJ	1100	R	1100	R	1100	UJ	1100	R
Hexachloropropene	9.7	UJ	9.8	UJ	9	UJ	9.4	U	9.7	UJ	9.6	UJ	9.4	UJ	9.3	U	9.4	UJ	9.9	UJ
Indeno[1,2,3-cd]pyrene	1.6	UJ	1.6	UJ	1.5	UJ	1.6	UJ	1.6	UJ	1.6	UJ	1.6	UJ	1.5	UJ	1.6	UJ	1.6	UJ
Isophorone	8.3	U	8.5	U	7.7	U	8.1	U	8.4	UJ	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
Isosafrole	9.5	U	9.7	U	8.8	U	9.2	U	9.6	UJ	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03		56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02		56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0		7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Semivolatile Organic Compounds (ug/kg) (Cont)																				
Methapyrilene	12	UJ	13	UJ	12	UJ	12	UJ	13	UJ	12	UJ	12	UJ	12	UJ	12	UJ	13	UJ
Methyl methanesulfonate	12	U	13	U	12	U	12	U	13	UJ	12	UJ	12	U	12	U	12	UJ	13	UJ
Naphthalene	0.81	U	0.82	U	0.75	U	0.78	U	0.81	UJ	0.8	UJ	0.78	U	0.77	U	0.78	UJ	0.82	UJ
Nitrobenzene	9.3	U	9.4	U	8.6	U	9	U	9.3	UJ	9.2	UJ	9	U	8.9	U	9	UJ	9.5	UJ
N-Nitro-o-toluidine	8.1	U	8.2	U	7.5	U	7.8	U	8.1	UJ	8	UJ	7.8	U	7.7	U	7.8	UJ	8.2	UJ
N-Nitrosodiethylamine	16	U	16	U	15	U	16	U	16	UJ	16	UJ	16	U	15	U	16	UJ	16	UJ
N-Nitrosodimethylamine	13	U	13	U	12	U	13	U	13	UJ	13	UJ	13	U	13	U	13	UJ	13	UJ
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	11	UJ	12	U	12	UJ	12	UJ	12	UJ	12	UJ	12	UJ	12	UJ
N-Nitrosodi-n-propylamine	8.7	U	8.9	U	8.1	U	8.5	U	8.8	UJ	8.7	UJ	8.5	U	8.4	U	8.5	UJ	8.9	UJ
N-Nitrosodiphenylamine	9.5	U	9.7	U	8.8	U	9.2	U	9.6	UJ	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ
N-Nitrosomethylethylamine	7.7	U	7.8	U	7.1	U	7.4	U	7.7	UJ	7.6	UJ	7.5	U	7.3	U	7.5	UJ	7.8	UJ
N-Nitrosomorpholine	8.9	UJ	9	UJ	8.2	UJ	8.5	UJ	8.9	UJ	8.8	UJ	8.6	UJ	8.5	UJ	8.6	UJ	9	UJ
N-Nitrosopiperidine	11	U	12	U	11	U	11	UJ	11	UJ	11	UJ	11	U	11	UJ	11	UJ	12	UJ
N-Nitrosopyrrolidine	12	U	12	U	11	U	12	UJ	12	UJ	12	UJ	12	U	11	UJ	12	UJ	12	UJ
p-Dimethylamino azobenzene	9.5	U	9.7	U	8.8	U	9.2	U	9.6	UJ	9.5	UJ	9.3	U	9.1	U	9.3	UJ	9.7	UJ
Pentachlorobenzene	8.3	U	8.5	U	7.7	U	8.1	U	8.4	UJ	8.3	UJ	8.1	U	8	U	8.1	UJ	8.5	UJ
Pentachloronitrobenzene	7.9	U	8.1	U	7.4	U	7.7	U	7.9	UJ	7.9	UJ	7.7	U	7.6	U	7.7	UJ	8.1	UJ
Pentachlorophenol	11	U	11	U	10	U	11	UJ	11	UJ	11	UJ	11	U	11	UJ	11	UJ	11	UJ
Phenacetin	6.3	U	6.4	U	5.9	U	6.1	U	6.3	UJ	6.3	UJ	6.1	U	6	U	6.1	UJ	6.4	UJ
Phenanthrene	2.3	UJ	2.3	UJ	2.1	UJ	2.2	UJ	2.3	UJ	2.3	UJ	2.2	UJ	2.2	UJ	2.2	UJ	2.3	UJ
Phenol	6.4	U	6.6	U	6	U	6.3	U	6.5	UJ	6.4	UJ	6.3	U	6.2	U	6.3	UJ	6.6	UJ
p-Phenylene diamine	210	U	220	U	200	U	210	U	220	UJ	210	UJ	210	U	210	U	210	UJ	220	UJ
Pronamide	12	U	12	U	11	U	12	U	12	UJ	12	UJ	12	U	12	U	12	UJ	12	UJ
Pyrene	2.3	U	2.3	U	2.1	U	2.2	U	2.3	UJ	2.3	UJ	8.1	J	2.2	U	2.2	UJ	2.3	UJ
Pyridine	15	U	15	U	14	U	14	U	15	UJ	15	UJ	14	U	14	U	14	UJ	15	UJ
Safrole, Total	11	U	11	U	10	U	11	U	11	UJ	11	UJ	11	U	11	U	11	UJ	11	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB01		56SB01		56SB02		56SB02		56SB03		56SB03		56SB04		56SB04		56SB05		56SB05	
Sample ID	56SB01-01		56SB01-04		56SB02-02		56SB02-04		56SB03-02		56SB03-04		56SB04-03		56SB04-04		56SB05-03		56SB05-05	
Date	4/28/2008		4/28/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008		4/28/2008		4/28/2008		4/29/2008		4/29/2008	
Depth Range	1.0-3.0		7.0-9.0		3.0-5.0		7.0-9.0		3.0-5.0		7.0-9.0		5.0-7.0		7.0-9.0		5.0-7.0		9-10	
Metals (mg/kg)																				
Antimony	0.094	U	0.14	U	0.084	U	0.096	U	0.096	UJ	0.15	UJ	0.088	U	0.26	U	0.089	UJ	0.12	UJ
Arsenic	1.1		1.2		0.5	J	0.48	J	0.47	U	3.4		0.8		1.5		1.2		1.7	
Barium	13	J	16	J	12	J	55	J	34	J	42	J	14	J	7.9	J	10	J	470	J
Beryllium	0.046	J	0.096	J	0.089	J	0.21		0.064	U	0.18		0.098	J	0.18		0.15		0.43	
Cadmium	0.039	UJ	0.04	UJ	0.035	UJ	0.04	UJ	0.04	UJ	0.064	J	0.036	UJ	0.036	UJ	0.037	UJ	0.061	J
Chromium	15		19		3.6		4		17	J	25	J	7.2		12		56	J	120	J
Cobalt	2.3		1.6		2.7		8		0.5	J	9.9	J	5.4		12		5.6	J	21	J
Copper	45	J	55	J	94	J	130	J	18	J	85	J	42	J	84	J	59	J	98	J
Lead	1.4		3		1.3		0.54		0.39	J	4.7	J	0.8		1.5		0.76	J	0.99	J
Mercury	0.042		0.005	U	0.005	U	0.006	J	0.005	U	0.74	J	0.015	J	0.005	U	0.017	J	0.005	U
Nickel	2.9		3.6		1.3		2.5		2.3	J	6.7	J	2.2		4.9		5.8	J	16	J
Selenium	2.9		0.64	J	0.76		0.4	J	0.59	J	2.2	J	0.57	J	1.2		0.49	J	0.62	J
Silver	0.091	J	0.051	J	0.018	U	0.035	J	0.034	UJ	0.052	UJ	0.04	J	0.036	J	0.035	UJ	0.061	UJ
Thallium	0.15	U	0.16	U	0.13	U	0.15	U	0.15	U	0.14	U	0.14	U	0.14	U	0.14	U	0.65	
Tin	5	U	5.2	U	4.5	U	5.1	U	5.1	U	4.8	U	4.7	U	4.6	U	4.8	U	4.9	U
Vanadium	110	J	140	J	230	J	200	J	29	J	470	J	170	J	380	J	170	J	220	J
Zinc	8.7	J	16	J	14	J	33	J	8.1	J	31	J	16	J	47	J	26	J	62	J

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Volatile Organic Compounds (ug/kg)												
1,1,1,2-Tetrachloroethane	0.62	U	0.66	U	0.69	U	0.57	U	0.62	U	0.62	U
1,1,1-Trichloroethane	0.57	U	0.6	U	0.63	U	0.52	U	0.56	U	0.56	U
1,1,2,2-Tetrachloroethane	1.4	U	1.4	U	1.5	U	1.2	U	1.3	U	1.3	U
1,1,2-Trichloroethane	1.2	U	1.2	U	1.3	U	1.1	U	1.2	U	1.2	U
1,1-Dichloroethane	0.49	U	0.52	U	0.54	U	0.45	U	0.48	U	0.48	U
1,1-Dichloroethene	0.53	U	0.56	U	0.59	U	0.48	U	0.52	U	0.52	U
1,2,3-Trichloropropane	1.4	U	1.4	U	1.5	U	1.2	U	1.3	U	1.3	U
1,2-Dibromo-3-Chloropropane	2.7	U	2.9	U	3	U	2.5	U	2.7	U	2.7	U
1,2-Dichloroethane	0.97	U	1	U	1.1	U	0.89	U	0.96	U	0.96	U
1,2-Dichloropropane	1.1	U	1.1	U	1.2	U	0.98	U	1.1	U	1.1	U
2-Butanone (MEK)	3.9	U	2.8	U	16	U	4.4	U	2.6	U	11	U
2-Chloro-1,3-butadiene	0.56	U	0.59	U	0.62	U	0.51	U	0.55	U	0.55	U
2-Hexanone	2	U	2.2	U	2.3	U	1.9	U	2	U	2	U
3-Chloro-1-propene	1.5	UJ	1.6	UJ	1.6	UJ	1.3	UJ	1.4	U	1.4	U
4-Methyl-2-pentanone (MIBK)	2.8	U	3	U	3.1	U	2.6	U	2.8	U	2.8	U
Acetone	50	J	25	U	260		54	U	110		140	
Acetonitrile	44	U	47	U	49	U	40	U	43	R	43	R
Acrolein	19	R	20	R	21	R	17	R	18	U	18	U
Acrylonitrile	22	U	24	UJ	25	UJ	21	UJ	22	U	22	U
Benzene	0.77	U	0.82	U	0.86	U	0.71	U	0.76	U	0.76	U
Bromoform	1.1	U	1.1	U	1.2	U	0.98	U	1.1	U	1.1	U
Bromomethane	1.6	U	1.7	U	1.7	U	1.4	U	1.5	U	1.5	U
Carbon disulfide	0.5	U	0.53	U	1.9	J	0.46	U	0.49	U	0.49	U
Carbon tetrachloride	0.97	U	1	U	1.1	U	0.89	U	0.96	U	0.96	U
Chlorobenzene	0.71	U	0.75	U	0.79	U	0.65	U	0.7	U	0.7	U
Chlorodibromomethane	0.49	U	0.52	U	0.54	U	0.45	U	0.48	U	0.48	U
Chloroethane	1.2	U	1.2	U	1.3	U	1.1	U	1.2	U	1.2	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Volatile Organic Compounds (ug/kg) (Cont)												
Chloroform	0.49	U	0.52	U	0.54	U	0.45	U	0.48	U	0.48	U
Chloromethane	0.69	U	0.73	U	0.77	U	0.63	U	0.68	U	0.68	U
cis-1,3-Dichloropropene	0.85	U	0.9	U	0.94	U	0.78	U	0.84	U	0.84	U
Dibromomethane	1.2	U	1.2	U	1.3	U	1.1	U	1.2	U	1.2	U
Dichlorobromomethane	0.81	U	0.86	U	0.9	U	0.74	U	0.8	U	0.8	U
Dichlorodifluoromethane	0.87	U	0.92	U	0.96	U	0.79	U	0.86	U	0.86	U
Ethyl methacrylate	2.1	U	2.3	U	2.4	U	2	U	2.1	U	2.1	U
Ethylbenzene	0.73	U	0.78	U	0.81	U	0.67	U	0.72	U	0.72	U
Ethylene Dibromide	1.5	U	1.6	U	1.6	U	1.3	U	1.4	U	1.4	U
Iodomethane	0.97	UJ	1	U	1.7	J	0.89	U	2.6	J	1.2	J
Isobutyl alcohol	67	R	71	R	75	R	62	R	66	R	66	R
Methacrylonitrile	23	UJ	25	U	26	U	21	U	23	UJ	23	UJ
Methyl methacrylate	3.6	UJ	3.8	U	4	U	3.3	U	3.6	U	3.6	U
Methylene Chloride	0.97	U	1	U	1.1	U	0.89	U	0.96	U	0.96	U
Pentachloroethane	2.1	UJ	2.3	UJ	2.4	UJ	2	UJ	2.1	UJ	2.1	UJ
Propionitrile	20	U	22	U	23	U	19	U	20	U	20	U
Styrene	0.64	U	0.68	U	0.72	U	0.59	U	0.63	U	0.63	U
Tetrachloroethene	0.71	U	0.75	U	0.79	U	0.65	U	0.7	U	0.7	U
Toluene	0.77	U	0.82	U	0.86	U	0.71	U	0.76	U	0.76	U
trans-1,2-Dichloroethene	0.95	U	1	U	1.1	U	0.87	U	0.93	U	0.93	U
trans-1,3-Dichloropropene	0.85	U	0.9	U	0.94	U	0.78	U	0.84	U	0.84	U
trans-1,4-Dichloro-2-butene	3	UJ	3.2	U	3.4	U	2.8	U	3	U	3	U
Trichloroethene	0.97	U	1	U	1.1	U	0.89	U	0.96	U	0.96	U
Trichlorofluoromethane	1.5	U	1.6	U	1.6	U	1.3	U	1.4	U	1.4	U
Vinyl acetate	1.5	U	1.6	U	1.6	U	1.3	U	1.4	U	1.4	U
Vinyl chloride	0.57	U	0.6	U	0.63	U	0.52	U	0.56	U	0.56	U
Xylenes, Total	2.2	U	2.4	U	2.5	U	2.1	U	2.2	U	2.2	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Semivolatile Organic Compounds (u												
1,1'-Biphenyl	9.4	UJ	10	UJ	9.6	U	9.3	U	9.6	UJ	10	UJ
1,2,4,5-Tetrachlorobenzene	8	UJ	8.6	UJ	8.2	U	7.9	U	8.1	UJ	8.5	UJ
1,2,4-Trichlorobenzene	9.4	UJ	10	UJ	9.6	U	9.4	U	9.6	UJ	10	UJ
1,2-Dichlorobenzene	8.9	UJ	9.5	UJ	9.1	U	8.8	U	9	UJ	9.4	UJ
1,3,5-Trinitrobenzene	22	UJ	23	UJ	22	U	21	U	22	UJ	23	UJ
1,3-Dichlorobenzene	7.6	UJ	8.2	UJ	7.8	U	7.6	U	7.8	UJ	8.1	UJ
1,3-Dinitrobenzene	5	UJ	5.3	UJ	5.1	U	4.9	U	5.1	UJ	5.3	UJ
1,4-Dichlorobenzene	7.9	UJ	8.4	UJ	8.1	U	7.8	U	8	UJ	8.4	UJ
1,4-Dioxane	10	UJ	11	UJ	10	U	10	U	10	UJ	11	UJ
1,4-Naphthoquinone	5	UJ	5.3	UJ	5.1	U	4.9	U	5	UJ	5.3	UJ
2,2'-oxybis[1-chloropropane]	8	UJ	8.6	UJ	8.3	U	8	U	8.3	UJ	8.5	UJ
2,3,4,6-Tetrachlorophenol	5.3	UJ	5.7	UJ	5.5	U	5.3	U	5.4	UJ	5.7	UJ
2,4,5-Trichlorophenol	8.6	UJ	9.2	UJ	8.9	U	8.6	U	8.8	UJ	9.2	UJ
2,4,6-Trichlorophenol	10	UJ	11	UJ	10	U	10	U	10	UJ	11	UJ
2,4-Dichlorophenol	10	UJ	11	UJ	11	U	10	U	10	UJ	11	UJ
2,4-Dimethylphenol	22	UJ	23	UJ	22	U	21	U	22	UJ	23	UJ
2,4-Dinitrophenol	110	UJ	110	UJ	110	U	100	U	110	UJ	110	UJ
2,4-Dinitrotoluene	7.5	UJ	8	UJ	7.7	UJ	7.4	UJ	7.6	UJ	7.9	UJ
2,6-Dichlorophenol	8.1	UJ	8.7	UJ	8.3	U	8.1	U	8.3	UJ	8.6	UJ
2,6-Dinitrotoluene	7.9	UJ	8.4	UJ	8.1	U	7.8	U	8	UJ	8.4	UJ
2-Acetylaminofluorene	6.5	UJ	6.9	UJ	6.6	U	6.4	UJ	6.6	UJ	6.9	UJ
2-Chloronaphthalene	7.9	UJ	8.4	UJ	8.1	U	7.8	U	8	UJ	8.4	UJ
2-Chlorophenol	8.4	UJ	9	UJ	8.6	U	8.3	U	8.5	UJ	8.9	UJ
2-Methylnaphthalene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	6.2	J	2.3	UJ
2-Methylphenol	10	UJ	11	UJ	11	U	10	U	10	UJ	11	UJ
2-Naphthylamine	25	UJ	27	UJ	26	U	25	U	26	UJ	27	UJ
2-Nitroaniline	8.3	UJ	8.8	UJ	8.5	U	8.2	U	8.4	UJ	8.8	UJ
2-Nitrophenol	9.3	UJ	9.9	UJ	9.5	U	9.2	U	9.4	UJ	9.8	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Semivolatile Organic Compounds (u												
2-Picoline	15	UJ	16	UJ	16	U	15	U	16	UJ	16	UJ
2-Toluidine	12	UJ	13	UJ	12	U	12	U	12	UJ	13	UJ
3 & 4 Methylphenol	9.3	UJ	9.9	UJ	9.5	U	9.2	U	9.4	UJ	9.8	UJ
3,3'-Dichlorobenzidine	12	UJ	13	UJ	12	U	12	U	12	UJ	12	UJ
3,3'-Dimethylbenzidine	230	UJ	240	UJ	230	U	230	U	230	UJ	240	UJ
3-Methylcholanthrene	7.7	UJ	8.3	UJ	7.9	U	7.7	U	7.9	UJ	8.2	UJ
3-Nitroaniline	5.7	UJ	6.1	UJ	5.9	U	5.7	U	5.8	UJ	6.1	UJ
4,6-Dinitro-2-methylphenol	7.4	UJ	7.9	UJ	7.5	UJ	7.3	UJ	7.5	UJ	7.8	UJ
4-Aminobiphenyl	17	UJ	18	UJ	17	U	16	U	17	UJ	18	UJ
4-Bromophenyl phenyl ether	9	UJ	9.7	UJ	9.2	U	9	U	9.2	UJ	9.6	UJ
4-Chloro-3-methylphenol	9.5	UJ	10	UJ	9.8	U	9.5	U	9.7	UJ	10	UJ
4-Chloroaniline	7.6	UJ	8.2	UJ	7.8	U	7.6	U	7.8	UJ	8.1	UJ
4-Chlorophenyl phenyl ether	7.9	UJ	8.4	UJ	8.1	U	7.8	U	8	UJ	8.4	UJ
4-Nitroaniline	9.8	UJ	10	UJ	10	U	9.7	U	9.9	UJ	10	UJ
4-Nitrophenol	42	UJ	45	UJ	43	U	42	U	43	UJ	44	UJ
4-Nitroquinoline-1-oxide	14	R	15	R	14	R	14	R	14	R	15	R
7,12-Dimethylbenz(a)anthracene	12	UJ	13	UJ	12	U	12	U	12	UJ	13	UJ
Acenaphthene	0.72	UJ	0.78	UJ	0.74	U	0.72	U	0.74	UJ	0.77	UJ
Acenaphthylene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ
Acetophenone	11	UJ	12	UJ	11	U	11	U	11	UJ	12	UJ
alpha,alpha-Dimethyl phenethylamine	75	UJ	80	UJ	77	UJ	74	UJ	76	UJ	79	UJ
Aniline	8	UJ	8.6	UJ	8.3	U	7.9	U	8.1	UJ	8.5	UJ
Anthracene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ
Aramite, Total	14	UJ	15	UJ	14	UJ	14	UJ	14	UJ	15	UJ
Benzo[a]anthracene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ
Benzo[a]pyrene	0.84	UJ	0.9	UJ	1.2	J	0.83	U	0.85	UJ	0.89	UJ
Benzo[b]fluoranthene	0.97	UJ	1	UJ	1	J	0.96	U	0.98	UJ	1	UJ
Benzo[g,h,i]perylene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Semivolatile Organic Compounds (u												
Benzo[k]fluoranthene	1.3	UJ	1.4	UJ	1.3	U	1.3	U	1.3	UJ	1.3	UJ
Benzyl alcohol	10	UJ	11	UJ	10	U	10	U	10	UJ	11	UJ
Bis(2-chloroethoxy)methane	8.6	UJ	9.2	UJ	8.9	U	8.6	U	8.8	UJ	9.2	UJ
Bis(2-chloroethyl)ether	7.2	UJ	7.8	UJ	7.4	U	7.2	U	7.4	UJ	7.7	UJ
Bis(2-ethylhexyl) phthalate	8.5	UJ	13	UJ	61	U	32	U	16	UJ	44	UJ
Butyl benzyl phthalate	9.1	UJ	9.8	UJ	9.5	U	9.1	U	9.5	UJ	9.7	UJ
Chrysene	0.77	UJ	0.83	UJ	1	J	0.77	U	0.79	UJ	0.82	UJ
Diallate	12	UJ	13	UJ	12	U	12	U	12	UJ	13	UJ
Dibenz(a,h)anthracene	0.75	UJ	0.8	UJ	0.77	U	0.74	U	0.76	UJ	0.79	UJ
Dibenzofuran	5.3	UJ	5.7	UJ	5.5	U	5.3	U	5.4	UJ	5.7	UJ
Diethyl phthalate	14	UJ	15	UJ	14	U	14	U	14	UJ	15	UJ
Dimethyl phthalate	8.1	UJ	8.7	UJ	8.3	U	8.1	U	8.4	UJ	8.6	UJ
Di-n-butyl phthalate	32	UJ	34	UJ	33	U	32	U	32	UJ	69	UJ
Di-n-octyl phthalate	4.2	UJ	4.5	UJ	4.3	U	4.2	U	4.3	UJ	4.4	UJ
Dinoseb	22	UJ	23	UJ	22	U	21	U	22	UJ	23	UJ
Ethyl methanesulfonate	14	UJ	15	UJ	14	U	14	U	14	UJ	15	UJ
Fluoranthene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ
Fluorene	0.98	UJ	1	UJ	1	U	0.97	U	0.99	UJ	1	UJ
Hexachlorobenzene	8.6	UJ	9.2	UJ	8.9	U	8.6	U	8.8	UJ	9.2	UJ
Hexachlorobutadiene	12	UJ	12	UJ	12	U	11	U	12	UJ	12	UJ
Hexachlorocyclopentadiene	18	UJ	19	UJ	18	U	18	U	18	UJ	19	UJ
Hexachloroethane	9.4	UJ	10	UJ	9.6	U	9.3	U	9.6	UJ	10	UJ
Hexachlorophene	1100	R	1100	R	1100	R	1000	R	1100	R	1100	R
Hexachloropropene	9.1	UJ	9.8	UJ	9.4	UJ	9.1	UJ	9.3	UJ	9.7	UJ
Indeno[1,2,3-cd]pyrene	1.5	UJ	1.6	UJ	1.6	U	1.5	U	1.6	UJ	1.6	UJ
Isophorone	7.9	UJ	8.4	UJ	8.1	U	7.8	U	8	UJ	8.4	UJ
Isosafrole	9	UJ	9.7	UJ	9.2	U	9	U	9.2	UJ	9.6	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Semivolatile Organic Compounds (u												
Methapyrilene	12	UJ	13	UJ	12	U	12	U	12	UJ	13	UJ
Methyl methanesulfonate	12	UJ	13	UJ	12	U	12	U	12	UJ	13	UJ
Naphthalene	0.76	UJ	0.82	UJ	0.78	U	0.76	U	0.78	UJ	0.81	UJ
Nitrobenzene	8.8	UJ	9.4	UJ	9	U	8.7	U	9.1	UJ	9.3	UJ
N-Nitro-o-toluidine	7.6	UJ	8.2	UJ	7.9	U	7.6	U	8.9	UJ	8.1	UJ
N-Nitrosodiethylamine	15	UJ	16	UJ	16	U	15	U	16	UJ	16	UJ
N-Nitrosodimethylamine	12	UJ	13	UJ	13	U	12	U	13	UJ	13	UJ
N-Nitrosodi-n-butylamine	12	UJ	12	UJ	12	U	11	U	12	UJ	12	UJ
N-Nitrosodi-n-propylamine	8.3	UJ	8.8	UJ	8.5	U	8.2	U	8.4	UJ	8.8	UJ
N-Nitrosodiphenylamine	9	UJ	9.7	UJ	9.2	U	9	U	9.2	UJ	9.6	UJ
N-Nitrosomethylethylamine	7.2	UJ	7.8	UJ	7.5	U	7.2	U	7.4	UJ	7.7	UJ
N-Nitrosomorpholine	8.4	UJ	9	UJ	8.6	UJ	8.3	UJ	8.5	UJ	8.9	UJ
N-Nitrosopiperidine	11	UJ	12	UJ	11	UJ	11	UJ	11	UJ	11	UJ
N-Nitrosopyrrolidine	11	UJ	12	UJ	12	U	11	U	12	UJ	12	UJ
p-Dimethylamino azobenzene	9	UJ	9.7	UJ	9.3	U	9	U	9.3	UJ	9.6	UJ
Pentachlorobenzene	7.9	UJ	8.4	UJ	8.2	U	7.8	U	8	UJ	8.4	UJ
Pentachloronitrobenzene	7.5	UJ	8	UJ	7.8	U	7.4	U	7.6	UJ	7.9	UJ
Pentachlorophenol	11	UJ	11	UJ	11	U	11	U	11	UJ	11	UJ
Phenacetin	6	UJ	6.4	UJ	6.1	U	5.9	U	6.1	UJ	6.3	UJ
Phenanthrene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ
Phenol	6.1	UJ	6.5	UJ	6.2	U	6.1	U	6.2	UJ	6.5	UJ
p-Phenylene diamine	200	UJ	220	UJ	210	U	200	U	210	UJ	220	UJ
Pronamide	11	UJ	12	UJ	12	U	11	U	12	UJ	12	UJ
Pyrene	2.2	UJ	2.3	UJ	2.2	U	2.1	U	2.2	UJ	2.3	UJ
Pyridine	14	UJ	15	UJ	14	U	14	U	14	UJ	15	UJ
Safrole, Total	11	UJ	11	UJ	11	U	10	U	11	UJ	11	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SB06		56SB06		56SB07		56SB07		56SB08		56SB08	
Sample ID	56SB06-01		56SB06-03		56SB07-02		56SB07-03		56SB08-01		56SB08-02	
Date	4/30/2008		4/30/2008		5/1/2008		5/1/2008		5/5/2008		5/5/2008	
Depth Range	1.0-3.0		5.0-7.0		3.0-5.0		5.0-7.0		1.0-3.0		3.0-5.0	
Metals (mg/kg)												
Antimony	0.33	UJ	0.12	UJ	0.18	UJ	0.13	UJ	0.092	UJ	0.095	UJ
Arsenic	4.9	R	2.6		2.4		2.1		1.2		2.1	
Barium	28	J	18	J	130	J	49	J	21		100	
Beryllium	0.17		0.3		0.3		0.3		0.071	U	0.28	
Cadmium	0.038	UJ	0.038	UJ	0.14	J	0.16	J	0.048	U	0.12	U
Chromium	90	R	70	J	60	J	67	J	13		33	
Cobalt	2.1	J	7.3	J	34	J	29	J	4.3	J	55	J
Copper	75	J	140	J	120	J	130	J	40	J	73	
Lead	19	R	11	J	8.5	J	5.8	J	1.2		7.7	
Mercury	0.078	J	0.11	J	0.13	J	0.081	J	0.056		0.11	
Nickel	4.1	J	6.5	J	17	J	11	J	2.6		9.7	
Selenium	2.3	J	1	J	1.4	J	0.85	J	0.72		2.2	
Silver	0.056	UJ	0.044	UJ	0.089	J	0.11	J	0.028	J	0.19	U
Thallium	0.15	U	0.15	U	0.19	J	0.19	J	0.15	U	0.15	U
Tin	4.9	U	4.9	U	4.9	U	4.7	U	4.9	U	5.1	U
Vanadium	940	R	410	J	290	J	360	J	120		270	
Zinc	8.8	J	20	J	72	J	35	J	8.9		67	

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Volatile Organic Compounds (ug/L)																
1,1,1,2-Tetrachloroethane	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
1,1,1-Trichloroethane	0.39	R	0.39	U	0.39	UJ	0.39	U	0.39	UJ	0.39	U	0.39	U	0.39	U
1,1,2,2-Tetrachloroethane	0.26	R	0.26	U	0.26	UJ	0.26	U	0.26	UJ	0.26	U	0.26	U	0.26	U
1,1,2-Trichloroethane	0.51	R	0.51	U	0.51	UJ	0.51	U	0.51	UJ	0.51	U	0.51	U	0.51	U
1,1-Dichloroethane	0.32	R	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
1,1-Dichloroethene	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
1,2,3-Trichloropropane	0.42	R	0.42	U	0.42	UJ	0.42	U	0.42	UJ	0.42	U	0.42	U	0.42	U
1,2-Dibromo-3-Chloropropane	0.48	R	0.48	U	0.48	UJ	0.48	U	0.48	UJ	0.48	U	0.48	U	0.48	U
1,2-Dichloroethane	0.31	R	0.31	U	0.31	UJ	0.31	U	0.31	UJ	0.31	U	0.31	U	0.31	U
1,2-Dichloropropane	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
2-Butanone (MEK)	0.6	R	0.6	U	0.6	UJ	0.6	U	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	UJ	0.35	UJ	0.35	UJ	0.35	U	0.35	U	0.35	U
2-Hexanone	0.68	R	0.68	U	0.68	UJ	0.68	U	0.68	UJ	0.68	U	0.68	U	0.68	U
3-Chloro-1-propene	0.46	R	0.46	U	0.46	UJ	0.46	U	0.46	UJ	0.46	U	0.46	U	0.46	U
4-Methyl-2-pentanone (MIBK)	0.6	R	0.6	U	0.6	UJ	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Acetone	5	R	5.2	J	5	UJ	5	UJ	7.1	J	5	U	5	U	5	U
Acetonitrile	15	R	15	UJ	15	UJ	15	UJ	15	UJ	15	U	15	U	15	U
Acrolein	18	R	18	U	18	UJ	18	U	18	UJ	18	R	18	R	18	R
Acrylonitrile	3.8	R	3.8	U	3.8	UJ	3.8	U	3.8	UJ	3.8	UJ	3.8	UJ	3.8	UJ
Benzene	0.32	R	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
Bromoform	0.41	R	0.41	U	0.41	UJ	0.41	U	0.41	UJ	0.41	U	0.41	U	0.41	U
Bromomethane	0.5	R	0.5	U	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ	0.5	UJ	0.5	UJ
Carbon disulfide	0.17	R	0.17	UJ	0.17	UJ	0.17	UJ	0.17	UJ	0.17	U	0.17	U	0.17	U
Carbon tetrachloride	0.27	R	0.27	U	0.27	UJ	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	U
Chlorobenzene	0.34	R	0.34	U	0.34	UJ	0.34	U	0.34	UJ	0.34	U	0.34	U	0.34	U
Chlorodibromomethane	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Chloroethane	1	R	1	UJ	1	UJ	1	UJ	1	UJ	1	U	1	U	1	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Volatile Organic Compounds (ug/L)																
Chloroform	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
Chloromethane	0.28	R	0.28	U	1.8	J	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
cis-1,3-Dichloropropene	0.37	R	0.37	U	0.37	UJ	0.37	U	0.37	UJ	0.37	U	0.37	U	0.37	U
Dibromomethane	0.29	R	0.29	U	0.29	UJ	0.29	U	0.29	UJ	0.29	U	0.29	U	0.29	U
Dichlorobromomethane	0.34	R	0.34	U	0.34	UJ	0.34	U	0.34	UJ	0.34	U	0.34	U	0.34	U
Dichlorodifluoromethane	0.33	R	0.33	U	0.33	UJ	0.33	U	0.33	UJ	0.33	UJ	0.33	UJ	0.33	UJ
Ethyl methacrylate	1	R	1	U	1	UJ	1	U	1	UJ	1	U	1	U	1	U
Ethylbenzene	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Ethylene Dibromide	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Iodomethane	1	R	1	U	1	UJ	1	U	1	UJ	1	U	1	U	1	U
Isobutyl alcohol	19	R	19	R	19	R	19	R	19	R	19	U	19	U	19	U
Methacrylonitrile	6.6	R	6.6	U	6.6	UJ	6.6	U	6.6	UJ	6.6	U	6.6	U	6.6	U
Methyl methacrylate	0.38	R	0.38	U	0.38	UJ	0.38	U	0.38	UJ	0.38	U	0.38	U	0.38	U
Methylene Chloride	1	R	1	U	1	UJ	1	U	1	UJ	1	U	1	U	1	U
Pentachloroethane	1.3	R	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ
Propionitrile	9.2	R	9.2	U	9.2	UJ	9.2	U	9.2	UJ	9.2	U	9.2	U	9.2	U
Styrene	0.36	R	0.36	U	0.36	UJ	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Tetrachloroethene	0.28	R	0.28	U	0.28	UJ	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
Toluene	0.31	R	0.31	U	0.31	UJ	0.31	U	0.31	UJ	0.31	U	0.31	U	0.31	U
trans-1,2-Dichloroethene	0.3	R	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
trans-1,3-Dichloropropene	0.27	R	0.27	U	0.27	UJ	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	UJ
trans-1,4-Dichloro-2-butene	0.83	R	0.83	UJ	0.83	UJ	0.83	UJ	0.83	UJ	0.83	U	0.83	U	0.83	U
Trichloroethene	0.4	R	0.4	U	0.4	UJ	0.4	U	0.4	UJ	0.4	U	0.4	U	0.4	U
Trichlorofluoromethane	0.29	R	0.29	UJ	0.29	UJ	0.29	UJ	0.29	UJ	0.29	U	0.29	U	0.29	U
Vinyl acetate	0.62	R	0.62	U	0.62	UJ	0.62	U	0.62	UJ	0.62	UJ	0.62	UJ	0.62	UJ
Vinyl chloride	0.2	R	0.2	U	0.2	UJ	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
Xylenes, Total	0.87	R	0.87	U	0.87	UJ	0.87	U	0.87	UJ	0.87	U	0.87	U	0.87	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Sample ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Semivolatile Organic Compounds (ug/L)								
1,1'-Biphenyl	0.17 U	0.17 U	0.17 UJ	0.17 U	0.17 UJ	0.17 U	0.17 U	0.17 U
1,2,4,5-Tetrachlorobenzene	0.23 U	0.23 U	0.23 UJ	0.23 U	0.23 UJ	0.23 U	0.23 U	0.23 U
1,2,4-Trichlorobenzene	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
1,2-Dichlorobenzene	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
1,3,5-Trinitrobenzene	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	0.12 U	0.12 U	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
1,3-Dinitrobenzene	0.22 U	0.22 U	0.22 UJ	0.22 U	0.22 UJ	0.22 U	0.22 U	0.22 U
1,4-Dichlorobenzene	0.12 U	0.16 J	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
1,4-Dioxane	0.49 U	0.49 U	0.49 UJ	0.49 U	0.49 UJ	0.49 U	0.49 U	0.49 U
1,4-Naphthoquinone	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
2,2'-oxybis[1-chloropropane]	0.097 U	0.097 U	0.097 UJ	0.097 U	0.097 UJ	0.097 U	0.097 U	0.097 U
2,3,4,6-Tetrachlorophenol	0.29 U	0.29 U	0.29 UJ	0.29 U	0.29 UJ	0.29 U	0.29 U	0.29 U
2,4,5-Trichlorophenol	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
2,4,6-Trichlorophenol	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
2,4-Dichlorophenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2,4-Dimethylphenol	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U
2,4-Dinitrophenol	2.4 U	2.4 U	2.4 UJ	2.4 U	2.4 UJ	2.4 U	2.4 U	2.4 U
2,4-Dinitrotoluene	0.17 UJ	0.17 U	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 UJ	0.17 U
2,6-Dichlorophenol	0.21 U	0.21 U	0.21 UJ	0.21 U	0.21 UJ	0.21 U	0.21 U	0.21 U
2,6-Dinitrotoluene	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2-Acetylaminofluorene	0.19 U	0.19 U	0.19 UJ	0.19 U	0.19 UJ	0.19 U	0.19 U	0.19 U
2-Chloronaphthalene	0.12 U	0.12 U	0.12 UJ	0.12 U	0.12 UJ	0.12 U	0.12 U	0.12 U
2-Chlorophenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2-Methylnaphthalene	0.022 U	0.022 UJ	0.022 UJ	0.022 U	0.022 UJ	0.022 U	0.022 U	0.022 U
2-Methylphenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
2-Naphthylamine	1.1 U	1.1 U	1.1 UJ	1.1 U	1.1 UJ	1.1 U	1.1 U	1.1 U
2-Nitroaniline	0.14 U	0.14 U	0.14 UJ	0.14 U	0.14 UJ	0.14 U	0.14 U	0.14 U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Sample ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Semivolatile Organic Compounds (ug/L) (Cont)								
2-Nitrophenol	0.17 U	0.17 U	0.17 UJ	0.17 U	0.17 UJ	0.17 U	0.17 U	0.17 U
2-Picoline	0.57 U	0.57 U	0.57 UJ	0.57 U	0.57 UJ	0.57 U	0.57 U	0.57 U
2-Toluidine	0.32 U	0.32 U	0.32 UJ	0.32 U	0.32 UJ	0.32 U	0.32 U	0.32 U
3 & 4 Methylphenol	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.63 J
3,3'-Dichlorobenzidine	3.7 U	3.7 U	3.7 UJ	3.7 U	3.7 UJ	3.7 U	3.7 U	3.7 UJ
3,3'-Dimethylbenzidine	3.7 U	3.7 UJ	3.7 UJ	3.7 U	3.7 UJ	3.7 U	3.7 U	3.7 UJ
3-Methylcholanthrene	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U
3-Nitroaniline	0.28 U	0.28 U	0.28 UJ	0.28 U	0.28 UJ	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	0.49 UJ	0.49 UJ	0.49 U
4-Aminobiphenyl	0.68 U	0.68 U	0.68 UJ	0.68 U	0.68 UJ	0.68 U	0.68 U	0.68 U
4-Bromophenyl phenyl ether	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
4-Chloro-3-methylphenol	0.16 U	0.16 U	0.16 UJ	0.16 U	0.16 UJ	0.16 U	0.16 U	0.16 U
4-Chloroaniline	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U
4-Chlorophenyl phenyl ether	0.15 U	0.15 U	0.15 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.15 U
4-Nitroaniline	0.26 U	0.26 U	0.26 UJ	0.26 U	0.26 UJ	0.26 U	0.26 U	0.26 UJ
4-Nitrophenol	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ	0.18 UJ	0.18 U
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	0.26 R
7,12-Dimethylbenz(a)anthracene	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U
Acenaphthene	0.019 U	0.019 U	0.019 UJ	0.019 U	0.019 UJ	0.019 U	0.019 U	0.019 U
Acenaphthylene	0.049 U	0.049 U	0.049 UJ	0.049 U	0.049 UJ	0.049 U	0.049 U	0.049 U
Acetophenone	0.19 U	0.19 U	0.19 UJ	0.19 U	0.19 UJ	0.19 U	0.19 U	0.19 U
alpha,alpha-Dimethyl phenethylamine	1.3 U	1.3 U	1.3 UJ	1.3 U	1.3 UJ	1.3 U	1.3 U	1.3 U
Aniline	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U
Anthracene	0.021 U	0.021 U	0.021 UJ	0.021 U	0.021 UJ	0.021 U	0.033 J	0.021 U
Aramite, Total	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 UJ	0.49 U
Benzo[a]anthracene	0.025 U	0.025 U	0.025 UJ	0.025 U	0.025 UJ	0.025 U	0.025 U	0.025 U
Benzo[a]pyrene	0.024 U	0.024 U	0.024 UJ	0.024 U	0.024 UJ	0.024 U	0.024 U	0.024 U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L) (Cont)																
Benzo[b]fluoranthene	0.036	U	0.036	U	0.036	UJ	0.036	U	0.036	UJ	0.036	U	0.036	U	0.036	U
Benzo[g,h,i]perylene	0.023	UJ	0.023	U	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	UJ	0.019	U	0.019	UJ	0.019	U	0.019	U	0.019	U
Benzyl alcohol	0.16	U	0.16	U	0.16	UJ	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
Bis(2-chloroethoxy)methane	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Bis(2-chloroethyl)ether	0.14	U	0.14	U	0.14	UJ	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
Bis(2-ethylhexyl) phthalate	0.34	U	0.98		0.34	UJ	0.34	U	0.73	UJ	0.71	U	0.66	U	0.34	U
Butyl benzyl phthalate	0.17	U	0.17	U	0.17	UJ	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
Chrysene	0.027	U	0.027	U	0.027	UJ	0.027	U	0.027	UJ	0.027	U	0.027	U	0.027	U
Diallate	0.19	U	0.19	U	0.19	UJ	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
Dibenz(a,h)anthracene	0.023	UJ	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ	0.023	U
Dibenzofuran	0.097	U	0.097	U	0.097	UJ	0.097	U	0.097	UJ	0.097	U	0.097	U	0.097	U
Diethyl phthalate	0.18	U	0.32	J	0.18	UJ	0.18	U	0.18	UJ	0.18	U	0.18	U	0.18	U
Dimethyl phthalate	0.17	U	0.17	U	0.17	UJ	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
Di-n-butyl phthalate	0.18	U	0.3	U	0.17	UJ	0.21	U	0.13	UJ	0.16	U	0.11	U	0.16	U
Di-n-octyl phthalate	0.097	U	0.097	U	0.097	UJ	0.097	U	0.097	UJ	0.097	U	0.097	U	0.097	U
Dinoseb	0.49	U	0.49	U	0.49	UJ	0.49	U	0.49	UJ	0.49	U	0.49	U	0.49	U
Ethyl methanesulfonate	0.23	U	0.23	U	0.23	UJ	0.23	U	0.23	UJ	0.23	U	0.23	U	0.23	U
Fluoranthene	0.049	U	0.049	U	0.049	UJ	0.049	U	0.049	UJ	0.049	U	0.056	J	0.049	U
Fluorene	0.018	U	0.018	U	0.018	UJ	0.018	U	0.018	UJ	0.018	U	0.055	J	0.018	U
Hexachlorobenzene	0.16	U	0.16	U	0.16	UJ	0.16	U	0.16	UJ	0.16	U	0.16	U	0.16	U
Hexachlorobutadiene	0.13	U	0.13	U	0.13	UJ	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
Hexachlorocyclopentadiene	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	UJ	0.49	U	0.49	U	0.49	U
Hexachloroethane	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Hexachlorophene	49	R	49	R	49	R	49	R	49	R	49	R	49	R	49	R
Hexachloropropene	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	U
Indeno[1,2,3-cd]pyrene	0.022	U	0.022	U	0.022	UJ	0.022	U	0.022	UJ	0.022	U	0.022	U	0.022	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Semivolatile Organic Compounds (ug/L) (Cont)																
Isophorone	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Isosafrole	0.3	U	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Methapyrilene	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	UJ	0.26	U
Methyl methanesulfonate	0.46	U	0.46	U	0.46	UJ	0.46	U	0.46	UJ	0.46	U	0.46	U	0.46	U
Naphthalene	0.049	U	0.049	U	0.049	UJ	0.049	U	0.049	UJ	0.049	U	0.049	U	0.049	U
Nitrobenzene	0.14	U	0.14	U	0.14	UJ	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
N-Nitro-o-toluidine	0.24	U	0.24	U	0.24	UJ	0.24	U	0.24	UJ	0.24	U	0.24	U	0.24	U
N-Nitrosodiethylamine	0.32	U	0.32	U	0.32	UJ	0.32	U	0.32	UJ	0.32	U	0.32	U	0.32	U
N-Nitrosodimethylamine	0.19	U	0.19	U	0.19	UJ	0.19	U	0.19	UJ	0.19	U	0.19	U	0.19	U
N-Nitrosodi-n-butylamine	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	UJ	0.18	U
N-Nitrosodi-n-propylamine	0.13	U	0.13	U	0.13	UJ	0.13	U	0.13	UJ	0.13	U	0.13	U	0.13	U
N-Nitrosodiphenylamine	0.17	U	0.17	U	0.17	UJ	0.17	U	0.17	UJ	0.17	U	0.17	U	0.17	U
N-Nitrosomethylethylamine	0.28	U	0.28	U	0.28	UJ	0.28	U	0.28	UJ	0.28	U	0.28	U	0.28	U
N-Nitrosomorpholine	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	UJ	0.19	U
N-Nitrosopiperidine	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	UJ	0.22	U
N-Nitrosopyrrolidine	0.25	U	0.25	U	0.25	UJ	0.25	U	0.25	UJ	0.25	U	0.25	U	0.25	U
p-Dimethylamino azobenzene	0.6	U	0.6	U	0.6	UJ	0.6	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Pentachlorobenzene	0.27	U	0.27	U	0.27	UJ	0.27	U	0.27	UJ	0.27	U	0.27	U	0.27	U
Pentachloronitrobenzene	0.3	U	0.3	U	0.3	UJ	0.3	U	0.3	UJ	0.3	U	0.3	U	0.3	U
Pentachlorophenol	0.18	U	0.18	U	0.18	UJ	0.18	U	0.18	UJ	0.18	U	0.18	U	0.18	U
Phenacetin	0.2	U	0.2	U	0.2	UJ	0.2	U	0.2	UJ	0.2	U	0.2	U	0.2	U
Phenanthrene	0.017	U	0.017	U	0.017	UJ	0.017	U	0.017	UJ	0.05	J	0.39		0.017	U
Phenol	0.14	U	0.14	U	0.14	UJ	0.14	U	0.14	UJ	0.14	U	0.14	U	0.14	U
p-Phenylene diamine	2.4	U	2.4	U	2.4	UJ	2.4	U	2.4	UJ	2.4	U	2.4	U	2.4	U
Pronamide	0.25	U	0.25	U	0.25	UJ	0.25	U	0.25	UJ	0.25	U	0.25	U	0.25	U
Pyrene	0.026	U	0.026	U	0.026	UJ	0.026	U	0.026	UJ	0.026	U	0.026	U	0.026	U
Pyridine	0.22	U	0.22	U	0.22	UJ	0.22	U	0.22	UJ	0.22	U	0.22	U	0.22	U
Safrole, Total	0.23	U	0.23	U	0.23	UJ	0.23	U	0.23	UJ	0.23	U	0.23	U	0.23	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Sample ID	56GW01	56GW02	56GW03	56GW04	56GW05	56GW06	56GW07	56GW08
Date	5/1/2008	5/1/2008	5/1/2008	5/1/2008	5/2/2008	5/3/2008	5/3/2008	5/7/2008
Total Metals (ug/L)								
Antimony	0.36 U	0.36 U	0.36 UJ	0.36 U	0.36 UJ	0.36 U	0.36 U	0.36 U
Arsenic	1.8 U	1.9 U	0.52 J	1.7 U	0.42 J	0.31 U	0.7 U	1.2 U
Barium	7.1	24	21 J	23	16 J	18	100	170
Beryllium	0.065 U	0.065 U	0.065 UJ	0.065 U	0.065 UJ	0.065 U	0.065 U	0.065 U
Cadmium	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 UJ	0.12 U
Chromium	1.3 U	2.4 U	0.6 UJ	1.7 U	0.6 UJ	0.6 U	0.6 U	2.3 J
Cobalt	0.18 R	0.42 R	1.6 J	6.6	1.2 J	0.29 U	1.5 J	38
Copper	1.2 U	1.7 U	1.8 UJ	2.5 U	1.2 UJ	2.7 U	1.2 U	8.3
Lead	0.15 U	0.16 U	0.16 UJ	0.15 U	0.15 UJ	0.15 U	0.15 U	0.3 U
Mercury	0.08 UJ	0.08 UJ	0.08 UJ	0.08 UJ	0.08 UJ	0.08 U	0.08 U	0.08 U
Nickel	0.32 U	0.88 J	0.32 UJ	0.82 J	0.35 J	0.38 J	0.32 U	3.9
Selenium	0.6 U	0.6 U	0.6 UJ	0.79 J	0.6 UJ	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	0.09 U
Thallium	0.55 U	0.55 U	0.55 UJ	0.55 U	0.55 UJ	0.55 U	0.55 U	0.55 U
Tin	0.9 U	3.4 U	2.4 UJ	0.9 U	0.9 UJ	0.9 U	0.9 U	0.9 U
Vanadium	9.3	17	16 J	20	8.8 J	7.9	2.7 U	13
Zinc	6.5 U	6.5 U	6.5 UJ	8.7 J	6.5 UJ	6.5 U	6.5 U	18 J

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Sample ID	56GW01		56GW02		56GW03		56GW04		56GW05		56GW06		56GW07		56GW08	
Date	5/1/2008		5/1/2008		5/1/2008		5/1/2008		5/2/2008		5/3/2008		5/3/2008		5/7/2008	
Dissolved Metals (ug/L)																
Antimony	0.36	U	0.39	U	0.38	J	0.36	U	0.36	UJ	0.36	U	0.36	U	0.36	U
Arsenic	1.1	U	1.6	U	0.5	J	0.99	U	0.28	UJ	0.28	U	0.54	U	0.86	U
Barium	7.1		22		20	J	14		15	J	15		100		140	
Beryllium	0.065	U	0.065	U	0.065	UJ	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	U	0.12	U	0.12	U
Chromium	1.1	U	1.7	U	0.6	UJ	1.2	U	0.6	UJ	0.6	U	0.6	U	0.6	U
Cobalt	1.6	R	1.6	R	1.8	J	2.1		1.4	J	0.45	UJ	1.9	J	31	
Copper	1.2	U	1.3	U	1.9	UJ	1.2	U	1.2	UJ	1.2	U	1.2	U	2.5	U
Lead	0.15	U	0.15	U	0.15	UJ	0.15	U	0.15	UJ	0.15	U	0.15	U	0.15	U
Mercury	0.08	U	0.08	U	0.08	UJ	0.098	J	0.08	UJ	0.08	U	0.08	U	0.08	U
Nickel	0.82	J	0.69	J	0.55	J	0.58	J	0.4	J	0.32	U	0.4	J	2.6	
Selenium	0.6	U	0.6	U	0.6	UJ	0.65	J	0.7	J	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	U	0.09	U	0.09	U
Thallium	0.55	U	0.55	U	0.55	UJ	0.55	U	0.55	UJ	0.55	U	0.55	U	0.55	U
Tin	0.9	U	2.4	U	0.9	UJ	0.9	U	0.9	UJ	0.9	U	0.9	U	0.9	U
Vanadium	8		14		14	J	9.8		5.8	J	3.6	U	2.5	U	1.7	J
Zinc	6.5	U	6.5	U	7.4	J	6.5	U	6.5	UJ	6.5	U	6.5	U	8	J

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SURFACE WATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Low-level PAHs (ug/L)										
2-Methylnaphthalene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ
Acenaphthene	0.019	U	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Acenaphthylene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.047	UJ
Anthracene	0.021	U	0.021	UJ	0.021	UJ	0.021	UJ	0.021	UJ
Benzo[a]anthracene	0.025	U	0.025	UJ	0.025	UJ	0.025	UJ	0.025	UJ
Benzo[a]pyrene	0.024	U	0.024	UJ	0.024	UJ	0.024	UJ	0.024	UJ
Benzo[b]fluoranthene	0.036	U	0.036	UJ	0.035	UJ	0.036	UJ	0.035	UJ
Benzo[g,h,i]perylene	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ
Benzo[k]fluoranthene	0.019	U	0.019	UJ	0.019	UJ	0.019	UJ	0.019	UJ
Chrysene	0.027	U	0.027	UJ	0.026	UJ	0.027	UJ	0.026	UJ
Dibenz(a,h)anthracene	0.023	U	0.023	UJ	0.023	UJ	0.023	UJ	0.023	UJ
Fluoranthene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.047	UJ
Fluorene	0.018	U	0.018	UJ	0.018	UJ	0.018	UJ	0.018	UJ
Indeno[1,2,3-cd]pyrene	0.022	U	0.022	UJ	0.022	UJ	0.022	UJ	0.022	UJ
Naphthalene	0.049	U	0.049	UJ	0.047	UJ	0.049	UJ	0.047	UJ
Phenanthrene	0.017	U	0.017	UJ	0.017	UJ	0.017	UJ	0.017	UJ
Pyrene	0.026	U	0.026	UJ	0.025	UJ	0.026	UJ	0.025	UJ

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SURFACE WATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Total Metals (ug/L)										
Antimony	0.36	U	0.36	U	0.36	U	0.36	U	0.36	U
Arsenic	3.2		1.4	U	1.4	U	1.7	U	2.4	U
Barium	60		15		13		35		86	
Beryllium	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
Cadmium	1.1	J	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	6.3		1.6	U	1.5	U	1.5	U	1.7	U
Cobalt	3.1		0.37	R	0.27	R	0.37	R	1.7	R
Copper	13		2.3	J	3.1	J	1.4	J	2.4	J
Lead	16		0.25	J	0.43	J	0.73	J	0.21	J
Mercury	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ	0.08	UJ
Nickel	3.8		0.52	J	0.53	J	0.43	J	1.3	
Selenium	0.71	J	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
Thallium	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
Vanadium	22		5.2		6		5	U	5.3	
Zinc	46		6.5	U	6.6	J	8.6	J	6.5	J

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SURFACE WATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Sample ID	56SW01		56SW02		56SW03		56SW04		56SW05	
Date	4/29/2008		4/29/2008		4/29/2008		4/29/2008		4/29/2008	
Dissolved Metals (ug/L)										
Antimony	0.42	U	0.38	U	0.37	U	0.36	U	0.36	U
Arsenic	1.8	U	1.4	U	1.1	U	1.5	U	2.3	U
Barium	33		14		12		33		84	
Beryllium	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
Cadmium	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ	0.12	UJ
Chromium	1.2	U	1.3	U	1.2	U	1.3	U	1.5	U
Cobalt	3.7		3.7	R	2.3	R	2.1	R	3.8	R
Copper	1.5	U	2	J	2.6	J	1.2	U	1.9	J
Lead	0.43	U	0.17	J	0.15	U	0.47	J	0.15	U
Mercury	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
Nickel	2.1		1		1.2		0.82	J	1.6	
Selenium	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
Thallium	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
Tin	0.9	U	1.7	U	1.2	U	4.3	U	0.9	U
Vanadium	4.6	U	4.6	U	4.9	U	4	U	4.2	U
Zinc	8.8	J	6.7	J	6.5	U	6.5	U	6.5	U

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)				0-0	0-0	0-0	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)									
1,1,1,2-Tetrachloroethane	0.37 UJ	1.8 UJ	1.7 UJ	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	0.33 UJ	1.7 UJ	1.5 UJ	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	0.81 UJ	4 UJ	3.7 UJ	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	0.69 UJ	3.4 UJ	3.1 UJ	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	0.29 UJ	1.4 UJ	1.3 UJ	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	0.31 UJ	1.6 UJ	1.4 UJ	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0.81 UJ	4 UJ	3.7 UJ	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	1.6 UJ	8 UJ	7.3 UJ	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.58 UJ	2.9 UJ	2.6 UJ	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.63 UJ	3.2 UJ	2.9 UJ	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	65 J	35 UJ	110 UJ	NA	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	0.33 UJ	1.6 UJ	1.5 UJ	NA	NA	NA	NA	NA	NA
2-Hexanone	1.2 UJ	6 UJ	5.5 UJ	NA	NA	NA	NA	NA	NA
3-Chloro-1-propene	0.86 UJ	4.3 UJ	3.9 UJ	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	1.7 UJ	8.3 UJ	7.6 UJ	NA	NA	NA	NA	NA	NA
Acetone	200 J	250 J	1200 J	NA	NA	NA	NA	NA	NA
Acetonitrile	26 UJ	130 UJ	120 UJ	NA	NA	NA	NA	NA	NA
Acrolein	11 R	55 R	50 R	NA	NA	NA	NA	NA	NA
Acrylonitrile	13 UJ	66 UJ	60 UJ	NA	NA	NA	NA	NA	NA
Benzene	0.46 UJ	2.3 UJ	2.1 UJ	NA	NA	NA	NA	NA	NA
Bromoform	0.63 UJ	3.2 UJ	2.9 UJ	NA	NA	NA	NA	NA	NA
Bromomethane	0.92 UJ	4.6 UJ	4.2 UJ	NA	NA	NA	NA	NA	NA
Carbon disulfide	0.29 UJ	19 J	800 J	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	0.58 UJ	2.9 UJ	2.6 UJ	NA	NA	NA	NA	NA	NA
Chlorobenzene	0.42 UJ	2.1 UJ	1.9 UJ	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	0.29 UJ	1.4 UJ	1.3 UJ	NA	NA	NA	NA	NA	NA
Chloroethane	0.69 UJ	3.4 UJ	3.1 UJ	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)							0-0	0-0	0-0	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)												
Chloroform	0.29	UJ	1.4	UJ	1.3	UJ	NA	NA	NA	NA	NA	NA
Chloromethane	0.41	UJ	2	UJ	1.9	UJ	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	0.5	UJ	2.5	UJ	2.3	UJ	NA	NA	NA	NA	NA	NA
Dibromomethane	0.69	UJ	3.4	UJ	3.1	UJ	NA	NA	NA	NA	NA	NA
Dichlorobromomethane	0.48	UJ	2.4	UJ	2.2	UJ	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	0.51	UJ	2.6	UJ	2.3	UJ	NA	NA	NA	NA	NA	NA
Ethyl methacrylate	1.3	UJ	6.3	UJ	5.8	UJ	NA	NA	NA	NA	NA	NA
Ethylbenzene	0.43	UJ	2.2	UJ	2	UJ	NA	NA	NA	NA	NA	NA
Ethylene Dibromide	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
Iodomethane	0.58	UJ	2.9	UJ	36	J	NA	NA	NA	NA	NA	NA
Isobutyl alcohol	40	UJ	200	UJ	180	UJ	NA	NA	NA	NA	NA	NA
Methacrylonitrile	14	UJ	69	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Methyl methacrylate	2.1	UJ	11	UJ	9.7	UJ	NA	NA	NA	NA	NA	NA
Methylene Chloride	0.58	UJ	2.9	UJ	2.6	UJ	NA	NA	NA	NA	NA	NA
Pentachloroethane	1.3	UJ	6.3	UJ	5.8	UJ	NA	NA	NA	NA	NA	NA
Propionitrile	12	UJ	60	UJ	55	UJ	NA	NA	NA	NA	NA	NA
Styrene	0.38	UJ	1.9	UJ	1.7	UJ	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.42	UJ	2.1	UJ	1.9	UJ	NA	NA	NA	NA	NA	NA
Toluene	0.46	UJ	2.3	UJ	2.1	UJ	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	0.56	UJ	2.8	UJ	2.5	UJ	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	0.5	UJ	2.5	UJ	2.3	UJ	NA	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	1.8	UJ	8.9	UJ	8.1	UJ	NA	NA	NA	NA	NA	NA
Trichloroethene	0.58	UJ	2.9	UJ	2.6	UJ	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
Vinyl acetate	0.86	UJ	4.3	UJ	3.9	UJ	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.33	UJ	1.7	UJ	1.5	UJ	NA	NA	NA	NA	NA	NA
Xylenes, Total	1.3	UJ	6.6	UJ	6	UJ	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)				0-0	0-0	0-0	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg)									
1,1'-Biphenyl	15 UJ	30 UJ	43 UJ	NA	NA	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	15 UJ	30 UJ	43 UJ	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	14 UJ	28 UJ	40 UJ	NA	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	35 UJ	68 UJ	98 UJ	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	12 UJ	24 UJ	34 UJ	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	8.1 UJ	16 UJ	22 UJ	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
1,4-Dioxane	17 UJ	32 UJ	46 UJ	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	8.1 UJ	16 UJ	22 UJ	NA	NA	NA	NA	NA	NA
2,2'-oxybis[1-chloropropane]	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	8.7 UJ	17 UJ	24 UJ	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	14 UJ	27 UJ	39 UJ	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	16 UJ	32 UJ	45 UJ	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	17 UJ	33 UJ	47 UJ	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	35 UJ	68 UJ	98 UJ	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	170 UJ	330 UJ	480 UJ	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	12 UJ	24 UJ	34 UJ	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	13 UJ	26 UJ	37 UJ	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	11 UJ	20 UJ	29 UJ	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
2-Chlorophenol	14 UJ	27 UJ	38 UJ	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	3.5 UJ	6.8 UJ	9.8 UJ	NA	NA	NA	NA	NA	NA
2-Methylphenol	17 UJ	33 UJ	47 UJ	NA	NA	NA	NA	NA	NA
2-Naphthylamine	41 UJ	80 UJ	110 UJ	NA	NA	NA	NA	NA	NA
2-Nitroaniline	13 UJ	26 UJ	37 UJ	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03		56SD04		56SD05		56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)							0-0	0-0	0-0	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)												
2-Nitrophenol	15	UJ	29	UJ	42	UJ	NA	NA	NA	NA	NA	NA
2-Picoline	25	UJ	48	UJ	69	UJ	NA	NA	NA	NA	NA	NA
2-Toluidine	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
3 & 4 Methylphenol	15	UJ	29	UJ	42	UJ	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	370	UJ	720	UJ	1000	UJ	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	13	UJ	25	UJ	35	UJ	NA	NA	NA	NA	NA	NA
3-Nitroaniline	9.3	UJ	18	UJ	26	UJ	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	12	UJ	23	UJ	33	UJ	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	27	UJ	52	UJ	75	UJ	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	15	UJ	29	UJ	41	UJ	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	16	UJ	30	UJ	43	UJ	NA	NA	NA	NA	NA	NA
4-Chloroaniline	12	UJ	24	UJ	34	UJ	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	13	UJ	25	UJ	36	UJ	NA	NA	NA	NA	NA	NA
4-Nitroaniline	16	UJ	31	UJ	44	UJ	NA	NA	NA	NA	NA	NA
4-Nitrophenol	68	UJ	130	UJ	190	UJ	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-oxide	23	R	44	R	63	UJ	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	19	UJ	37	UJ	53	UJ	NA	NA	NA	NA	NA	NA
Acenaphthene	1.2	UJ	2.3	UJ	3.3	UJ	NA	NA	NA	NA	NA	NA
Acenaphthylene	3.5	UJ	6.8	UJ	9.8	UJ	NA	NA	NA	NA	NA	NA
Acetophenone	18	UJ	35	UJ	49	UJ	NA	NA	NA	NA	NA	NA
alpha,alpha-Dimethyl phenethylamine	120	UJ	240	UJ	340	UJ	NA	NA	NA	NA	NA	NA
Aniline	13	UJ	25	UJ	36	UJ	NA	NA	NA	NA	NA	NA
Anthracene	3.5	UJ	6.8	UJ	9.8	UJ	NA	NA	NA	NA	NA	NA
Aramite, Total	23	UJ	44	UJ	63	UJ	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	270	J	58	J	9.8	UJ	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	300	J	85	J	3.8	UJ	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)				0-0	0-0	0-0	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)									
Benzo[b]fluoranthene	1.6 UJ	77 J	4.4 UJ	NA	NA	NA	NA	NA	NA
Benzo[g,h,i]perylene	150 J	46 J	9.8 UJ	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	630 J	160 J	5.7 UJ	NA	NA	NA	NA	NA	NA
Benzyl alcohol	17 UJ	32 UJ	47 J	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	14 UJ	27 UJ	39 UJ	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	12 UJ	23 UJ	33 UJ	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	260 J	79 U	160 U	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	22 J	29 UJ	41 UJ	NA	NA	NA	NA	NA	NA
Chrysene	410 J	87 J	7.1 J	NA	NA	NA	NA	NA	NA
Diallate	20 UJ	39 UJ	55 UJ	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	52 J	2.4 UJ	3.4 UJ	NA	NA	NA	NA	NA	NA
Dibenzofuran	8.7 UJ	17 UJ	24 UJ	NA	NA	NA	NA	NA	NA
Diethyl phthalate	23 UJ	44 UJ	63 UJ	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	13 UJ	26 UJ	37 UJ	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	52 UJ	100 UJ	610 UJ	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	6.8 UJ	13 UJ	19 UJ	NA	NA	NA	NA	NA	NA
Dinoseb	35 UJ	68 UJ	98 UJ	NA	NA	NA	NA	NA	NA
Ethyl methanesulfonate	23 UJ	44 UJ	63 UJ	NA	NA	NA	NA	NA	NA
Fluoranthene	350 J	79 J	9.8 UJ	NA	NA	NA	NA	NA	NA
Fluorene	1.6 UJ	3.1 UJ	4.4 UJ	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	14 UJ	27 UJ	39 UJ	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	19 UJ	37 UJ	52 UJ	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	29 UJ	56 UJ	80 UJ	NA	NA	NA	NA	NA	NA
Hexachloroethane	15 UJ	30 UJ	43 UJ	NA	NA	NA	NA	NA	NA
Hexachlorophene	1700 R	3300 R		NA	NA	NA	NA	NA	NA
Hexachloropropene	15 UJ	29 UJ	41 UJ	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	110 J	32 J	6.9 UJ	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sample ID	56SD03	56SD04	56SD05	56SD12	56SD13	56SD14	56SD15	56SD16	56SD17
Sampling Date	4/29/2008	4/29/2008	4/29/2008	9/25/2008	9/25/2008	9/25/2008	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)				0-0	0-0	0-0	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)									
Isophorone	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
Isosafrole	15 UJ	29 UJ	41 UJ	NA	NA	NA	NA	NA	NA
Methapyrilene	19 UJ	37 UJ	53 UJ	NA	NA	NA	NA	NA	NA
Methyl methanesulfonate	19 UJ	37 UJ	53 UJ	NA	NA	NA	NA	NA	NA
Naphthalene	1.2 UJ	2.4 UJ	3.4 UJ	NA	NA	NA	NA	NA	NA
Nitrobenzene	14 UJ	28 UJ	40 UJ	NA	NA	NA	NA	NA	NA
N-Nitro-o-toluidine	12 UJ	24 UJ	34 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	25 UJ	48 UJ	69 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	20 UJ	39 UJ	56 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-butylamine	19 UJ	37 UJ	52 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	13 UJ	26 UJ	37 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	15 UJ	29 UJ	41 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	12 UJ	23 UJ	33 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	14 UJ	27 UJ	38 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	18 UJ	34 UJ	49 UJ	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	18 UJ	36 UJ	51 UJ	NA	NA	NA	NA	NA	NA
p-Dimethylamino azobenzene	15 UJ	29 UJ	41 UJ	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	13 UJ	25 UJ	36 UJ	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	12 UJ	24 UJ	34 UJ	NA	NA	NA	NA	NA	NA
Pentachlorophenol	17 UJ	33 UJ	48 UJ	NA	NA	NA	NA	NA	NA
Phenacetin	9.7 UJ	19 UJ	27 UJ	NA	NA	NA	NA	NA	NA
Phenanthrene	21 J	19 J	9.8 UJ	NA	NA	NA	NA	NA	NA
Phenol	9.9 UJ	19 J	28 UJ	NA	NA	NA	NA	NA	NA
p-Phenylene diamine	330 UJ	640 UJ	920 UJ	NA	NA	NA	NA	NA	NA
Pronamide	19 UJ	36 UJ	52 UJ	NA	NA	NA	NA	NA	NA
Pyrene	570 J	110 J	9.8 UJ	NA	NA	NA	NA	NA	NA
Pyridine	23 UJ	44 UJ	63 UJ	NA	NA	NA	NA	NA	NA
Safrole, Total	17 UJ	33 UJ	48 UJ	NA	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD03		56SD04		56SD05		56SD12		56SD13		56SD14		56SD15		56SD16		56SD17	
Sample ID	56SD03		56SD04		56SD05		56SD12		56SD13		56SD14		56SD15		56SD16		56SD17	
Sampling Date	4/29/2008		4/29/2008		4/29/2008		9/25/2008		9/25/2008		9/25/2008		6/24/2009		6/24/2009		6/24/2009	
Depth Range (ft bgs)							0-0		0-0		0-0		0-0.5		0-0.5		0-0.5	
Total Metals (mg/kg)																		
Antimony	0.59	UJ	1.4	UJ	0.66	UJ	0.42	UJ	0.97	UJ	0.66	UJ	0.57	UJ	0.64	UJ	0.66	UJ
Arsenic	3.9	J	4.2	J	3.8	J	2.6	J	3.2	J	4	J	1.5	J	0.96	J	2.2	J
Barium	54	J	78	J	160	J	78	J	110	J	51	J	93	J	67.3	J	140	J
Beryllium	0.21	J	0.29	J	0.27	J	0.26	UJ	0.25	UJ	0.3	J	0.45	UJ	0.5	UJ	0.5	UJ
Cadmium	2.6	J	3.9	J	0.54	J	0.54	J	0.72	J	0.39	J	0.09	UJ	0.1	UJ	0.1	UJ
Chromium	39	J	46	J	34	J	29	J	38	J	51	J	28.7	J	27.7	J	29.7	J
Cobalt	18	J	24	J	40	J	29	J	29	J	59	J	27.5	J	23.6	J	41.9	J
Copper	130	J	130	J	110	J	100	J	110	J	100	J	107	J	100	J	96.6	J
Lead	280	J	160	J	25	J	13	J	48	J	54	J	32.4	J	39.4	J	45.7	J
Mercury	0.052	J	0.11	J	0.069	J	0.039	UJ	0.086	J	0.064	J	0.092	J	0.38	J	0.068	J
Nickel	13	J	19	J	16	J	11	J	14	J	19	J	9.5	J	9.6	J	11.5	J
Selenium	1.2	J	4.2	J	2	J	1.3	J	1.2	J	0.99	J	0.92	UJ	2	J	1.1	UJ
Silver	0.18	J	0.21	J	0.23	J	0.074	UJ	0.72	J	0.14	UJ	4.6	J	0.31	J	0.12	UJ
Thallium	0.23	UJ	0.46	UJ	0.68	UJ	0.41	UJ	0.39	UJ	0.28	UJ	1.2	UJ	1.3	UJ	1.3	UJ
Tin	7.8	UJ	15	UJ	23	UJ	14	UJ	13	UJ	9.5	UJ	8.2	J	7.7	J	13.6	J
Vanadium	220	J	250	J	190	J	240	J	180	J	260	J	184	J	172	J	189	J
Zinc	89	J	140	J	110	J	86	J	100	J	120	J	93.3	J	90.5	J	98.1	J

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg)					
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA
2-Chloro-1,3-butadiene	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA
3-Chloro-1-propene	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Volatile Organic Compounds (ug/kg) (Cont)					
Chloroform	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA
Dichlorobromomethane	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA
Ethyl methacrylate	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA
Ethylene Dibromide	NA	NA	NA	NA	NA
Iodomethane	NA	NA	NA	NA	NA
Isobutyl alcohol	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA
Methyl methacrylate	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA
trans-1,4-Dichloro-2-butene	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA
Vinyl acetate	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA
Xylenes, Total	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg)					
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

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)					
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
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

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)					
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
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
Ethyl methanesulfonate	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
Hexachlorophene	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	NA	NA	NA

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sample ID	56SD18	56SD19	56SD20	56SD21	56SD22
Sampling Date	6/24/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
Depth Range (ft bgs)	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Semivolatile Organic Compound (ug/kg) (Cont)					
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
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
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
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

APPENDIX H

SUMMARY OF HUMAN HEALTH RISK ANALYTICAL RESULTS, SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	56SD18		56SD19		56SD20		56SD21		56SD22	
Sample ID	56SD18		56SD19		56SD20		56SD21		56SD22	
Sampling Date	6/24/2009		6/24/2009		6/24/2009		6/24/2009		6/24/2009	
Depth Range (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5		0-0.5	
Total Metals (mg/kg)										
Antimony	0.92	J	0.29	UJ	0.81	UJ	0.72	UJ	0.86	UJ
Arsenic	3.4	J	2		1.1	UJ	1	J	10.4	J
Barium	101	J	42		109	J	105	J	571	J
Beryllium	0.56	UJ	0.4	U	0.44	UJ	0.57	UJ	1.2	UJ
Cadmium	0.13	UJ	0.04	U	0.12	UJ	0.11	UJ	0.13	UJ
Chromium	25.1	J	29.2		19.8	J	24.4	J	34.4	J
Cobalt	58.8	J	33		50.8	J	36.7	J	91.4	J
Copper	89.3	J	77.3		75.1	J	85.7	J	92.8	J
Lead	23.3	J	73.1		16.7	J	19.7	J	22	J
Mercury	0.11	J	0.11		0.15	J	0.1	J	0.088	J
Nickel	10.5	J	11.9		8.7	J	9.9	J	19.1	J
Selenium	1.8	J	0.46	UJ	1.3	UJ	1.4	J	1.4	UJ
Silver	0.16	UJ	0.05	U	0.15	UJ	0.13	UJ	0.16	UJ
Thallium	1.8	UJ	0.59	U	1.7	UJ	1.5	UJ	1.8	UJ
Tin	10.7	J	4.6	J	14.6	J	10.1	J	16	J
Vanadium	201	J	167		147	J	176	J	171	J
Zinc	104	J	86		69.2	J	75.5	J	98.2	J

APPENDIX I
HHRA STATISTICAL SUMMARY (ProUCL Computational Output)

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iodomethane

General Statistics

Number of Valid Data	24	Number of Detected Data	7
Number of Distinct Detected Data	6	Number of Non-Detect Data	17
Number of Missing Values	12	Percent Non-Detects	70.83%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	
Maximum Detected	2.6	Maximum Detected	0.956
Mean of Detected	1.829	Mean of Detected	0.552
SD of Detected	0.602	SD of Detected	0.357
Minimum Non-Detect	0.89	Minimum Non-Detect	-0.117
Maximum Non-Detect	1.2	Maximum Non-Detect	0.182

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	18
Number treated as Detected	6
Single DL Non-Detect Percentage	75.00%

Warning: There are only 7 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	0.942	Shapiro Wilk Test Statistic	0.925
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
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	0.889	Mean	-0.328
SD	0.689	SD	0.608
95% DL/2 (t) UCL	1.13	95% H-Stat (DL/2) UCL	1.022
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.422	Mean in Log Scale	-0.33
SD	1.189	SD in Log Scale	0.666
95% MLE (t) UCL	0.838	Mean in Original Scale	0.905
95% MLE (Tiku) UCL	1.25	SD in Original Scale	0.692
		95% Percentile Bootstrap UCL	1.144

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

95% BCA Bootstrap UCL	1.173

Iodomethane (Cont)

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	5.718
Theta Star	0.32
nu star	80.05
A-D Test Statistic	0.306
5% A-D Critical Value	0.709
K-S Test Statistic	0.709
5% K-S Critical Value	0.312

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1
Maximum	2.6
Mean	1.762
Median	1.7
SD	0.412
k star	16.82
Theta star	0.105
Nu star	807.5
AppChi2	742.5
95% Gamma Approximate UCL	1.916
95% Adjusted Gamma UCL	1.927

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	1.242
SD	0.482
SE of Mean	0.106
95% KM (t) UCL	1.424
95% KM (z) UCL	1.417
95% KM (jackknife) UCL	1.412
95% KM (bootstrap t) UCL	1.428
95% KM (BCA) UCL	1.888
95% KM (Percentile Bootstrap) UCL	1.808
95% KM (Chebyshev) UCL	1.705
97.5% KM (Chebyshev) UCL	1.905
99% KM (Chebyshev) UCL	2.299

Potential UCLs to Use

95% KM (t) UCL	1.424
95% KM (Percentile Bootstrap) UCL	1.808

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo[a]anthracene

General Statistics

Number of Valid Data	24	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	20
Number of Missing Values	12	Percent Non-Detects	83.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2.4	Minimum Detected	0.875
Maximum Detected	9.2	Maximum Detected	2.219
Mean of Detected	4.625	Mean of Detected	1.386
SD of Detected	3.122	SD of Detected	0.594
Minimum Non-Detect	2.1	Minimum Non-Detect	0.742
Maximum Non-Detect	2.3	Maximum Non-Detect	0.833

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	20
Number treated as Detected	4
Single DL Non-Detect Percentage	83.33%

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	0.807	Shapiro Wilk Test Statistic	0.903
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	1.7	Mean	0.321
SD	1.749	SD	0.533
95% DL/2 (t) UCL	2.312	95% H-Stat (DL/2) UCL	1.711
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.249
		SD in Log Scale	1.616
		Mean in Original Scale	1.014
		SD in Original Scale	2.015
		95% Percentile Bootstrap UCL	1.769

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

95% BCA Bootstrap UCL	2.028

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo[a]anthracene (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.068	Data appear Normal at 5% Significance Level	
Theta Star	4.331		
nu star	8.544		
A-D Test Statistic	0.422	Nonparametric Statistics	
5% A-D Critical Value	0.659	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.659	Mean	2.771
5% K-S Critical Value	0.396	SD	1.381
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.325
		95% KM (t) UCL	3.329
Assuming Gamma Distribution		95% KM (z) UCL	3.306
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.245
Minimum	1.741	95% KM (bootstrap t) UCL	3.953
Maximum	9.2	95% KM (BCA) UCL	N/A
Mean	4.149	95% KM (Percentile Bootstrap) UCL	4.65
Median	4.018	95% KM (Chebyshev) UCL	4.189
SD	1.779	97.5% KM (Chebyshev) UCL	4.803
k star	5.234	99% KM (Chebyshev) UCL	6.009
Theta star	0.793		
Nu star	251.2	Potential UCLs to Use	
AppChi2	215.5	95% KM (t) UCL	3.329
95% Gamma Approximate UCL	4.836	95% KM (Percentile Bootstrap) UCL	4.65
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo[a]pyrene

General Statistics

Number of Valid Data	24	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	19
Number of Missing Values	12	Percent Non-Detects	79.17%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.2	Minimum Detected	0.182
Maximum Detected	20	Maximum Detected	2.996
Mean of Detected	6.24	Mean of Detected	1.348
SD of Detected	7.766	SD of Detected	1.03
Minimum Non-Detect	0.82	Minimum Non-Detect	-0.198
Maximum Non-Detect	0.9	Maximum Non-Detect	-0.105

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	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	79.17%

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	0.683	Shapiro Wilk Test Statistic	0.912
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
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	1.643	Mean	-0.382
SD	4.036	SD	1.004
95% DL/2 (t) UCL	3.055	95% H-Stat (DL/2) UCL	1.36
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.301
		SD in Log Scale	2.234
		Mean in Original Scale	1.355
		SD in Original Scale	4.129
		95% Percentile Bootstrap UCL	2.889

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

95% BCA Bootstrap UCL	3.854

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo[a]pyrene (Cont)

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.603	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	10.35		
nu star	6.031		
A-D Test Statistic	0.559	**Nonparametric Statistics**	
5% A-D Critical Value	0.69	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.69	Mean	2.25
5% K-S Critical Value	0.363	SD	3.774
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.861
		95% KM (t) UCL	3.726
Assuming Gamma Distribution		95% KM (z) UCL	3.667
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.605
Minimum	1E-09	95% KM (bootstrap t) UCL	7.106
Maximum	20	95% KM (BCA) UCL	6.558
Mean	5.652	95% KM (Percentile Bootstrap) UCL	4.858
Median	5.171	95% KM (Chebyshev) UCL	6.004
SD	5.257	97.5% KM (Chebyshev) UCL	7.628
k star	0.15	99% KM (Chebyshev) UCL	10.82
Theta star	37.61		
Nu star	7.213	Potential UCLs to Use	
AppChi2	2.288	95% KM (t) UCL	3.726
95% Gamma Approximate UCL	17.82		
95% Adjusted Gamma UCL	19.43		

Note: DL/2 is not a recommended method.

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo[b]fluoranthene

General Statistics

Number of Valid Data	24	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	20
Number of Missing Values	12	Percent Non-Detects	83.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	
Maximum Detected	44	Maximum Detected	3.784
Mean of Detected	14.03	Mean of Detected	1.749
SD of Detected	20.2	SD of Detected	1.601
Minimum Non-Detect	0.95	Minimum Non-Detect	-0.0513
Maximum Non-Detect	1	Maximum Non-Detect	

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	20
Number treated as Detected	4
Single DL Non-Detect Percentage	83.33%

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	0.754	Shapiro Wilk Test Statistic	0.99
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	2.749	Mean	-0.297
SD	8.93	SD	1.099
95% DL/2 (t) UCL	5.873	95% H-Stat (DL/2) UCL	1.708
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-5.403
		SD in Log Scale	4.169
		Mean in Original Scale	2.347
		SD in Original Scale	9.037
		95% Percentile Bootstrap UCL	5.848

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

95% BCA Bootstrap UCL	8.795

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo[b]fluoranthene (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.337	Data appear Normal at 5% Significance Level	
Theta Star	41.65		
nu star	2.694		
A-D Test Statistic	0.307	Nonparametric Statistics	
5% A-D Critical Value	0.673	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.673	Mean	3.171
5% K-S Critical Value	0.406	SD	8.634
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	2.035
		95% KM (t) UCL	6.659
Assuming Gamma Distribution		95% KM (z) UCL	6.518
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	5.835
Minimum	1	95% KM (bootstrap t) UCL	14.24
Maximum	44	95% KM (BCA) UCL	N/A
Mean	13.95	95% KM (Percentile Bootstrap) UCL	11
Median	14.06	95% KM (Chebyshev) UCL	12.04
SD	7.302	97.5% KM (Chebyshev) UCL	15.88
k star	3.103	99% KM (Chebyshev) UCL	23.42
Theta star	4.495		
Nu star	149	Potential UCLs to Use	
AppChi2	121.7	95% KM (t) UCL	6.659
95% Gamma Approximate UCL	17.07	95% KM (Percentile Bootstrap) UCL	11
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Number of Valid Data	24	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	19
Number of Missing Values	12	Percent Non-Detects	79.17%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	
Maximum Detected	36	Maximum Detected	3.584
Mean of Detected	10	Mean of Detected	1.533
SD of Detected	14.7	SD of Detected	1.351
Minimum Non-Detect	0.76	Minimum Non-Detect	-0.274
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	20
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	4
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	83.33%

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	0.688	Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
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	2.413	Mean	-0.381
SD	7.308	SD	1.156
95% DL/2 (t) UCL	4.97	95% H-Stat (DL/2) UCL	1.696
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-3.134
		SD in Log Scale	2.787
		Mean in Original Scale	2.104
		SD in Original Scale	7.397
		95% Percentile Bootstrap UCL	4.985

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

95% BCA Bootstrap UCL	6.757

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.443	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	22.57		
nu star	4.431		
A-D Test Statistic	0.408	Nonparametric Statistics	
5% A-D Critical Value	0.698	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.698	Mean	2.875
5% K-S Critical Value	0.366	SD	7.028
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	1.604
		95% KM (t) UCL	5.624
Assuming Gamma Distribution		95% KM (z) UCL	5.513
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	4.993
Minimum	1E-09	95% KM (bootstrap t) UCL	14.19
Maximum	36	95% KM (BCA) UCL	36
Mean	8.912	95% KM (Percentile Bootstrap) UCL	6.9
Median	8.849	95% KM (Chebyshev) UCL	9.866
SD	8.785	97.5% KM (Chebyshev) UCL	12.89
k star	0.147	99% KM (Chebyshev) UCL	18.83
Theta star	60.56		
Nu star	7.064	Potential UCLs to Use	
AppChi2	2.206	95% KM (t) UCL	5.624
95% Gamma Approximate UCL	28.54		
95% Adjusted Gamma UCL	31.17		

Note: DL/2 is not a recommended method.

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Data	23	Number of Detected Data	22
Number of Distinct Detected Data	17	Number of Non-Detect Data	1
Number of Missing Values	13	Percent Non-Detects	4.35%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.48	Minimum Detected	-0.734
Maximum Detected	3.4	Maximum Detected	1.224
Mean of Detected	1.84	Mean of Detected	0.462
SD of Detected	0.911	SD of Detected	0.598
Minimum Non-Detect	0.47	Minimum Non-Detect	-0.755
Maximum Non-Detect	0.47	Maximum Non-Detect	-0.755

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.952	Shapiro Wilk Test Statistic	0.918
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
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	1.77	Mean	0.379
SD	0.95	SD	0.707
95% DL/2 (t) UCL	2.11	95% H-Stat (DL/2) UCL	2.381
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.761	Mean in Log Scale	0.399
SD	0.948	SD in Log Scale	0.658
95% MLE (t) UCL	2.101	Mean in Original Scale	1.776
95% MLE (Tiku) UCL	2.095	SD in Original Scale	0.941
		95% Percentile Bootstrap UCL	2.086
		95% BCA Bootstrap UCL	2.094

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (Cont)

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	3.09	Data appear Normal at 5% Significance Level	
Theta Star	0.595		
nu star	136		
A-D Test Statistic	0.433	**Nonparametric Statistics**	
5% A-D Critical Value	0.748	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.748	Mean	1.78
5% K-S Critical Value	0.186	SD	0.913
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.195
		95% KM (t) UCL	2.115
Assuming Gamma Distribution		95% KM (z) UCL	2.101
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.114
Minimum	1E-09	95% KM (bootstrap t) UCL	2.145
Maximum	3.4	95% KM (BCA) UCL	2.109
Mean	1.76	95% KM (Percentile Bootstrap) UCL	2.1
Median	1.7	95% KM (Chebyshev) UCL	2.63
SD	0.969	97.5% KM (Chebyshev) UCL	2.998
k star	0.553	99% KM (Chebyshev) UCL	3.72
Theta star	3.181		
Nu star	25.44	Potential UCLs to Use	
AppChi2	14.95	95% KM (t) UCL	2.115
95% Gamma Approximate UCL	2.994	95% KM (Percentile Bootstrap) UCL	2.1
95% Adjusted Gamma UCL	3.116		

Note: DL/2 is not a recommended method.

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Data	24	Number of Detected Data	24
Number of Distinct Detected Data	22	Number of Non-Detect Data	
Number of Missing Values	12	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.5	Minimum Detected	-0.693
Maximum Detected	55	Maximum Detected	4.007
Mean of Detected	14.85	Mean of Detected	2.106
SD of Detected	15.45	SD of Detected	1.209
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	0.815	Shapiro Wilk Test Statistic	0.968
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	14.85	Mean	2.106
SD	15.45	SD	1.209
95% DL/2 (t) UCL	20.25	95% H-Stat (DL/2) UCL	34.89
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

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.884	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	16.8		
nu star	42.42		
A-D Test Statistic	0.426	Nonparametric Statistics	
5% A-D Critical Value	0.773	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.773	Mean	14.85
5% K-S Critical Value	0.183	SD	15.13
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	3.154
		95% KM (t) UCL	20.25
Assuming Gamma Distribution		95% KM (z) UCL	20.03
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	20.25
Minimum	0.5	95% KM (bootstrap t) UCL	21.34
Maximum	55	95% KM (BCA) UCL	20.21
Mean	14.85	95% KM (Percentile Bootstrap) UCL	19.68
Median	7.65	95% KM (Chebyshev) UCL	28.6
SD	15.45	97.5% KM (Chebyshev) UCL	34.54
k star	0.884	99% KM (Chebyshev) UCL	46.23
Theta star	16.8		
Nu star	42.42	Potential UCLs to Use	
AppChi2	28.49	95% KM (Chebyshev) UCL	28.6
95% Gamma Approximate UCL	22.11		
95% Adjusted Gamma UCL	22.75		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Data	29	Number of Detected Data	29
Number of Distinct Detected Data	28	Number of Non-Detect Data	
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.39	Minimum Detected	-0.942
Maximum Detected	210	Maximum Detected	5.347
Mean of Detected	14.16	Mean of Detected	1.351
SD of Detected	40.51	SD of Detected	1.382
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	0.337	Shapiro Wilk Test Statistic	0.91
5% Shapiro Wilk Critical Value	0.926	5% Shapiro Wilk Critical Value	0.926
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	14.16	Mean	1.351
SD	40.51	SD	1.382
95% DL/2 (t) UCL	26.95	95% H-Stat (DL/2) UCL	21.81
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

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (Cont)

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.463	Data do not follow a Discernable Distribution (0.05)	
Theta Star	30.61		
nu star	26.83		
A-D Test Statistic	3.13	**Nonparametric Statistics**	
5% A-D Critical Value	0.814	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.814	Mean	14.16
5% K-S Critical Value	0.172	SD	39.8
Data not Gamma Distributed at 5% Significance Level		SE of Mean	7.522
		95% KM (t) UCL	26.95
Assuming Gamma Distribution		95% KM (z) UCL	26.53
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	26.95
Minimum	0.39	95% KM (bootstrap t) UCL	143.8
Maximum	210	95% KM (BCA) UCL	28.35
Mean	14.16	95% KM (Percentile Bootstrap) UCL	28.11
Median	5	95% KM (Chebyshev) UCL	46.95
SD	40.51	97.5% KM (Chebyshev) UCL	61.13
k star	0.463	99% KM (Chebyshev) UCL	89
Theta star	30.61		
Nu star	26.83	Potential UCLs to Use	
AppChi2	16.02	97.5% KM (Chebyshev) UCL	61.13
95% Gamma Approximate UCL	23.71		
95% Adjusted Gamma UCL	24.47		

Note: DL/2 is not a recommended method.

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Number of Valid Data	24	Number of Detected Data	18
Number of Distinct Detected Data	16	Number of Non-Detect Data	6
Number of Missing Values	12	Percent Non-Detects	25.00%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0056	Minimum Detected	-5.185
Maximum Detected	0.74	Maximum Detected	-0.301
Mean of Detected	0.0906	Mean of Detected	-3.085
SD of Detected	0.166	SD of Detected	1.092
Minimum Non-Detect	0.0047	Minimum Non-Detect	-5.36
Maximum Non-Detect	0.0054	Maximum Non-Detect	-5.221

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	6
Number treated as Detected	18
Single DL Non-Detect Percentage	25.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.449	Shapiro Wilk Test Statistic	0.96
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	0.0686	Mean	-3.815
SD	0.148	SD	1.598
95% DL/2 (t) UCL	0.12	95% H-Stat (DL/2) UCL	0.15
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0371	Mean in Log Scale	-3.704
SD	0.175	SD in Log Scale	1.447
95% MLE (t) UCL	0.0984	Mean in Original Scale	0.069
95% MLE (Tiku) UCL	0.0987	SD in Original Scale	0.148
		95% Percentile Bootstrap UCL	0.127
		95% BCA Bootstrap UCL	0.157

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.753	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.12		
nu star	27.12		
A-D Test Statistic	1.003	**Nonparametric Statistics**	
5% A-D Critical Value	0.773	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.773	Mean	0.0694
5% K-S Critical Value	0.211	SD	0.145
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.0304
		95% KM (t) UCL	0.121
Assuming Gamma Distribution		95% KM (z) UCL	0.119
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.119
Minimum	1E-09	95% KM (bootstrap t) UCL	0.236
Maximum	0.74	95% KM (BCA) UCL	0.132
Mean	0.068	95% KM (Percentile Bootstrap) UCL	0.125
Median	0.0305	95% KM (Chebyshev) UCL	0.202
SD	0.148	97.5% KM (Chebyshev) UCL	0.259
k star	0.167	99% KM (Chebyshev) UCL	0.372
Theta star	0.408		
Nu star	7.995	Potential UCLs to Use	
AppChi2	2.732	95% KM (Chebyshev) UCL	0.202
95% Gamma Approximate UCL	0.199		
95% Adjusted Gamma UCL	0.216		

Note: DL/2 is not a recommended method.

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Number of Valid Data	24	Number of Detected Data	6
Number of Distinct Detected Data	5	Number of Non-Detect Data	18
Number of Missing Values	12	Percent Non-Detects	75.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.15	Minimum Detected	-1.897
Maximum Detected	0.65	Maximum Detected	-0.431
Mean of Detected	0.267	Mean of Detected	-1.468
SD of Detected	0.191	SD of Detected	0.535
Minimum Non-Detect	0.13	Minimum Non-Detect	-2.04
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	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	5
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	79.17%

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	0.65	Shapiro Wilk Test Statistic	0.771
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
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	-2.327
SD	0.123	SD	0.566
95% DL/2 (t) UCL	0.165	95% H-Stat (DL/2) UCL	0.127
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.974
		SD in Log Scale	1.104
		Mean in Original Scale	0.0953
		SD in Original Scale	0.136
		95% Percentile Bootstrap UCL	0.142

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

95% BCA Bootstrap UCL	0.167

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.9	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.14		
nu star	22.8		
A-D Test Statistic	0.88	Nonparametric Statistics	
5% A-D Critical Value	0.701	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.701	Mean	0.179
5% K-S Critical Value	0.334	SD	0.101
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.0225
		95% KM (t) UCL	0.218
Assuming Gamma Distribution		95% KM (z) UCL	0.216
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.21
Minimum	1E-09	95% KM (bootstrap t) UCL	0.349
Maximum	0.65	95% KM (BCA) UCL	0.251
Mean	0.265	95% KM (Percentile Bootstrap) UCL	0.233
Median	0.264	95% KM (Chebyshev) UCL	0.277
SD	0.15	97.5% KM (Chebyshev) UCL	0.32
k star	0.614	99% KM (Chebyshev) UCL	0.403
Theta star	0.432		
Nu star	29.49	Potential UCLs to Use	
AppChi2	18.1	95% KM (t) UCL	0.218
95% Gamma Approximate UCL	0.433		
95% Adjusted Gamma UCL	0.448		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Data	29	Number of Detected Data	29
Number of Distinct Detected Data	22	Number of Non-Detect Data	
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	29	Minimum Detected	3.367
Maximum Detected	470	Maximum Detected	6.153
Mean of Detected	229.8	Mean of Detected	5.297
SD of Detected	110.7	SD of Detected	0.598
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	0.955	Shapiro Wilk Test Statistic	0.9
5% Shapiro Wilk Critical Value	0.926	5% Shapiro Wilk Critical Value	0.926
Data appear 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	229.8	Mean	5.297
SD	110.7	SD	0.598
95% DL/2 (t) UCL	264.8	95% H-Stat (DL/2) UCL	300.5
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

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - TOTAL SOIL
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.367	Data appear Normal at 5% Significance Level	
Theta Star	68.26		
nu star	195.3		
A-D Test Statistic	0.404	Nonparametric Statistics	
5% A-D Critical Value	0.751	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.751	Mean	229.8
5% K-S Critical Value	0.164	SD	108.8
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	20.56
		95% KM (t) UCL	264.8
Assuming Gamma Distribution		95% KM (z) UCL	263.6
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	264.8
Minimum	29	95% KM (bootstrap t) UCL	265.7
Maximum	470	95% KM (BCA) UCL	261.7
Mean	229.8	95% KM (Percentile Bootstrap) UCL	263.3
Median	200	95% KM (Chebyshev) UCL	319.4
SD	110.7	97.5% KM (Chebyshev) UCL	358.2
k star	3.367	99% KM (Chebyshev) UCL	434.3
Theta star	68.26		
Nu star	195.3	Potential UCLs to Use	
AppChi2	163.9	95% KM (t) UCL	264.8
95% Gamma Approximate UCL	273.7	95% KM (Percentile Bootstrap) UCL	263.3
95% Adjusted Gamma UCL	276.6		

Note: DL/2 is not a recommended method.

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - GROUNDWATER
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Data	8	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	1
		Percent Non-Detects	12.50%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	7.9	Minimum Detected	2.067
Maximum Detected	20	Maximum Detected	2.996
Mean of Detected	13.14	Mean of Detected	2.52
SD of Detected	4.676	SD of Detected	0.365
Minimum Non-Detect	2.7	Minimum Non-Detect	0.993
Maximum Non-Detect	2.7	Maximum Non-Detect	0.993

Warning: There are only 7 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	0.917	Shapiro Wilk Test Statistic	0.914
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
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	11.67	Mean	2.242
SD	6.011	SD	0.854
95% DL/2 (t) UCL	15.69	95% H-Stat (DL/2) UCL	20.21
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	11.51	Mean in Log Scale	2.407
SD	5.986	SD in Log Scale	0.465
95% MLE (t) UCL	15.52	Mean in Original Scale	12.13
95% MLE (Tiku) UCL	15.66	SD in Original Scale	5.193
		95% Percentile Bootstrap UCL	14.9
		95% BCA Bootstrap UCL	15.14

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (Cont)

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	5.277	Data appear Normal at 5% Significance Level	
Theta Star	2.49		
nu star	73.88		
A-D Test Statistic	0.371	**Nonparametric Statistics**	
5% A-D Critical Value	0.709	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.709	Mean	12.49
5% K-S Critical Value	0.312	SD	4.405
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	1.682
		95% KM (t) UCL	15.67
Assuming Gamma Distribution		95% KM (z) UCL	15.25
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	15.62
Minimum	5.428	95% KM (bootstrap t) UCL	16.45
Maximum	20	95% KM (BCA) UCL	15.45
Mean	12.18	95% KM (Percentile Bootstrap) UCL	15.34
Median	11.15	95% KM (Chebyshev) UCL	19.82
SD	5.117	97.5% KM (Chebyshev) UCL	22.99
k star	3.929	99% KM (Chebyshev) UCL	29.23
Theta star	3.1		
Nu star	62.86	**Potential UCLs to Use**	
AppChi2	45.63	95% KM (t) UCL	15.67
95% Gamma Approximate UCL	16.78	95% KM (Percentile Bootstrap) UCL	15.34
95% Adjusted Gamma UCL	18.26		

Note: DL/2 is not a recommended method.

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Data	11	Number of Detected Data	10
Number of Distinct Detected Data	10	Number of Non-Detect Data	1
		Percent Non-Detects	9.09%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.96	Minimum Detected	-0.0408
Maximum Detected	10.4	Maximum Detected	2.342
Mean of Detected	3.126	Mean of Detected	0.892
SD of Detected	2.749	SD of Detected	0.706
Minimum Non-Detect	1.1	Minimum Non-Detect	0.0953
Maximum Non-Detect	1.1	Maximum Non-Detect	0.0953

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.715	Shapiro Wilk Test Statistic	0.949
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
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	2.892	Mean	0.756
SD	2.721	SD	0.806
95% DL/2 (t) UCL	4.379	95% H-Stat (DL/2) UCL	4.722
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.376	Mean in Log Scale	0.803
SD	3.219	SD in Log Scale	0.731
95% MLE (t) UCL	4.135	Mean in Original Scale	2.926
95% MLE (Tiku) UCL	4.196	SD in Original Scale	2.691
		95% Percentile Bootstrap UCL	4.356
		95% BCA Bootstrap UCL	4.96

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (Cont)

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.584	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	1.974		
nu star	31.68		
A-D Test Statistic	0.415	Nonparametric Statistics	
5% A-D Critical Value	0.735	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.735	Mean	2.931
5% K-S Critical Value	0.27	SD	2.562
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.814
		95% KM (t) UCL	4.407
Assuming Gamma Distribution		95% KM (z) UCL	4.27
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	4.399
Minimum	0.541	95% KM (bootstrap t) UCL	6.093
Maximum	10.4	95% KM (BCA) UCL	4.615
Mean	2.891	95% KM (Percentile Bootstrap) UCL	4.358
Median	2.2	95% KM (Chebyshev) UCL	6.48
SD	2.722	97.5% KM (Chebyshev) UCL	8.016
k star	1.354	99% KM (Chebyshev) UCL	11.03
Theta star	2.136		
Nu star	29.78	Potential UCLs to Use	
AppChi2	18.32	95% KM (Chebyshev) UCL	6.48
95% Gamma Approximate UCL	4.699		
95% Adjusted Gamma UCL	5.104		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	23.6	Minimum of Log Data	3.161
Maximum	91.4	Maximum of Log Data	4.515
Mean	43.7	Mean of log Data	3.694
Median	36.7	SD of log Data	0.414
SD	20.13		
Coefficient of Variation	0.461		
Skewness	1.432		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.856	Shapiro Wilk Test Statistic	0.939
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
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	54.7	95% H-UCL	57.44
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	67.44
95% Adjusted-CLT UCL	56.49	97.5% Chebyshev (MVUE) UCL	77.81
95% Modified-t UCL	55.14	99% Chebyshev (MVUE) UCL	98.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.567	Data appear Normal at 5% Significance Level	
Theta Star	9.568		
MLE of Mean	43.7		
MLE of Standard Deviation	20.45		
nu star	100.5		
Approximate Chi Square Value (.05)	78.35	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	53.68
Adjusted Chi Square Value	75.17	95% Jackknife UCL	54.7
		95% Standard Bootstrap UCL	53.05
Anderson-Darling Test Statistic	0.409	95% Bootstrap-t UCL	60.26
Anderson-Darling 5% Critical Value	0.731	95% Hall's Bootstrap UCL	60.22
Kolmogorov-Smirnov Test Statistic	0.158	95% Percentile Bootstrap UCL	53.87
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	55.98
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	70.16
		97.5% Chebyshev(Mean, Sd) UCL	81.61
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	104.1
95% Approximate Gamma UCL	56.04		
95% Adjusted Gamma UCL	58.41		

General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Potential UCL to Use	Use 95% Student's-t UCL 54.7

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	11
Raw Statistics		**Log-transformed Statistics**	
Minimum	13	Minimum of Log Data	2.565
Maximum	73.1	Maximum of Log Data	4.292
Mean	35.21	Mean of log Data	3.43
Median	32.4	SD of log Data	0.547
SD	18.66		
Coefficient of Variation	0.53		
Skewness	0.74		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
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	45.4	95% H-UCL	52.77
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	61.29
95% Adjusted-CLT UCL	45.8	97.5% Chebyshev (MVUE) UCL	72.53
95% Modified-t UCL	45.61	99% Chebyshev (MVUE) UCL	94.61
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.939	Data appear Normal at 5% Significance Level	
Theta Star	11.98		
MLE of Mean	35.21		
MLE of Standard Deviation	20.54		
nu star	64.66		
Approximate Chi Square Value (.05)	47.16	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	44.46
Adjusted Chi Square Value	44.73	95% Jackknife UCL	45.4
		95% Standard Bootstrap UCL	43.66
Anderson-Darling Test Statistic	0.251	95% Bootstrap-t UCL	46.61
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	46
Kolmogorov-Smirnov Test Statistic	0.179	95% Percentile Bootstrap UCL	44.89
Kolmogorov-Smirnov 5% Critical Value	0.257	95% BCA Bootstrap UCL	45.05
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	59.73
		97.5% Chebyshev(Mean, Sd) UCL	70.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	91.18
95% Approximate Gamma UCL	48.28		
95% Adjusted Gamma UCL	50.9		

APPENDIX I

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Potential UCL to Use	Use 95% Student's-t UCL 45.4

HHRA STATISTICAL SUMMARY (PROUCL COMPUTATIONAL OUTPUT) - SEDIMENT
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	11
Raw Statistics		**Log-transformed Statistics**	
Minimum	147	Minimum of Log Data	4.99
Maximum	260	Maximum of Log Data	5.561
Mean	189.7	Mean of log Data	5.233
Median	180	SD of log Data	0.163
SD	33.04		
Coefficient of Variation	0.174		
Skewness	1.254		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.866	Shapiro Wilk Test Statistic	0.908
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
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	207.8	95% H-UCL	208.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	230.5
95% Adjusted-CLT UCL	210.1	97.5% Chebyshev (MVUE) UCL	248.2
95% Modified-t UCL	208.4	99% Chebyshev (MVUE) UCL	282.9
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	28.93	Data appear Normal at 5% Significance Level	
Theta Star	6.558		
MLE of Mean	189.7		
MLE of Standard Deviation	35.27		
nu star	636.5		
Approximate Chi Square Value (.05)	579	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	206.1
Adjusted Chi Square Value	570	95% Jackknife UCL	207.8
		95% Standard Bootstrap UCL	205.5
Anderson-Darling Test Statistic	0.615	95% Bootstrap-t UCL	222.7
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	318.2
Kolmogorov-Smirnov Test Statistic	0.216	95% Percentile Bootstrap UCL	206.5
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	208.5
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	233.1
		97.5% Chebyshev(Mean, Sd) UCL	251.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	288.8
95% Approximate Gamma UCL	208.6		
95% Adjusted Gamma UCL	211.9		

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\Documents and Settings\dlanigan\My Documents\00 Projects\Puerto Rico\SWMU 56\Tables\ProUCL.xls.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Potential UCL to Use — Use 95% Student's-t UCL 207.8

APPENDIX J
CHEMICAL INTAKE EQUATIONS

Surface Soil/Subsurface Soil/Sediment

Incidental Ingestion of Soil and Sediment

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:

$$CDI = \frac{Cs \times IR \times FI \times CF \times EF \times ED}{BW \times AT_c \text{ or } AT_{nc}}$$

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 and Sediment

The absorbed dose associated with the potential dermal contact of COPCs in soil was calculated using the following equation (USEPA, 1989):

$$DAD = \frac{Cs \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

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, 2009):

$$CDI = \frac{Ca \times ET \times EF \times ED}{AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Ca	=	Chemical concentration in air as fugitive dust, milligrams per cubic meter (mg/m^3)
ET	=	Exposure Time, hours/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
AT	=	Averaging Time, hours

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 calculated using Equation 5-14 found in USEPA's Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2002). Volatilization factors can be found on the inhalation spreadsheets in Appendix K.

Groundwater

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):

$$CDI = \frac{DA_{event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
DA_{event}	=	Absorbed dose per event (mg/cm^2-event)
EV	=	Event Frequency, 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

$$DA_{event} = 2FA \times K_p \times C_w \times \sqrt{\frac{6\tau_{event} \times t_{event}}{\pi}}$$

If $t_{event} > t^*$, then

$$DA_{event} = FA \times K_p \times C_w \left[\frac{t_{event}}{1+B} + 2\tau_{event} \left(\frac{1+3B+3B^2}{(1+B)^2} \right) \right]$$

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)
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:

$$DA_{event} = K_p \times C_w \times t_{event}$$

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)

<u>Surface Water</u>

Ingestion of Surface Water

The daily intake associated with the indirect potential ingestion of the COPCs in surface water under a wading scenario were calculated using the following equation (USEPA, 1989):

$$CDI = \frac{Cw \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Cw	=	Chemical concentration in water, mg/L
IR	=	Ingestion Rate, L/hour
ET	=	Exposure Time, hours/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

Dermal Contact with Surface Water

The absorbed dose associated with potential dermal contact with COPCs in surface water was calculated using the following equation (USEPA, 1989). (Note: Only inorganic COPCs were identified in surface water. Therefore, the equation presented is for the evaluation of dermal exposure to inorganics in surface water.)

$$CDI = \frac{Cw \times K_p \times ET \times EF \times ED \times SA \times CF}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Cw	=	Chemical concentration in water, mg/L
K_p	=	Dermal permeability coefficient of compound in water (cm/hour)
ET	=	Exposure Time, hours/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
SA	=	Surface Area of exposed skin, cm^2
CF	=	Conversion Factor, 1 L/1000 cm^3
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

APPENDIX K
RISK CALCULATION SPREADSHEETS

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00142	NA	NA	9.9E-11	--	--	2.9E-10	--	--	7.1E-11	--	--	4.5E-10	--	--
Benzo[a]anthracene	0.00333	7.3E-01	NA	2.3E-10	1.7E-10	0.1%	6.8E-10	--	--	1.7E-10	1.2E-10	0.1%	1.1E-09	--	--
Benzo[a]pyrene	0.00373	7.3E+00	NA	2.6E-10	1.9E-09	0.8%	7.6E-10	--	--	1.9E-10	1.4E-09	0.8%	1.2E-09	--	--
Benzo[b]fluoranthene	0.00666	7.3E-01	NA	4.6E-10	3.4E-10	0.1%	1.4E-09	--	--	3.3E-10	2.4E-10	0.1%	2.1E-09	--	--
Benzo[k]fluoranthene	0.00860	7.3E-02	NA	6.0E-10	4.4E-11	0.0%	1.8E-09	--	--	4.3E-10	3.1E-11	0.0%	2.7E-09	--	--
Chrysene	0.00562	7.3E-03	NA	3.9E-10	2.9E-12	0.0%	1.1E-09	--	--	2.8E-10	2.0E-12	0.0%	1.8E-09	--	--
Dibenz(a,h)anthracene	0.00290	7.3E+00	NA	2.0E-10	1.5E-09	0.7%	5.9E-10	--	--	1.4E-10	1.1E-09	0.7%	9.2E-10	--	--
Indeno[1,2,3-cd]pyrene	0.00750	7.3E-01	NA	5.2E-10	3.8E-10	0.2%	1.5E-09	--	--	3.7E-10	2.7E-10	0.2%	2.4E-09	--	--
Arsenic	2.12	1.5E+00	3.0E-04	1.5E-07	2.2E-07	98.1%	4.3E-07	1.4E-03	0.2%	1.1E-07	1.6E-07	98.1%	6.7E-07	2.2E-03	0.2%
Cobalt	28.6	NA	3.0E-04	2.0E-06	--	--	5.8E-06	1.9E-02	2.5%	1.4E-06	--	--	9.1E-06	3.0E-02	2.5%
Mercury	0.202	NA	1.6E-04	1.4E-08	--	--	4.1E-08	2.6E-04	0.0%	1.0E-08	--	--	6.4E-08	4.0E-04	0.0%
Thallium	0.650	NA	NA	4.5E-08	--	--	1.3E-07	--	--	3.2E-08	--	--	2.1E-07	--	--
Vanadium	265	NA	7.0E-05	1.8E-05	--	--	5.4E-05	7.7E-01	97.3%	1.3E-05	--	--	8.4E-05	1.2E+00	97.3%
				Total ILCR:	2.3E-07	100.0%	Total HI:	7.9E-01	100.0%	Total ILCR:	1.6E-07	100.0%	Total HI:	1.2E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00142	NA	NA	NA	4.0E-10	--	--	1.2E-09	--	--	4.5E-10	--	--	2.9E-09	--	--
Benzo[a]anthracene	0.00333	1.3E-01	7.3E-01	NA	1.2E-10	8.8E-11	0.3%	3.5E-10	--	--	1.4E-10	1.0E-10	0.3%	8.8E-10	--	--
Benzo[a]pyrene	0.00373	1.3E-01	7.3E+00	NA	1.4E-10	9.9E-10	3.4%	3.9E-10	--	--	1.5E-10	1.1E-09	3.4%	9.8E-10	--	--
Benzo[b]fluoranthene	0.00666	1.3E-01	7.3E-01	NA	2.4E-10	1.8E-10	0.6%	7.0E-10	--	--	2.8E-10	2.0E-10	0.6%	1.8E-09	--	--
Benzo[k]fluoranthene	0.00860	1.3E-01	7.3E-02	NA	3.1E-10	2.3E-11	0.1%	9.1E-10	--	--	3.6E-10	2.6E-11	0.1%	2.3E-09	--	--
Chrysene	0.00562	1.3E-01	7.3E-03	NA	2.0E-10	1.5E-12	0.0%	5.9E-10	--	--	2.3E-10	1.7E-12	0.0%	1.5E-09	--	--
Dibenz(a,h)anthracene	0.00290	1.3E-01	7.3E+00	NA	1.0E-10	7.7E-10	2.7%	3.1E-10	--	--	1.2E-10	8.8E-10	2.7%	7.6E-10	--	--
Indeno[1,2,3-cd]pyrene	0.00750	1.3E-01	7.3E-01	NA	2.7E-10	2.0E-10	0.7%	7.9E-10	--	--	3.1E-10	2.3E-10	0.7%	2.0E-09	--	--
Arsenic	2.12	3.0E-02	1.5E+00	3.0E-04	1.8E-08	2.7E-08	92.2%	5.2E-08	1.7E-04	0.0%	2.0E-08	3.0E-08	92.2%	1.3E-07	4.3E-04	0.0%
Cobalt	28.6	1.0E-02	NA	3.0E-04	8.0E-08	--	--	2.3E-07	7.7E-04	0.1%	9.1E-08	--	--	5.8E-07	1.9E-03	0.1%
Mercury	0.202	1.0E-02	NA	1.1E-05	5.6E-10	--	--	1.6E-09	1.5E-04	0.0%	6.4E-10	--	--	4.1E-09	3.7E-04	0.0%
Thallium	0.650	1.0E-02	NA	NA	1.8E-09	--	--	5.3E-09	--	--	2.1E-09	--	--	1.3E-08	--	--
Vanadium	265	1.0E-02	NA	1.8E-06	7.4E-07	--	--	2.2E-06	1.2E+00	99.9%	8.4E-07	--	--	5.4E-06	3.0E+00	99.9%
					Total ILCR:	2.9E-08	100.0%	Total HI:	1.2E+00	100.0%	Total ILCR:	3.3E-08	100.0%	Total HI:	3.0E+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 TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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	min	Averaging time, carcinogens	613,200	613,200	
AT-N	days	Averaging time, noncarcinogens	210,240	52,560	

						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
Iodomethane	0.00142	NA	1.04E-12	NA	NA	4.3E-15	--	--	1.2E-14	--	--	1.9E-15	--	--	2.3E-14	--	--
Benzo[a]anthracene	0.00333	1.8E+07	1.86E-10	1.1E-04	NA	7.6E-13	8.3E-14	0.0%	2.2E-12	--	--	3.5E-13	3.8E-14	0.0%	4.1E-12	--	--
Benzo[a]pyrene	0.00373	3.5E+07	1.09E-10	1.1E-03	NA	4.4E-13	4.9E-13	0.1%	1.3E-12	--	--	2.0E-13	2.2E-13	0.1%	2.4E-12	--	--
Benzo[b]fluoranthene	0.00666	2.1E+07	3.20E-10	1.1E-04	NA	1.3E-12	1.4E-13	0.0%	3.8E-12	--	--	6.0E-13	6.6E-14	0.0%	7.0E-12	--	--
Benzo[k]fluoranthene	0.00860	4.5E+07	1.97E-10	1.1E-04	NA	8.0E-13	8.8E-14	0.0%	2.3E-12	--	--	3.7E-13	4.0E-14	0.0%	4.3E-12	--	--
Chrysene	0.00562	2.7E+06	2.07E-09	1.1E-05	NA	8.4E-12	9.2E-14	0.0%	2.5E-11	--	--	3.9E-12	4.2E-14	0.0%	4.5E-11	--	--
Dibenz(a,h)anthracene	0.00290	8.7E+07	3.56E-11	1.2E-03	NA	1.4E-13	1.7E-13	0.0%	4.2E-13	--	--	6.6E-14	8.0E-14	0.0%	7.8E-13	--	--
Indeno[1,2,3-cd]pyrene	0.00750	8.2E+07	9.70E-11	1.1E-04	NA	3.9E-13	4.3E-14	0.0%	1.2E-12	--	--	1.8E-13	2.0E-14	0.0%	2.1E-12	--	--
Arsenic	2.12	NA	1.56E-09	4.3E-03	1.5E-05	6.3E-12	2.7E-11	3.4%	1.9E-11	1.2E-06	1.8%	2.9E-12	1.3E-11	3.4%	3.4E-11	2.3E-06	1.8%
Cobalt	28.6	NA	2.10E-08	9.0E-03	6.0E-06	8.6E-11	7.7E-10	96.4%	2.5E-10	4.2E-05	61.4%	3.9E-11	3.5E-10	96.4%	4.6E-10	7.6E-05	61.4%
Mercury	0.202	4.5E+06	4.48E-08	NA	3.0E-04	1.8E-10	--	--	5.3E-10	1.8E-06	2.6%	8.4E-11	--	--	9.8E-10	3.3E-06	2.6%
Thallium	0.650	NA	4.78E-10	NA	NA	1.9E-12	--	--	5.7E-12	--	--	8.9E-13	--	--	1.0E-11	--	--
Vanadium	265	NA	1.95E-07	NA	1.0E-04	7.9E-10	--	--	2.3E-09	2.3E-05	34.1%	3.6E-10	--	--	4.2E-09	4.2E-05	34.1%
						Total ILCR:	8.0E-10	100.0%	Total HI:	6.8E-05	100.0%	Total ILCR:	3.7E-10	100.0%	Total HI:	1.2E-04	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SURFACE WATER - SWMU 56 (HANGER 200 APRON)
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*ET*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/L	Concentration of chemical in water	CS	CS	
IR-W	L/hour	Ingestion rate of water	0.05	0.05	
ET	hours/day	Exposure time	2	2	
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/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	0.00320	1.5E+00	3.0E-04	2.2E-07	3.3E-07	100.0%	6.5E-07	2.2E-03	3.2%	1.6E-07	2.4E-07	100.0%	1.0E-06	3.4E-03	3.2%
Cobalt	0.00310	NA	3.0E-04	2.2E-07	--	--	6.3E-07	2.1E-03	3.1%	1.5E-07	--	--	9.8E-07	3.3E-03	3.1%
Lead	0.0160	NA	NA	1.1E-06	--	--	3.3E-06	--	--	8.0E-07	--	--	5.1E-06	--	--
Vanadium	0.0220	NA	7.0E-05	1.5E-06	--	--	4.5E-06	6.4E-02	93.7%	1.1E-06	--	--	7.0E-06	9.9E-02	93.7%
				Total ILCR:	3.3E-07	100.0%	Total HI:	6.8E-02	100.0%	Total ILCR:	2.4E-07	100.0%	Total HI:	1.1E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SURFACE WATER - SWMU 56 (HANGER 200 APRON)
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)

ILCR = CDI*CSFo Adj   CSF Adj = CSF/AD
HQ = CDI/RfDo Adj   RfD Adj = RfD*AD

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	
SA	cm2	Skin surface area available for contact	5,700	3,200	
EF	days/year	Exposure frequency	52	52	
ED	years	Exposure duration	24	11	
ET	hours/day	Exposure time	2.0	2.0	
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	
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						Youth					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	C (mg/L)	Kp (cm/hour)	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	0.00320	6.03E-04	1.5E+00	3.0E-04	1.5E-08	2.3E-08	100.0%	4.5E-08	1.5E-04	0.1%	6.1E-09	9.2E-09	100.0%	3.9E-08	1.3E-04	0.1%
Cobalt	0.00310	7.41E-04	NA	3.0E-04	1.8E-08	--	--	5.3E-08	1.8E-04	0.1%	7.3E-09	--	--	4.7E-08	1.6E-04	0.1%
Lead	0.0160	1.10E-04	NA	NA	1.4E-08	--	--	4.1E-08	--	--	5.6E-09	--	--	3.6E-08	--	--
Vanadium	0.0220	8.22E-04	NA	1.8E-06	1.4E-07	--	--	4.2E-07	2.3E-01	99.9%	5.8E-08	--	--	3.7E-07	2.0E-01	99.9%
					Total ILCR:	2.3E-08	100.0%	Total HI:	2.3E-01	100.0%	Total ILCR:	9.2E-09	100.0%	Total HI:	2.0E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

Kp value is derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SEDIMENT - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.0360	NA	NA	2.5E-09	--	--	7.3E-09	--	--	1.8E-09	--	--	1.1E-08	--	--
Benzo[a]anthracene	0.270	7.3E-01	NA	1.9E-08	1.4E-08	1.6%	5.5E-08	--	--	1.3E-08	9.8E-09	1.6%	8.5E-08	--	--
Benzo[a]pyrene	0.30	7.3E+00	NA	2.1E-08	1.5E-07	17.3%	6.1E-08	--	--	1.5E-08	1.1E-07	17.3%	9.5E-08	--	--
Benzo[b]fluoranthene	0.0770	7.3E-01	NA	5.4E-09	3.9E-09	0.4%	1.6E-08	--	--	3.8E-09	2.8E-09	0.4%	2.4E-08	--	--
Benzo[k]fluoranthene	0.630	7.3E-02	NA	4.4E-08	3.2E-09	0.4%	1.3E-07	--	--	3.1E-08	2.3E-09	0.4%	2.0E-07	--	--
Chrysene	0.410	7.3E-03	NA	2.9E-08	2.1E-10	0.0%	8.3E-08	--	--	2.0E-08	1.5E-10	0.0%	1.3E-07	--	--
Dibenz(a,h)anthracene	0.0520	7.3E+00	NA	3.6E-09	2.6E-08	3.0%	1.1E-08	--	--	2.6E-09	1.9E-08	3.0%	1.6E-08	--	--
Indeno[1,2,3-cd]pyrene	0.110	7.3E-01	NA	7.7E-09	5.6E-09	0.6%	2.2E-08	--	--	5.5E-09	4.0E-09	0.6%	3.5E-08	--	--
Arsenic	6.48	1.5E+00	3.0E-04	4.5E-07	6.8E-07	76.7%	1.3E-06	4.4E-03	0.7%	3.2E-07	4.8E-07	76.7%	2.1E-06	6.8E-03	0.7%
Cobalt	54.7	NA	3.0E-04	3.8E-06	--	--	1.1E-05	3.7E-02	5.7%	2.7E-06	--	--	1.7E-05	5.8E-02	5.7%
Vanadium	208	NA	7.0E-05	1.5E-05	--	--	4.2E-05	6.0E-01	93.6%	1.0E-05	--	--	6.6E-05	9.4E-01	93.6%
				Total ILCR:	8.8E-07	100.0%	Total HI:	6.5E-01	100.0%	Total ILCR:	6.3E-07	100.0%	Total HI:	1.0E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUTH TRESPASSERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SEDIMENT - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.0360	NA	NA	NA	4.3E-08	--	--	1.3E-07	--	--	1.7E-08	--	--	1.1E-07	--	--
Benzo[a]anthracene	0.270	1.3E-01	7.3E-01	NA	4.2E-08	3.1E-08	3.8%	1.2E-07	--	--	1.7E-08	1.2E-08	3.8%	1.1E-07	--	--
Benzo[a]pyrene	0.30	1.3E-01	7.3E+00	NA	4.7E-08	3.4E-07	42.2%	1.4E-07	--	--	1.9E-08	1.4E-07	42.2%	1.2E-07	--	--
Benzo[b]fluoranthene	0.0770	1.3E-01	7.3E-01	NA	1.2E-08	8.7E-09	1.1%	3.5E-08	--	--	4.8E-09	3.5E-09	1.1%	3.0E-08	--	--
Benzo[k]fluoranthene	0.630	1.3E-01	7.3E-02	NA	9.8E-08	7.1E-09	0.9%	2.9E-07	--	--	3.9E-08	2.9E-09	0.9%	2.5E-07	--	--
Chrysene	0.410	1.3E-01	7.3E-03	NA	6.4E-08	4.6E-10	0.1%	1.9E-07	--	--	2.5E-08	1.9E-10	0.1%	1.6E-07	--	--
Dibenz(a,h)anthracene	0.0520	1.3E-01	7.3E+00	NA	8.1E-09	5.9E-08	7.3%	2.4E-08	--	--	3.2E-09	2.4E-08	7.3%	2.1E-08	--	--
Indeno[1,2,3-cd]pyrene	0.110	1.3E-01	7.3E-01	NA	1.7E-08	1.2E-08	1.5%	5.0E-08	--	--	6.8E-09	5.0E-09	1.5%	4.3E-08	--	--
Arsenic	6.48	3.0E-02	1.5E+00	3.0E-04	2.3E-07	3.5E-07	43.2%	6.8E-07	2.3E-03	0.1%	9.3E-08	1.4E-07	43.2%	5.9E-07	2.0E-03	0.1%
Cobalt	54.7	1.0E-02	NA	3.0E-04	6.5E-07	--	--	1.9E-06	6.3E-03	0.2%	2.6E-07	--	--	1.7E-06	5.5E-03	0.2%
Vanadium	208	1.0E-02	NA	1.8E-06	2.5E-06	--	--	7.2E-06	4.0E+00	99.8%	9.9E-07	--	--	6.3E-06	3.5E+00	99.8%
					Total ILCR:	8.1E-07	100.0%	Total HI:	4.0E+00	100.0%	Total ILCR:	3.2E-07	100.0%	Total HI:	3.5E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIC
ACCIDENTAL INGESTION OF TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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	0.00333	1.6E-09	4.7E-09	1.1E-08	3.6E-08
Benzo[a]pyrene	0.00373	1.8E-09	5.3E-09	1.2E-08	4.1E-08
Benzo[b]fluoranthene	0.00666	3.1E-09	9.4E-09	2.2E-08	7.3E-08
Benzo[k]fluoranthene	0.00860	4.0E-09	1.2E-08	2.8E-08	9.4E-08
Chrysene	0.00562	2.6E-09	7.9E-09	1.8E-08	6.2E-08
Dibenz(a,h)anthracene	0.00290	1.4E-09	4.1E-09	9.5E-09	3.2E-08
Indeno[1,2,3-cd]pyrene	0.00750	1.6E-09	4.7E-09	1.1E-08	3.6E-08

				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
Iodomethane	0.00142	NA	NA	6.7E-10	--	--	1.9E-09	--	--	1.6E-09	--	--	1.8E-08	--	--
Benzo[a]anthracene	0.00333	7.3E-01	NA	5.4E-08	3.9E-08	1.6%	4.6E-09	--	--	4.7E-08	3.5E-08	0.8%	4.3E-08	--	--
Benzo[a]pyrene	0.00373	7.3E+00	NA	6.0E-08	4.4E-07	18.0%	5.1E-09	--	--	5.3E-08	3.9E-07	9.0%	4.8E-08	--	--
Benzo[b]fluoranthene	0.00666	7.3E-01	NA	1.1E-07	7.8E-08	3.2%	9.1E-09	--	--	9.5E-08	6.9E-08	1.6%	8.5E-08	--	--
Benzo[k]fluoranthene	0.00860	7.3E-02	NA	1.4E-07	1.0E-08	0.4%	1.2E-08	--	--	1.2E-07	8.9E-09	0.2%	1.1E-07	--	--
Chrysene	0.00562	7.3E-03	NA	9.1E-08	6.6E-10	0.0%	7.7E-09	--	--	8.0E-08	5.8E-10	0.0%	7.2E-08	--	--
Dibenz(a,h)anthracene	0.00290	7.3E+00	NA	4.7E-08	3.4E-07	14.0%	4.0E-09	--	--	4.1E-08	3.0E-07	7.0%	3.7E-08	--	--
Indeno[1,2,3-cd]pyrene	0.00750	7.3E-01	NA	5.4E-08	3.9E-08	1.6%	1.0E-08	--	--	4.7E-08	3.5E-08	0.8%	9.6E-08	--	--
Arsenic	2.12	1.5E+00	3.0E-04	1.0E-06	1.5E-06	61.2%	2.9E-06	9.7E-03	0.2%	2.3E-06	3.5E-06	80.6%	2.7E-05	9.0E-02	0.2%
Cobalt	28.6	NA	3.0E-04	1.3E-05	--	--	3.9E-05	1.3E-01	2.5%	3.1E-05	--	--	3.7E-04	1.2E+00	2.5%
Mercury	0.202	NA	1.6E-04	9.5E-08	--	--	2.8E-07	1.7E-03	0.0%	2.2E-07	--	--	2.6E-06	1.6E-02	0.0%
Thallium	0.650	NA	NA	3.1E-07	--	--	8.9E-07	--	--	7.1E-07	--	--	8.3E-06	--	--
Vanadium	265	NA	7.0E-05	1.2E-04	--	--	3.6E-04	5.2E+00	97.3%	2.9E-04	--	--	3.4E-03	4.8E+01	97.3%
				Total ILCR:	2.4E-06	100.0%	Total HI:	5.3E+00	100.0%	Total ILCR:	4.3E-06	100.0%	Total HI:	5.0E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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	0.00333	1.3E-01	8.1E-10	2.4E-09	4.0E-09	1.3E-08
Benzo[a]pyrene	0.00373	1.3E-01	9.1E-10	2.7E-09	4.5E-09	1.5E-08
Benzo[b]fluoranthene	0.00666	1.3E-01	1.6E-09	4.9E-09	8.0E-09	2.7E-08
Benzo[k]fluoranthene	0.00860	1.3E-01	2.1E-09	6.3E-09	1.0E-08	3.4E-08
Chrysene	0.00562	1.3E-01	1.4E-09	4.1E-09	6.7E-09	2.2E-08
Dibenz(a,h)anthracene	0.00290	1.3E-01	7.1E-10	2.1E-09	3.5E-09	1.2E-08
Indeno[1,2,3-cd]pyrene	0.00750	1.3E-01	1.8E-09	5.5E-09	9.0E-09	3.0E-08

					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
Iodomethane	0.00142	NA	NA	NA	2.7E-09	--	--	7.8E-09	--	--	4.4E-09	--	--	5.1E-08	--	--
Benzo[a]anthracene	0.00333	1.3E-01	7.3E-01	NA	2.1E-08	1.5E-08	2.7%	2.4E-09	--	--	1.7E-08	1.3E-08	2.1%	1.5E-08	--	--
Benzo[a]pyrene	0.00373	1.3E-01	7.3E+00	NA	2.3E-08	1.7E-07	30.0%	2.7E-09	--	--	1.9E-08	1.4E-07	23.0%	1.7E-08	--	--
Benzo[b]fluoranthene	0.00666	1.3E-01	7.3E-01	NA	4.1E-08	3.0E-08	5.4%	4.7E-09	--	--	3.5E-08	2.5E-08	4.1%	3.1E-08	--	--
Benzo[k]fluoranthene	0.00860	1.3E-01	7.3E-02	NA	5.3E-08	3.9E-09	0.7%	6.1E-09	--	--	4.5E-08	3.3E-09	0.5%	4.0E-08	--	--
Chrysene	0.00562	1.3E-01	7.3E-03	NA	3.5E-08	2.5E-10	0.0%	4.0E-09	--	--	2.9E-08	2.1E-10	0.0%	2.6E-08	--	--
Dibenz(a,h)anthracene	0.00290	1.3E-01	7.3E+00	NA	1.8E-08	1.3E-07	23.3%	2.1E-09	--	--	1.5E-08	1.1E-07	17.9%	1.3E-08	--	--
Indeno[1,2,3-cd]pyrene	0.00750	1.3E-01	7.3E-01	NA	4.6E-08	3.4E-08	6.0%	5.3E-09	--	--	3.9E-08	2.8E-08	4.6%	3.5E-08	--	--
Arsenic	2.12	3.0E-02	1.5E+00	3.0E-04	1.2E-07	1.8E-07	31.9%	3.5E-07	1.2E-03	0.0%	2.0E-07	2.9E-07	47.7%	2.3E-06	7.6E-03	0.0%
Cobalt	28.6	1.0E-02	NA	3.0E-04	5.4E-07	--	--	1.6E-06	5.2E-03	0.1%	8.8E-07	--	--	1.0E-05	3.4E-02	0.1%
Mercury	0.202	1.0E-02	NA	1.1E-05	3.8E-09	--	--	1.1E-08	9.9E-04	0.0%	6.2E-09	--	--	7.2E-08	6.5E-03	0.0%
Thallium	0.650	1.0E-02	NA	NA	1.2E-08	--	--	3.6E-08	--	--	2.0E-08	--	--	2.3E-07	--	--
Vanadium	265	1.0E-02	NA	1.8E-06	5.0E-06	--	--	1.4E-05	8.0E+00	99.9%	8.1E-06	--	--	9.5E-05	5.2E+01	99.9%
					Total ILCR:	5.6E-07	100.0%	Total HI:	8.0E+00	100.0%	Total ILCR:	6.1E-07	100.0%	Total HI:	5.2E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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	min	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	1.9E-10	6.1E-11	1.8E-10	4.6E-11	1.5E-10
Benzo[a]pyrene	1.1E-10	3.6E-11	1.1E-10	2.7E-11	8.9E-11
Benzo[b]fluoranthene	3.2E-10	1.1E-10	3.2E-10	7.9E-11	2.6E-10
Benzo[k]fluoranthene	2.0E-10	6.5E-11	1.9E-10	4.8E-11	1.6E-10
Chrysene	2.1E-09	6.8E-10	2.0E-09	5.1E-10	1.7E-09
Dibenz(a,h)anthracene	3.6E-11	1.2E-11	3.5E-11	8.8E-12	2.9E-11
Indeno[1,2,3-cd]pyrene	9.7E-11	3.2E-11	9.6E-11	2.4E-11	8.0E-11

						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
Iodomethane	0.00142	NA	1.04E-12	NA	NA	3.4E-13	--	--	1.0E-12	--	--	8.6E-14	--	--	1.0E-12	--	--
Benzo[a]anthracene	0.00333	1.8E+07	1.86E-10	1.1E-04	NA	4.4E-10	4.9E-11	0.1%	1.8E-10	--	--	2.0E-10	2.2E-11	0.1%	1.8E-10	--	--
Benzo[a]pyrene	0.00373	3.5E+07	1.09E-10	1.1E-03	NA	2.6E-10	2.8E-10	0.4%	1.0E-10	--	--	1.2E-10	1.3E-10	0.8%	1.0E-10	--	--
Benzo[b]fluoranthene	0.00666	2.1E+07	3.20E-10	1.1E-04	NA	7.6E-10	8.4E-11	0.1%	3.1E-10	--	--	3.4E-10	3.8E-11	0.2%	3.1E-10	--	--
Benzo[k]fluoranthene	0.00860	4.5E+07	1.97E-10	1.1E-04	NA	4.7E-10	5.2E-11	0.1%	1.9E-10	--	--	2.1E-10	2.3E-11	0.1%	1.9E-10	--	--
Chrysene	0.00562	2.7E+06	2.07E-09	1.1E-05	NA	4.9E-09	5.4E-11	0.1%	2.0E-09	--	--	2.2E-09	2.4E-11	0.1%	2.0E-09	--	--
Dibenz(a,h)anthracene	0.00290	8.7E+07	3.56E-11	1.2E-03	NA	8.5E-11	1.0E-10	0.2%	3.4E-11	--	--	3.8E-11	4.6E-11	0.3%	3.4E-11	--	--
Indeno[1,2,3-cd]pyrene	0.00750	8.2E+07	9.70E-11	1.1E-04	NA	2.3E-10	2.5E-11	0.0%	9.3E-11	--	--	1.0E-10	1.1E-11	0.1%	9.3E-11	--	--
Arsenic	2.12	NA	1.56E-09	4.3E-03	1.5E-05	5.1E-10	2.2E-09	3.4%	1.5E-09	1.0E-04	1.8%	1.3E-10	5.5E-10	3.4%	1.5E-09	1.0E-04	1.8%
Cobalt	28.6	NA	2.10E-08	9.0E-03	6.0E-06	6.9E-09	6.2E-08	95.6%	2.0E-08	3.4E-03	61.4%	1.7E-09	1.6E-08	94.9%	2.0E-08	3.4E-03	61.4%
Mercury	0.202	4.5E+06	4.48E-08	NA	3.0E-04	1.5E-08	--	--	4.3E-08	1.4E-04	2.6%	3.7E-09	--	--	4.3E-08	1.4E-04	2.6%
Thallium	0.650	NA	4.78E-10	NA	NA	1.6E-10	--	--	4.6E-10	--	--	3.9E-11	--	--	4.6E-10	--	--
Vanadium	265	NA	1.95E-07	NA	1.0E-04	6.4E-08	--	--	1.9E-07	1.9E-03	34.1%	1.6E-08	--	--	1.9E-07	1.9E-03	34.1%
						Total ILCR:	6.5E-08	100.0%	Total HI:	5.5E-03	100.0%	Total ILCR:	1.6E-08	100.0%	Total HI:	5.5E-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 56 (HANGER 200 APRON)
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	0.00052	1.5E+00	3.0E-04	4.9E-06	7.3E-06	100.0%	1.4E-05	4.7E-02	0.5%	2.8E-06	4.3E-06	100.0%	3.3E-05	1.1E-01	0.5%
Cobalt	0.0380	NA	3.0E-04	3.6E-04	--	--	1.0E-03	3.5E+00	35.9%	2.1E-04	--	--	2.4E-03	8.1E+00	35.9%
Vanadium	0.0157	NA	7.0E-05	1.5E-04	--	--	4.3E-04	6.1E+00	63.6%	8.6E-05	--	--	1.0E-03	1.4E+01	63.6%
				Total ILCR:	7.3E-06	100.0%	Total HI:	9.7E+00	100.0%	Total ILCR:	4.3E-06	100.0%	Total HI:	2.3E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER - SWMU 56 (HANGER 200 APRON)
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) — $ET \leq t^*$ (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	0.00052	6.03E-04	NA	NA	NA	1.5E+00	3.0E-04	1.5E-08	2.3E-08	100.0%	4.5E-08	1.5E-04	0.0%	1.1E-08	1.7E-08	100.0%	1.3E-07	4.4E-04	0.0%
Cobalt	0.0380	7.41E-04	NA	NA	NA	NA	3.0E-04	1.4E-06	--	--	4.0E-06	1.3E-02	1.3%	1.0E-06	--	--	1.2E-05	4.0E-02	1.3%
Vanadium	0.0157	8.22E-04	NA	NA	NA	NA	1.8E-06	6.3E-07	--	--	1.8E-06	1.0E+00	98.7%	4.7E-07	--	--	5.4E-06	3.0E+00	98.7%
								Total ILCR:	2.3E-08	100.0%	Total HI:	1.0E+00	100.0%	Total ILCR:	1.7E-08	100.0%	Total HI:	3.0E+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 AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SURFACE WATER - SWMU 56 (HANGER 200 APRON)
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*ET*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/hour	Ingestion rate of water	0.05	0.05
ET	hours/day	Exposure time	2	2
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/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	0.00320	1.5E+00	3.0E-04	2.2E-07	3.3E-07	100.0%	6.5E-07	2.2E-03	3.2%	2.6E-07	3.9E-07	100.0%	3.0E-06	1.0E-02	3.2%
Cobalt	0.00310	NA	3.0E-04	2.2E-07	--	--	6.3E-07	2.1E-03	3.1%	2.5E-07	--	--	2.9E-06	9.8E-03	3.1%
Lead	0.0160	NA	NA	1.1E-06	--	--	3.3E-06	--	--	1.3E-06	--	--	1.5E-05	--	--
Vanadium	0.0220	NA	7.0E-05	1.5E-06	--	--	4.5E-06	6.4E-02	93.7%	1.8E-06	--	--	2.1E-05	3.0E-01	93.7%
				Total ILCR:	3.3E-07	100.0%	Total HI:	6.8E-02	100.0%	Total ILCR:	3.9E-07	100.0%	Total HI:	3.2E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SURFACE WATER - SWMU 56 (HANGER 200 APRON)
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)

ILCR = CDI*CSFo Adj   CSF Adj = CSF/AD   CS - Chemical Specific
HQ = CDI/RfDo Adj   RfD Adj = RfD*AD

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
SA	cm2	Skin surface area available for contact	5,700	2,800
EF	days/year	Exposure frequency	52	52
ED	years	Exposure duration	24	6
ET	hours/day	Exposure time	2.0	2.0
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)	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	0.00320	6.03E-04	1.5E+00	3.0E-04	1.5E-08	2.3E-08	100.0%	4.5E-08	1.5E-04	0.1%	8.8E-09	1.3E-08	100.0%	1.0E-07	3.4E-04	0.1%
Cobalt	0.00310	7.41E-04	NA	3.0E-04	1.8E-08	--	--	5.3E-08	1.8E-04	0.1%	1.0E-08	--	--	1.2E-07	4.1E-04	0.1%
Lead	0.0160	1.10E-04	NA	NA	1.4E-08	--	--	4.1E-08	--	--	8.0E-09	--	--	9.3E-08	--	--
Vanadium	0.0220	8.22E-04	NA	1.8E-06	1.4E-07	--	--	4.2E-07	2.3E-01	99.9%	8.2E-08	--	--	9.6E-07	5.3E-01	99.9%
					Total ILCR:	2.3E-08	100.0%	Total HI:	2.3E-01	100.0%	Total ILCR:	1.3E-08	100.0%	Total HI:	5.3E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

Kp value is derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SEDIMENT - SWMU 56 (HANGER 200 APRON)
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

		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	0.270	1.9E-08	5.7E-08	1.3E-07	4.4E-07
Benzo[a]pyrene	0.30	2.1E-08	6.3E-08	1.5E-07	4.9E-07
Benzo[b]fluoranthene	0.0770	5.4E-09	1.6E-08	3.8E-08	1.3E-07
Benzo[k]fluoranthene	0.630	4.4E-08	1.3E-07	3.1E-07	1.0E-06
Chrysene	0.410	2.9E-08	8.6E-08	2.0E-07	6.7E-07
Dibenz(a,h)anthracene	0.0520	3.6E-09	1.1E-08	2.5E-08	8.5E-08
Indeno[1,2,3-cd]pyrene	0.110	7.7E-09	2.3E-08	5.4E-08	1.8E-07

				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
Iodomethane	0.0360	NA	NA	2.5E-09	--	--	7.3E-09	--	--	5.9E-09	--	--	6.8E-08	--	--
Benzo[a]anthracene	0.270	7.3E-01	NA	6.5E-07	4.7E-07	6.1%	5.5E-08	--	--	5.7E-07	4.2E-07	5.3%	5.1E-07	--	--
Benzo[a]pyrene	0.30	7.3E+00	NA	7.2E-07	5.2E-06	67.7%	6.1E-08	--	--	6.3E-07	4.6E-06	59.2%	5.7E-07	--	--
Benzo[b]fluoranthene	0.0770	7.3E-01	NA	1.8E-07	1.3E-07	1.7%	1.6E-08	--	--	1.6E-07	1.2E-07	1.5%	1.5E-07	--	--
Benzo[k]fluoranthene	0.630	7.3E-02	NA	1.5E-06	1.1E-07	1.4%	1.3E-07	--	--	1.3E-06	9.7E-08	1.2%	1.2E-06	--	--
Chrysene	0.410	7.3E-03	NA	9.8E-07	7.2E-09	0.1%	8.3E-08	--	--	8.7E-07	6.3E-09	0.1%	7.8E-07	--	--
Dibenz(a,h)anthracene	0.0520	7.3E+00	NA	1.2E-07	9.1E-07	11.7%	1.1E-08	--	--	1.1E-07	8.0E-07	10.3%	9.9E-08	--	--
Indeno[1,2,3-cd]pyrene	0.110	7.3E-01	NA	2.6E-07	1.9E-07	2.5%	2.2E-08	--	--	2.3E-07	1.7E-07	2.2%	2.1E-07	--	--
Arsenic	6.48	1.5E+00	3.0E-04	4.5E-07	6.8E-07	8.8%	1.3E-06	4.4E-03	0.7%	1.1E-06	1.6E-06	20.2%	1.2E-05	4.1E-02	0.7%
Cobalt	54.7	NA	3.0E-04	3.8E-06	--	--	1.1E-05	3.7E-02	5.7%	8.9E-06	--	--	1.0E-04	3.5E-01	5.7%
Vanadium	208	NA	7.0E-05	1.5E-05	--	--	4.2E-05	6.0E-01	93.6%	3.4E-05	--	--	4.0E-04	5.6E+00	93.6%
				Total ILCR:	7.8E-06	100.0%	Total HI:	6.5E-01	100.0%	Total ILCR:	7.8E-06	100.0%	Total HI:	6.0E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
DERMAL CONTACT WITH SEDIMENT - SWMU 56 (HANGER 200 APRON)
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

			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	0.270	1.3E-01	4.2E-08	1.3E-07	7.2E-08	2.4E-07
Benzo[a]pyrene	0.30	1.3E-01	4.7E-08	1.4E-07	8.0E-08	2.7E-07
Benzo[b]fluoranthene	0.0770	1.3E-01	1.2E-08	3.6E-08	2.1E-08	6.8E-08
Benzo[k]fluoranthene	0.630	1.3E-01	9.8E-08	2.9E-07	1.7E-07	5.6E-07
Chrysene	0.410	1.3E-01	6.4E-08	1.9E-07	1.1E-07	3.6E-07
Dibenz(a,h)anthracene	0.0520	1.3E-01	8.1E-09	2.4E-08	1.4E-08	4.6E-08
Indeno[1,2,3-cd]pyrene	0.110	1.3E-01	1.7E-08	5.1E-08	2.9E-08	9.8E-08

					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
Iodomethane	0.0360	NA	NA	NA	4.3E-08	--	--	1.3E-07	--	--	2.5E-08	--	--	2.9E-07	--	--
Benzo[a]anthracene	0.270	1.3E-01	7.3E-01	NA	4.8E-07	3.5E-07	6.3%	1.2E-07	--	--	3.1E-07	2.3E-07	6.3%	2.8E-07	--	--
Benzo[a]pyrene	0.30	1.3E-01	7.3E+00	NA	5.3E-07	3.9E-06	69.6%	1.4E-07	--	--	3.5E-07	2.5E-06	70.1%	3.1E-07	--	--
Benzo[b]fluoranthene	0.0770	1.3E-01	7.3E-01	NA	1.4E-07	1.0E-07	1.8%	3.5E-08	--	--	8.9E-08	6.5E-08	1.8%	8.0E-08	--	--
Benzo[k]fluoranthene	0.630	1.3E-01	7.3E-02	NA	1.1E-06	8.2E-08	1.5%	2.9E-07	--	--	7.3E-07	5.3E-08	1.5%	6.5E-07	--	--
Chrysene	0.410	1.3E-01	7.3E-03	NA	7.3E-07	5.3E-09	0.1%	1.9E-07	--	--	4.7E-07	3.5E-09	0.1%	4.3E-07	--	--
Dibenz(a,h)anthracene	0.0520	1.3E-01	7.3E+00	NA	9.2E-08	6.7E-07	12.1%	2.4E-08	--	--	6.0E-08	4.4E-07	12.1%	5.4E-08	--	--
Indeno[1,2,3-cd]pyrene	0.110	1.3E-01	7.3E-01	NA	2.0E-07	1.4E-07	2.6%	5.0E-08	--	--	1.3E-07	9.3E-08	2.6%	1.1E-07	--	--
Arsenic	6.48	3.0E-02	1.5E+00	3.0E-04	2.3E-07	3.5E-07	6.2%	6.8E-07	2.3E-03	0.1%	1.3E-07	2.0E-07	5.5%	1.6E-06	5.2E-03	0.1%
Cobalt	54.7	1.0E-02	NA	3.0E-04	6.5E-07	--	--	1.9E-06	6.3E-03	0.2%	3.7E-07	--	--	4.4E-06	1.5E-02	0.2%
Vanadium	208	1.0E-02	NA	1.8E-06	2.5E-06	--	--	7.2E-06	4.0E+00	99.8%	1.4E-06	--	--	1.7E-05	9.1E+00	99.8%
					Total ILCR:	5.6E-06	100.0%	Total HI:	4.0E+00	100.0%	Total ILCR:	3.6E-06	100.0%	Total HI:	9.1E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00185	NA	NA	6.5E-10	--	--	1.8E-09	--	--
Benzo[a]anthracene	0.00920	7.3E-01	NA	3.2E-09	2.3E-09	0.1%	9.0E-09	--	--
Benzo[a]pyrene	0.020	7.3E+00	NA	7.0E-09	5.1E-08	3.2%	2.0E-08	--	--
Benzo[b]fluoranthene	0.0440	7.3E-01	NA	1.5E-08	1.1E-08	0.7%	4.3E-08	--	--
Benzo[k]fluoranthene	0.00860	7.3E-02	NA	3.0E-09	2.2E-10	0.0%	8.4E-09	--	--
Chrysene	0.0360	7.3E-03	NA	1.3E-08	9.2E-11	0.0%	3.5E-08	--	--
Dibenz(a,h)anthracene	0.00290	7.3E+00	NA	1.0E-09	7.4E-09	0.5%	2.8E-09	--	--
Indeno[1,2,3-cd]pyrene	0.00750	7.3E-01	NA	2.6E-09	1.9E-09	0.1%	7.3E-09	--	--
Arsenic	2.88	1.5E+00	3.0E-04	1.0E-06	1.5E-06	95.3%	2.8E-06	9.4E-03	0.2%
Cobalt	30.3	NA	3.0E-04	1.1E-05	--	--	3.0E-05	9.9E-02	2.6%
Mercury	0.202	NA	1.6E-04	7.1E-08	--	--	2.0E-07	1.2E-03	0.0%
Thallium	0.650	NA	NA	2.3E-07	--	--	6.4E-07	--	--
Vanadium	267	NA	7.0E-05	9.3E-05	--	--	2.6E-04	3.7E+00	97.2%
				Total ILCR:	1.6E-06	100.0%	Total HI:	3.8E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00185	NA	NA	NA	4.3E-09	--	--	1.2E-08	--	--
Benzo[a]anthracene	0.00920	1.3E-01	7.3E-01	NA	2.8E-09	2.0E-09	0.6%	7.7E-09	--	--
Benzo[a]pyrene	0.020	1.3E-01	7.3E+00	NA	6.0E-09	4.4E-08	12.1%	1.7E-08	--	--
Benzo[b]fluoranthene	0.0440	1.3E-01	7.3E-01	NA	1.3E-08	9.6E-09	2.7%	3.7E-08	--	--
Benzo[k]fluoranthene	0.00860	1.3E-01	7.3E-02	NA	2.6E-09	1.9E-10	0.1%	7.2E-09	--	--
Chrysene	0.0360	1.3E-01	7.3E-03	NA	1.1E-08	7.9E-11	0.0%	3.0E-08	--	--
Dibenz(a,h)anthracene	0.00290	1.3E-01	7.3E+00	NA	8.7E-10	6.3E-09	1.8%	2.4E-09	--	--
Indeno[1,2,3-cd]pyrene	0.00750	1.3E-01	7.3E-01	NA	2.2E-09	1.6E-09	0.5%	6.3E-09	--	--
Arsenic	2.88	3.0E-02	1.5E+00	3.0E-04	2.0E-07	3.0E-07	82.4%	5.6E-07	1.9E-03	0.0%
Cobalt	30.3	1.0E-02	NA	3.0E-04	7.0E-07	--	--	2.0E-06	6.5E-03	0.1%
Mercury	0.202	1.0E-02	NA	1.1E-05	4.7E-09	--	--	1.3E-08	1.2E-03	0.0%
Thallium	0.650	1.0E-02	NA	NA	1.5E-08	--	--	4.2E-08	--	--
Vanadium	267	1.0E-02	NA	1.8E-06	6.2E-06	--	--	1.7E-05	9.6E+00	99.9%
					Total ILCR:	3.6E-07	100.0%	Total HI:	9.6E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS/VOLATILES EMANATING FROM SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00185	NA	1.36E-12	NA	NA	1.1E-13	--	--	3.1E-13	--	--
Benzo[a]anthracene	0.00920	1.8E+07	5.14E-10	1.1E-04	NA	4.2E-11	4.6E-12	0.0%	1.2E-10	--	--
Benzo[a]pyrene	0.020	3.5E+07	5.82E-10	1.1E-03	NA	4.7E-11	5.2E-11	0.3%	1.3E-10	--	--
Benzo[b]fluoranthene	0.0440	2.1E+07	2.11E-09	1.1E-04	NA	1.7E-10	1.9E-11	0.1%	4.8E-10	--	--
Benzo[k]fluoranthene	0.00860	4.5E+07	1.97E-10	1.1E-04	NA	1.6E-11	1.8E-12	0.0%	4.5E-11	--	--
Chrysene	0.0360	2.7E+06	1.32E-08	1.1E-05	NA	1.1E-09	1.2E-11	0.1%	3.0E-09	--	--
Dibenz(a,h)anthracene	0.00290	8.7E+07	3.56E-11	1.2E-03	NA	2.9E-12	3.5E-12	0.0%	8.1E-12	--	--
Indeno[1,2,3-cd]pyrene	0.00750	8.2E+07	9.70E-11	1.1E-04	NA	7.9E-12	8.7E-13	0.0%	2.2E-11	--	--
Arsenic	2.88	NA	2.12E-09	4.3E-03	1.5E-05	1.7E-10	7.4E-10	4.3%	4.8E-10	3.2E-05	2.4%
Cobalt	30.3	NA	2.23E-08	9.0E-03	6.0E-06	1.8E-09	1.6E-08	95.1%	5.1E-09	8.5E-04	62.2%
Mercury	0.202	4.5E+06	4.48E-08	NA	3.0E-04	3.7E-09	--	--	1.0E-08	3.4E-05	2.5%
Thallium	0.650	NA	4.78E-10	NA	NA	3.9E-11	--	--	1.1E-10	--	--
Vanadium	267	NA	1.96E-07	NA	1.0E-04	1.6E-08	--	--	4.5E-08	4.5E-04	32.9%
						Total ILCR:	1.7E-08	100.0%	Total HI:	1.4E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT INDUSTRIAL / COMMERCIAL WORKERS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 56 (HANGER 200 APRON)
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	0.00052	1.5E+00	3.0E-04	1.8E-06	2.7E-06	100.0%	5.1E-06	1.7E-02	0.5%
Cobalt	0.0380	NA	3.0E-04	1.3E-04	--	--	3.7E-04	1.2E+00	35.9%
Vanadium	0.0157	NA	7.0E-05	5.5E-05	--	--	1.5E-04	2.2E+00	63.6%
				Total ILCR:	2.7E-06	100.0%	Total HI:	3.5E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
ACCIDENTAL INGESTION OF TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00142	NA	NA	6.6E-11	--	--	4.6E-09	--	--
Benzo[a]anthracene	0.00333	7.3E-01	NA	1.5E-10	1.1E-10	0.1%	1.1E-08	--	--
Benzo[a]pyrene	0.00373	7.3E+00	NA	1.7E-10	1.3E-09	0.8%	1.2E-08	--	--
Benzo[b]fluoranthene	0.00666	7.3E-01	NA	3.1E-10	2.2E-10	0.1%	2.2E-08	--	--
Benzo[k]fluoranthene	0.00860	7.3E-02	NA	4.0E-10	2.9E-11	0.0%	2.8E-08	--	--
Chrysene	0.00562	7.3E-03	NA	2.6E-10	1.9E-12	0.0%	1.8E-08	--	--
Dibenz(a,h)anthracene	0.00290	7.3E+00	NA	1.3E-10	9.8E-10	0.7%	9.4E-09	--	--
Indeno[1,2,3-cd]pyrene	0.00750	7.3E-01	NA	3.5E-10	2.5E-10	0.2%	2.4E-08	--	--
Arsenic	2.12	1.5E+00	3.0E-04	9.8E-08	1.5E-07	98.1%	6.8E-06	2.3E-02	0.2%
Cobalt	28.6	NA	3.0E-04	1.3E-06	--	--	9.2E-05	3.1E-01	2.5%
Mercury	0.202	NA	1.6E-04	9.3E-09	--	--	6.5E-07	4.1E-03	0.0%
Thallium	0.650	NA	NA	3.0E-08	--	--	2.1E-06	--	--
Vanadium	265	NA	7.0E-05	1.2E-05	--	--	8.6E-04	1.2E+01	97.3%
				Total ILCR:	1.5E-07	100.0%	Total HI:	1.3E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00142	NA	NA	NA	2.0E-10	--	--	1.4E-08	--	--
Benzo[a]anthracene	0.00333	1.3E-01	7.3E-01	NA	6.0E-11	4.4E-11	0.3%	4.2E-09	--	--
Benzo[a]pyrene	0.00373	1.3E-01	7.3E+00	NA	6.7E-11	4.9E-10	3.4%	4.7E-09	--	--
Benzo[b]fluoranthene	0.00666	1.3E-01	7.3E-01	NA	1.2E-10	8.7E-11	0.6%	8.4E-09	--	--
Benzo[k]fluoranthene	0.00860	1.3E-01	7.3E-02	NA	1.5E-10	1.1E-11	0.1%	1.1E-08	--	--
Chrysene	0.00562	1.3E-01	7.3E-03	NA	1.0E-10	7.4E-13	0.0%	7.1E-09	--	--
Dibenz(a,h)anthracene	0.00290	1.3E-01	7.3E+00	NA	5.2E-11	3.8E-10	2.7%	3.7E-09	--	--
Indeno[1,2,3-cd]pyrene	0.00750	1.3E-01	7.3E-01	NA	1.3E-10	9.8E-11	0.7%	9.4E-09	--	--
Arsenic	2.12	3.0E-02	1.5E+00	3.0E-04	8.8E-09	1.3E-08	92.2%	6.2E-07	2.1E-03	0.0%
Cobalt	28.6	1.0E-02	NA	3.0E-04	4.0E-08	--	--	2.8E-06	9.2E-03	0.1%
Mercury	0.202	1.0E-02	NA	1.1E-05	2.8E-10	--	--	2.0E-08	1.7E-03	0.0%
Thallium	0.650	1.0E-02	NA	NA	9.0E-10	--	--	6.3E-08	--	--
Vanadium	265	1.0E-02	NA	1.8E-06	3.7E-07	--	--	2.6E-05	1.4E+01	99.9%
					Total ILCR:	1.4E-08	100.0%	Total HI:	1.4E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM TOTAL SOIL - SWMU 56 (HANGER 200 APRON)
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	5.59E+06	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
AT-C	min	Averaging time, carcinogens	613,200	
AT-N	days	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
Iodomethane	0.00142	NA	2.54E-10	NA	NA	8.3E-13	--	--	5.8E-11	--	--
Benzo[a]anthracene	0.00333	1.8E+07	7.80E-10	1.1E-04	NA	2.5E-12	2.8E-13	0.0%	1.8E-10	--	--
Benzo[a]pyrene	0.00373	3.5E+07	7.73E-10	1.1E-03	NA	2.5E-12	2.8E-12	0.0%	1.8E-10	--	--
Benzo[b]fluoranthene	0.00666	2.1E+07	1.51E-09	1.1E-04	NA	4.9E-12	5.4E-13	0.0%	3.4E-10	--	--
Benzo[k]fluoranthene	0.00860	4.5E+07	1.73E-09	1.1E-04	NA	5.6E-12	6.2E-13	0.0%	3.9E-10	--	--
Chrysene	0.00562	2.7E+06	3.07E-09	1.1E-05	NA	1.0E-11	1.1E-13	0.0%	7.0E-10	--	--
Dibenz(a,h)anthracene	0.00290	8.7E+07	5.53E-10	1.2E-03	NA	1.8E-12	2.2E-12	0.0%	1.3E-10	--	--
Indeno[1,2,3-cd]pyrene	0.00750	8.2E+07	1.43E-09	1.1E-04	NA	4.7E-12	5.1E-13	0.0%	3.3E-10	--	--
Arsenic	2.12	NA	3.79E-07	4.3E-03	1.5E-05	1.2E-09	5.3E-09	3.4%	8.7E-08	5.8E-03	1.9%
Cobalt	28.6	NA	5.12E-06	9.0E-03	6.0E-06	1.7E-08	1.5E-07	96.6%	1.2E-06	1.9E-01	63.1%
Mercury	0.202	4.5E+06	8.08E-08	NA	3.0E-04	2.6E-10	--	--	1.8E-08	6.2E-05	0.0%
Thallium	0.650	NA	1.16E-07	NA	NA	3.8E-10	--	--	2.7E-08	--	--
Vanadium	265	NA	4.74E-05	NA	1.0E-04	1.5E-07	--	--	1.1E-05	1.1E-01	35.1%
						Total ILCR:	1.6E-07	100.0%	Total HI:	3.1E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 56 (HANGER 200 APRON)
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	0.00052	1.5E+00	3.0E-04	2.9E-10	4.4E-10	100.0%	2.0E-08	6.8E-05	0.5%
Cobalt	0.0380	NA	3.0E-04	2.1E-08	--	--	1.5E-06	5.0E-03	35.9%
Vanadium	0.0157	NA	7.0E-05	8.8E-09	--	--	6.1E-07	8.8E-03	63.6%
				Total ILCR:	4.4E-10	100.0%	Total HI:	1.4E-02	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER - SWMU 56 (HANGER 200 APRON)
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 $\leq$ 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	
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	0.00052	6.03E-04	NA	NA	NA	1.5E+00	3.0E-04	5.8E-11	8.7E-11	100.0%	4.1E-09	1.4E-05	0.0%
Cobalt	0.0380	7.41E-04	NA	NA	NA	NA	3.0E-04	5.2E-09	--	--	3.6E-07	1.2E-03	1.3%
Vanadium	0.0157	8.22E-04	NA	NA	NA	NA	1.8E-06	2.4E-09	--	--	1.7E-07	9.2E-02	98.7%
								Total ILCR:	8.7E-11	100.0%	Total HI:	9.3E-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

PARTICULATE EMISSION FACTOR - CONSTRUCTION WORKERS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT - NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

$$PEF = Q/C_{sr} \times 1/F_D \times \left[\frac{T \times A_R}{556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)}\right]$$

$$Q/C_{sr} = A \times \exp((\ln A_S - B)^2/C)$$

Symbol	Definition (units)	Default	Reference
Q/C_{sr}	Inverse of a 1-h avg. air concentration along a straight road bisecting a 1.3 acre square site (g/m2 -s/kg/m3)	19.6	USEPA 2001
A	Constant (unitless)	12.9351	USEPA 2001
A_S	Arial extent of site surface soil contamination (acres)	1.3	Site-specific
B	Constant (unitless)	5.7383	USEPA 2001
C	Constant (unitless)	71.7711	USEPA 2001
F_D	Dispersion correction factor	0.185	USEPA 2001
T	Total time over which construction occurs (s)	7.20E+06	USEPA 2001
A_R	Surface area of contaminated road segment (m^2)	1,105	Site-specific
W	Mean vehicle weight (tons)	8	USEPA 2001
p	Number of days with at least 0.01 inches of precipitation (days/year)	120	USEPA 2001
Sum(VKT)	Sum of fleet vehicle kilometers traveled during the exposure duration (km)	273.75	USEPA 2001
PEF	Particulate Emission Factor (m^3/kg)	5.59E+06	Site-specific

Q/C_{sr} Calculation

$\ln A_S$	0.262	
$(\ln A_S - B)^2$	30.0	
$(\ln A_S - B)^2/C$	0.418	
$e^{(\ln AS - B)2/C}$	1.52	
$A \times e^{(\ln AS - B)2/C}$	19.6	Q/C_{sr}

PEF Calculation

$Q/C_{sr} \times 1/F_D$	106	
$T \times A_R$	7,958,777,284	
$(W/3)^{0.4}$	1.48	
$(365-p)/365$	0.671	
$556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)$	151,248	
$T \times A_R/556 \times (W/3)^{0.4} \times (365-p)/365 \times Sum(VKT)$	52,621	
PEF	5,587,306	
1.3 acres / 0.000247 acres / m2 =	5,263	m^2
sqrt (5263) / 1000 =	0.073	km

Assumptions

W assumptions: 10 - 2-ton cars and 5 - 20-ton trucks = 15 vehicles

Sum(VKT) assumptions:

Assume that the site is 1.3 acres configured as a square with the unpaved road segment dividing the square evenly. The road length equals the square root of the 1.3 acres (0.073 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) = 15 vehicles x 0.073 km/day x 50 weeks/yr x 5 days/week = 273.75 km

A_R assumptions:

Based on VKT, the road length is 73 m and assume the road width is 50 ft. (15.24).

Reference

USEPA 2001. Draft Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00185	NA	NA	6.5E-10	--	--	1.8E-09	--	--
Benzo[a]anthracene	0.00920	7.3E-01	NA	3.2E-09	2.3E-09	0.1%	9.0E-09	--	--
Benzo[a]pyrene	0.020	7.3E+00	NA	7.0E-09	5.1E-08	3.2%	2.0E-08	--	--
Benzo[b]fluoranthene	0.0440	7.3E-01	NA	1.5E-08	1.1E-08	0.7%	4.3E-08	--	--
Benzo[k]fluoranthene	0.00860	7.3E-02	NA	3.0E-09	2.2E-10	0.0%	8.4E-09	--	--
Chrysene	0.0360	7.3E-03	NA	1.3E-08	9.2E-11	0.0%	3.5E-08	--	--
Dibenz(a,h)anthracene	0.00290	7.3E+00	NA	1.0E-09	7.4E-09	0.5%	2.8E-09	--	--
Indeno[1,2,3-cd]pyrene	0.00750	7.3E-01	NA	2.6E-09	1.9E-09	0.1%	7.3E-09	--	--
Arsenic	2.88	1.5E+00	3.0E-04	1.0E-06	1.5E-06	95.3%	2.8E-06	9.4E-03	0.2%
Cobalt	30.3	NA	3.0E-04	1.1E-05	--	--	3.0E-05	9.9E-02	2.6%
Mercury	0.202	NA	1.6E-04	7.1E-08	--	--	2.0E-07	1.2E-03	0.0%
Thallium	0.650	NA	NA	2.3E-07	--	--	6.4E-07	--	--
Vanadium	267	NA	7.0E-05	9.3E-05	--	--	2.6E-04	3.7E+00	97.2%
				Total ILCR:	1.6E-06	100.0%	Total HI:	3.8E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SOIL - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00185	NA	NA	NA	4.3E-09	--	--	1.2E-08	--	--
Benzo[a]anthracene	0.00920	1.3E-01	7.3E-01	NA	2.8E-09	2.0E-09	0.6%	7.7E-09	--	--
Benzo[a]pyrene	0.020	1.3E-01	7.3E+00	NA	6.0E-09	4.4E-08	12.1%	1.7E-08	--	--
Benzo[b]fluoranthene	0.0440	1.3E-01	7.3E-01	NA	1.3E-08	9.6E-09	2.7%	3.7E-08	--	--
Benzo[k]fluoranthene	0.00860	1.3E-01	7.3E-02	NA	2.6E-09	1.9E-10	0.1%	7.2E-09	--	--
Chrysene	0.0360	1.3E-01	7.3E-03	NA	1.1E-08	7.9E-11	0.0%	3.0E-08	--	--
Dibenz(a,h)anthracene	0.00290	1.3E-01	7.3E+00	NA	8.7E-10	6.3E-09	1.8%	2.4E-09	--	--
Indeno[1,2,3-cd]pyrene	0.00750	1.3E-01	7.3E-01	NA	2.2E-09	1.6E-09	0.5%	6.3E-09	--	--
Arsenic	2.88	3.0E-02	1.5E+00	3.0E-04	2.0E-07	3.0E-07	82.4%	5.6E-07	1.9E-03	0.0%
Cobalt	30.3	1.0E-02	NA	3.0E-04	7.0E-07	--	--	2.0E-06	6.5E-03	0.1%
Mercury	0.202	1.0E-02	NA	1.1E-05	4.7E-09	--	--	1.3E-08	1.2E-03	0.0%
Thallium	0.650	1.0E-02	NA	NA	1.5E-08	--	--	4.2E-08	--	--
Vanadium	267	1.0E-02	NA	1.8E-06	6.2E-06	--	--	1.7E-05	9.6E+00	99.9%
					Total ILCR:	3.6E-07	100.0%	Total HI:	9.6E+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 - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.00185	NA	1.36E-12	NA	NA	1.1E-13	--	--	3.1E-13	--	--
Benzo[a]anthracene	0.00920	1.8E+07	5.14E-10	1.1E-04	NA	4.2E-11	4.6E-12	0.0%	1.2E-10	--	--
Benzo[a]pyrene	0.020	3.5E+07	5.82E-10	1.1E-03	NA	4.7E-11	5.2E-11	0.3%	1.3E-10	--	--
Benzo[b]fluoranthene	0.0440	2.1E+07	2.11E-09	1.1E-04	NA	1.7E-10	1.9E-11	0.1%	4.8E-10	--	--
Benzo[k]fluoranthene	0.00860	4.5E+07	1.97E-10	1.1E-04	NA	1.6E-11	1.8E-12	0.0%	4.5E-11	--	--
Chrysene	0.0360	2.7E+06	1.32E-08	1.1E-05	NA	1.1E-09	1.2E-11	0.1%	3.0E-09	--	--
Dibenz(a,h)anthracene	0.00290	8.7E+07	3.56E-11	1.2E-03	NA	2.9E-12	3.5E-12	0.0%	8.1E-12	--	--
Indeno[1,2,3-cd]pyrene	0.00750	8.2E+07	9.70E-11	1.1E-04	NA	7.9E-12	8.7E-13	0.0%	2.2E-11	--	--
Arsenic	2.88	NA	2.12E-09	4.3E-03	1.5E-05	1.7E-10	7.4E-10	4.3%	4.8E-10	3.2E-05	2.4%
Cobalt	30.3	NA	2.23E-08	9.0E-03	6.0E-06	1.8E-09	1.6E-08	95.1%	5.1E-09	8.5E-04	62.2%
Mercury	0.202	4.5E+06	4.48E-08	NA	3.0E-04	3.7E-09	--	--	1.0E-08	3.4E-05	2.5%
Thallium	0.650	NA	4.78E-10	NA	NA	3.9E-11	--	--	1.1E-10	--	--
Vanadium	267	NA	1.96E-07	NA	1.0E-04	1.6E-08	--	--	4.5E-08	4.5E-04	32.9%
						Total ILCR:	1.7E-08	100.0%	Total HI:	1.4E-03	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SURFACE WATER - SWMU 56 (HANGER 200 APRON)
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*ET*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/hour	Ingestion rate of water	0.05	
ET	hours/day	Exposure time	2	
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	0.00320	1.5E+00	3.0E-04	1.1E-06	1.7E-06	100.0%	3.1E-06	1.0E-02	3.2%
Cobalt	0.00310	NA	3.0E-04	1.1E-06	--	--	3.0E-06	1.0E-02	3.1%
Lead	0.0160	NA	NA	5.6E-06	--	--	1.6E-05	--	--
Vanadium	0.0220	NA	7.0E-05	7.7E-06	--	--	2.2E-05	3.1E-01	93.7%
				Total ILCR:	1.7E-06	100.0%	Total HI:	3.3E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SURFACE WATER - SWMU 56 (HANGER 200 APRON)
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)

ILCR = CDI*CSFo Adj   CSF Adj = CSF/AD
HQ = CDI/RfDo Adj   RfD Adj = RfD*AD

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	250	
ED	years	Exposure duration	25	
ET	hours/day	Exposure time	2.0	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	9,125	
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)	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	0.00320	1.00E-03 (61)	1.5E+00	3.0E-04	7.4E-08	1.1E-07	100.0%	2.1E-07	6.9E-04	0.1%
Cobalt	0.00310	4.00E-04 (61)	NA	3.0E-04	2.9E-08	--	--	8.0E-08	2.7E-04	0.0%
Lead	0.0160	1.00E-04 (61)	NA	NA	3.7E-08	--	--	1.0E-07	--	--
Vanadium	0.0220	1.00E-03 (61)	NA	1.8E-06	5.1E-07	--	--	1.4E-06	7.9E-01	99.9%
					Total ILCR:	1.1E-07	100.0%	Total HI:	7.9E-01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

Kp value is derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
ACCIDENTAL INGESTION OF SEDIMENT - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.0360	NA	NA	1.3E-08	--	--	3.5E-08	--	--
Benzo[a]anthracene	0.270	7.3E-01	NA	9.4E-08	6.9E-08	1.6%	2.6E-07	--	--
Benzo[a]pyrene	0.30	7.3E+00	NA	1.0E-07	7.7E-07	17.3%	2.9E-07	--	--
Benzo[b]fluoranthene	0.0770	7.3E-01	NA	2.7E-08	2.0E-08	0.4%	7.5E-08	--	--
Benzo[k]fluoranthene	0.630	7.3E-02	NA	2.2E-07	1.6E-08	0.4%	6.2E-07	--	--
Chrysene	0.410	7.3E-03	NA	1.4E-07	1.0E-09	0.0%	4.0E-07	--	--
Dibenz(a,h)anthracene	0.0520	7.3E+00	NA	1.8E-08	1.3E-07	3.0%	5.1E-08	--	--
Indeno[1,2,3-cd]pyrene	0.110	7.3E-01	NA	3.8E-08	2.8E-08	0.6%	1.1E-07	--	--
Arsenic	6.48	1.5E+00	3.0E-04	2.3E-06	3.4E-06	76.7%	6.3E-06	2.1E-02	0.7%
Cobalt	54.7	NA	3.0E-04	1.9E-05	--	--	5.4E-05	1.8E-01	5.7%
Vanadium	208	NA	7.0E-05	7.3E-05	--	--	2.0E-04	2.9E+00	93.6%
				Total ILCR:	4.4E-06	100.0%	Total HI:	3.1E+00	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

ADULT ON-SITE WORKERS - CURRENT AND FUTURE SCENARIOS
DERMAL CONTACT WITH SEDIMENT - SWMU 56 (HANGER 200 APRON)
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
Iodomethane	0.0360	NA	NA	NA	1.2E-07	--	--	3.5E-07	--	--
Benzo[a]anthracene	0.270	1.3E-01	7.3E-01	NA	1.2E-07	8.9E-08	3.8%	3.4E-07	--	--
Benzo[a]pyrene	0.30	1.3E-01	7.3E+00	NA	1.3E-07	9.8E-07	42.2%	3.8E-07	--	--
Benzo[b]fluoranthene	0.0770	1.3E-01	7.3E-01	NA	3.5E-08	2.5E-08	1.1%	9.7E-08	--	--
Benzo[k]fluoranthene	0.630	1.3E-01	7.3E-02	NA	2.8E-07	2.1E-08	0.9%	7.9E-07	--	--
Chrysene	0.410	1.3E-01	7.3E-03	NA	1.8E-07	1.3E-09	0.1%	5.2E-07	--	--
Dibenz(a,h)anthracene	0.0520	1.3E-01	7.3E+00	NA	2.3E-08	1.7E-07	7.3%	6.5E-08	--	--
Indeno[1,2,3-cd]pyrene	0.110	1.3E-01	7.3E-01	NA	4.9E-08	3.6E-08	1.5%	1.4E-07	--	--
Arsenic	6.48	3.0E-02	1.5E+00	3.0E-04	6.7E-07	1.0E-06	43.2%	1.9E-06	6.3E-03	0.1%
Cobalt	54.7	1.0E-02	NA	3.0E-04	1.9E-06	--	--	5.3E-06	1.8E-02	0.2%
Vanadium	208	1.0E-02	NA	1.8E-06	7.2E-06	--	--	2.0E-05	1.1E+01	99.8%
					Total ILCR:	2.3E-06	100.0%	Total HI:	1.1E+01	100.0%

NOTES:
-- - Not applicable.
NA - Toxicity criterion not available.

APPENDIX L
RAGS PART D TABLES

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	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 Dermal	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.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 56 (HANGER 200 APRON)
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
		Air	Volatile Emissions to Indoor Air	Industrial / Commercial Workers	Adult	Inhalation	NA	Not a current receptor.
				Residents	Adult	Inhalation	NA	Not a current receptor.
			Volatile Emissions to Trench Air	Construction Workers	Adult	Inhalation	NA	Not a current receptor.
	Surface Water	Surface Water	Surface Water	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.
	Sediment	Sediment	Sediment	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.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	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.
				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 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	NA	Not expected to be exposed to this medium.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 56 (HANGER 200 APRON)
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
		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.
	Surface Water	Surface Water	Surface Water	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.
	Sediment	Sediment	Sediment	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 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

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)**													
	67-64-1	Acetone	23 J	280	µg/kg	56SB08	7/8	86U - 86U	280	ND	6.10E+06	N/A	N/A	NO	BSL
	71-43-2	Benzene	0.95 J	0.99 J	µg/kg	56SB08	2/8	0.7U - 0.8U	0.99	ND	1.10E+03	N/A	N/A	NO	BSL
	75-15-0	Carbon disulfide	1.9 J	1.9 J	µg/kg	56SB07	1/8	0.45U - 0.6U	1.9	ND	8.20E+04	N/A	N/A	NO	BSL
	74-87-3	Chloromethane	2.2 J	2.2 J	µg/kg	56SB03	1/8	0.65U - 0.84U	2.2	ND	1.20E+04	N/A	N/A	NO	BSL
	74-88-4	Iodomethane	1 J	2.4 J	µg/kg	56SB07	4/8	0.96UJ - 1.2U	2.4	ND	N/A	N/A	N/A	YES	NSC
		Semivolatile Organic Compounds (ug/kg)													
	91-57-6	2-Methylnaphthalene	19	19	µg/kg	56SB08	1/8	2.1U - 2.3UJ	19	ND	3.10E+04	N/A	N/A	NO	BSL
	56-55-3	Benzo[a]anthracene	2.4 J	9.2 J	µg/kg	56SB03	3/8	2.1UJ - 2.3UJ	9.2	ND	1.50E+02	N/A	N/A	YES	CHEM
	50-32-8	Benzo[a]pyrene	2.8 J	20 J	µg/kg	56SB03	3/8	0.83UJ - 0.88UJ	20	ND	1.50E+01	N/A	N/A	YES	ASL
	205-99-2	Benzo[b]fluoranthene	3.1 J	44 J	µg/kg	56SB03	3/8	0.96UJ - 1UJ	44	ND	1.50E+02	N/A	N/A	YES	CHEM
	191-24-2	Benzo[g,h,i]perylene	3.1 J	17 J	µg/kg	56SB03	2/8	2.1U - 2.3UJ	17	ND	1.70E+05 [7]	N/A	N/A	NO	BSL
	207-08-9	Benzo[k]fluoranthene	1.5 J	1.5 J	µg/kg	56SB07	1/8	1.2UJ - 1.3U	1.5	ND	1.50E+03	N/A	N/A	YES	CHEM
	85-68-7	Butyl benzyl phthalate	10 J	10 J	µg/kg	56SB03	1/8	9UJ - 9.7U	10	ND	2.60E+05	N/A	N/A	NO	BSL
	218-01-9	Chrysene	2.2 J	36 J	µg/kg	56SB03	3/8	0.79U - 1.4UJ	36	ND	1.50E+04	N/A	N/A	YES	CHEM
	53-70-3	Dibenz(a,h)anthracene	2.9 J	2.9 J	µg/kg	56SB03	1/8	0.74UJ - 0.79U	2.9	ND	1.50E+01	N/A	N/A	YES	CHEM
	206-44-0	Fluoranthene	5 J	9.2 J	µg/kg	56SB03	2/8	2.1U - 2.3UJ	9.2	ND	2.30E+05	N/A	N/A	NO	BSL
	193-39-5	Indeno[1,2,3-cd]pyrene	1.9 J	7.5 J	µg/kg	56SB03	2/8	1.5UJ - 1.6UJ	7.5	ND	1.50E+02	N/A	N/A	YES	CHEM
	91-20-3	Naphthalene	1.9 J	4.3 J	µg/kg	56SB08	2/8	0.73UJ - 0.8UJ	4.3	ND	3.60E+03	N/A	N/A	NO	BSL
	85-01-8	Phenanthrene	2.3 J	2.5 J	µg/kg	56SB08	2/8	2.1UJ - 3.1U	2.5	ND	1.70E+05 [7]	N/A	N/A	NO	BSL
	129-00-0	Pyrene	5.1 J	16 J	µg/kg	56SB03	3/8	2.1UJ - 2.3UJ	16	ND	1.70E+05	N/A	N/A	NO	BSL
		Metals (mg/kg)													
	7440-36-0	Antimony	2	2	mg/kg	56SB01	1/8	0.091U - 0.16UJ	2	2.43	3.10E+00	N/A	N/A	NO	BSL
	7440-38-2	Arsenic	0.59 J	3.4	mg/kg	56SB05	8/8	(6)	3.4	2.37	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	15 J	190 J	mg/kg	56SB07	8/8	(6)	190	233	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.053 J	0.34	mg/kg	56SB07	8/8	(6)	0.34	0.717	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.055 J	3.3 J	mg/kg	56SB01	7/8	0.038UJ - 0.038UJ	3.3	0.655	7.00E+00	N/A	N/A	NO	BSL
	7440-47-3	Chromium	6.3	54 J	mg/kg	56SB07	8/8	(6)	54	87.6	1.20E+04 [8]	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	2.6	50 J	mg/kg	56SB07	8/8	(6)	50	51.9	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	31 J	130 J	mg/kg	56SB07	8/8	(6)	130	225	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.88	210	mg/kg	56SB01	14/14	(6)	210	28.2	4.00E+02 [9]	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.015 J	0.066 J	mg/kg	56SB07	7/8	0.0047U - 0.0047U	0.066	0.112	5.60E-01	N/A	N/A	NO	BSL
	7440-02-0	Nickel	1.1	14 J	mg/kg	56SB07	8/8	(6)	14	27.0	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.33 J	3.5	mg/kg	56SS04	20/20	(6)	3.5	1.85	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.032 J	0.24 J	mg/kg	56SB01	2/8	0.019U - 0.13UJ	0.24	--	3.90E+01	N/A	N/A	NO	BSL
	7440-28-0	Thallium	0.15 J	0.25 J	mg/kg	56SB07	3/8	0.14U - 0.15U	0.25	0.775	N/A	N/A	N/A	YES	NSC
	7440-62-2	Vanadium	55	430	mg/kg	56SS09	14/14	(6)	430	367	5.50E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	7.5 J	77 J	mg/kg	56SB01	8/8	(6)	77	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, 2008): 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 pyrene used as a surrogate.
(8) Value for chromium III used as a surrogate.
(9) USEPA Residential Soil Action Level

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Total Soil
Exposure Medium: Total Soil

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		**Volatile Organic Compounds (ug/kg)**													
	67-64-1	Acetone	8.3 J	280	µg/kg	56SB08	21/24	25U - 86U	280	ND	6.10E+06	N/A	N/A	NO	BSL
	71-43-2	Benzene	0.95 J	0.99 J	µg/kg	56SB08	2/24	0.7U - 0.88U	0.99	ND	1.10E+03	N/A	N/A	NO	BSL
	75-15-0	Carbon disulfide	1.9 J	1.9 J	µg/kg	56SB07, 56SB07	2/24	0.45U - 0.6U	1.9	ND	8.20E+04	N/A	N/A	NO	BSL
	74-87-3	Chloromethane	2.2 J	2.2 J	µg/kg	56SB03	1/24	0.63U - 0.84U	2.2	ND	1.20E+04	N/A	N/A	NO	BSL
	74-88-4	Iodomethane	1 J	2.6 J	µg/kg	56SB08	7/24	0.89U - 1.2U	2.6	ND	N/A	N/A	N/A	YES	NSC
		Semivolatile Organic Compounds (ug/kg)													
	91-57-6	2-Methylnaphthalene	6.2 J	19	µg/kg	56SB08	2/24	2.1U - 2.3UJ	19	ND	3.10E+04	N/A	N/A	NO	BSL
	56-55-3	Benzo[a]anthracene	2.4 J	9.2 J	µg/kg	56SB03	4/24	2.1U - 2.3UJ	9.2	ND	1.50E+02	N/A	N/A	YES	CHEM
	50-32-8	Benzo[a]pyrene	1.2 J	20 J	µg/kg	56SB03	5/24	0.82U - 0.9UJ	20	ND	1.50E+01	N/A	N/A	YES	ASL
	205-99-2	Benzo[b]fluoranthene	1 J	44 J	µg/kg	56SB03	4/24	0.95U - 1UJ	44	ND	1.50E+02	N/A	N/A	YES	CHEM
	191-24-2	Benzo[g,h,i]perylene	3.1 J	17 J	µg/kg	56SB03	2/24	2.1U - 2.3UJ	17	ND	1.70E+05 [7]	N/A	N/A	NO	BSL
	207-08-9	Benzo[k]fluoranthene	1.5 J	8.6 J	µg/kg	56SB04	2/24	1.2U - 1.4UJ	8.6	ND	1.50E+03	N/A	N/A	YES	CHEM
	85-68-7	Butyl benzyl phthalate	10 J	10 J	µg/kg	56SB03	1/24	9U - 9.9UJ	10	ND	2.60E+05	N/A	N/A	NO	BSL
	218-01-9	Chrysene	1 J	36 J	µg/kg	56SB03	5/24	0.76U - 1.4UJ	36	ND	1.50E+04	N/A	N/A	YES	CHEM
	53-70-3	Dibenz(a,h)anthracene	2.9 J	2.9 J	µg/kg	56SB03	1/24	0.74U - 0.81UJ	2.9	ND	1.50E+01	N/A	N/A	YES	CHEM
	84-74-2	Di-n-butyl phthalate	41 J	41 J	µg/kg	56SB05	1/24	30UJ - 97U	41	ND	6.10E+05	N/A	N/A	NO	BSL
	206-44-0	Fluoranthene	5 J	9.2 J	µg/kg	56SB03	3/24	2.1U - 2.3UJ	9.2	ND	2.30E+05	N/A	N/A	NO	BSL
	193-39-5	Indeno[1,2,3-cd]pyrene	1.9 J	7.5 J	µg/kg	56SB03	2/24	1.5U - 1.6UJ	7.5	ND	1.50E+02	N/A	N/A	YES	CHEM
	91-20-3	Naphthalene	1.9 J	4.3 J	µg/kg	56SB08	2/24	0.73UJ - 0.82UJ	4.3	ND	3.60E+03	N/A	N/A	NO	BSL
	85-01-8	Phenanthrene	2.3 J	2.5 J	µg/kg	56SB08	2/24	2.1U - 3.1U	2.5	ND	1.70E+05 [7]	N/A	N/A	NO	BSL
	129-00-0	Pyrene	5.1 J	16 J	µg/kg	56SB03	4/24	2.1U - 2.3UJ	16	ND	1.70E+05	N/A	N/A	NO	BSL
		Metals (mg/kg)													
	7440-36-0	Antimony	2	2	mg/kg	56SB01	1/24	0.084U - 0.33UJ	2	2.43	3.10E+00	N/A	N/A	NO	BSL
	7440-38-2	Arsenic	0.48 J	3.4	mg/kg	56SB05, 56SB03	22/23	0.47U - 0.47U	3.4	2.37	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	7.9 J	470 J	mg/kg	56SB05	24/24	(6)	470	233	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.046 J	0.43	mg/kg	56SB05	22/24	0.064U - 0.071U	0.43	0.717	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.055 J	3.3 J	mg/kg	56SB01	11/24	0.035UJ - 0.12U	3.3	0.655	7.00E+00	N/A	N/A	NO	BSL
	7440-47-3	Chromium	3.6	120 J	mg/kg	56SB05	23/23	(6)	120	87.6	1.20E+04 [8]	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	0.5 J	55 J	mg/kg	56SB08	24/24	(6)	55	51.9	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	18 J	140 J	mg/kg	56SB06	24/24	(6)	140	225	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.39 J	210	mg/kg	56SB01	29/29	(6)	210	28.2	4.00E+02 [9]	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.0056 J	0.74 J	mg/kg	56SB03	18/24	0.0047U - 0.0054U	0.74	0.112	5.60E-01	N/A	N/A	YES	ASL
	7440-02-0	Nickel	1.1	17 J	mg/kg	56SB07	24/24	(6)	17	27.0	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.33 J	3.5	mg/kg	56SS04	36/36	(6)	3.5	1.85	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.028 J	0.24 J	mg/kg	56SB01	10/24	0.018U - 0.19U	0.24	--	3.90E+01	N/A	N/A	NO	BSL
	7440-28-0	Thallium	0.15 J	0.65	mg/kg	56SB05	6/24	0.13U - 0.16U	0.65	0.775	N/A	N/A	N/A	YES	NSC
	7440-62-2	Vanadium	29 J	470 J	mg/kg	56SB03	29/29	(6)	470	367	5.50E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	7.5 J	77 J	mg/kg	56SB01	24/24	(6)	77	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
(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2008): 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)

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

(6) No detection limits given; analyte detected in every sample.
(7) Value for pyrene used as a surrogate.
(8) Value for chromium III used as a surrogate.
(9) USEPA Residential Soil Action Level

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

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		**Volatile Organic Compounds (ug/L)**													
	67-64-1	Acetone	5.2 J	7.1 J	µg/L	56GW05	2/7	5U - 5U	7.1	ND	2.20E+03	N/A	N/A	NO	BSL
	74-87-3	Chloromethane	1.8 J	1.8 J	µg/L	56GW03	1/7	0.28U - 0.28U	1.8	ND	1.90E+01	N/A	N/A	NO	BSL
		Semivolatile Organic Compounds (ug/L)													
	106-46-7	1,4-Dichlorobenzene	0.16 J	0.16 J	µg/L	56GW02	1/8	0.12U - 0.12U	0.16	ND	4.30E-01	75		NO	BSL
	1319-77-3	3 & 4 Methylphenol	0.63 J	0.63 J	µg/L	56GW08	1/8	0.15U - 0.15U	0.63	ND	9.30E+01	N/A	N/A	NO	BSL
	120-12-7	Anthracene	0.033 J	0.033 J	µg/L	56GW07	1/8	0.021U - 0.021U	0.033	ND	1.10E+03	N/A	N/A	NO	BSL
	117-81-7	Bis(2-ethylhexyl) phthalate	0.98	0.98	µg/L	56GW02	1/8	0.34U - 0.73UJ	0.98	ND	4.80E+00	6		NO	BSL
	84-66-2	Diethyl phthalate	0.32 J	0.32 J	µg/L	56GW02	1/8	0.18U - 0.18U	0.32	ND	2.90E+03	N/A	N/A	NO	BSL
	206-44-0	Fluoranthene	0.056 J	0.056 J	µg/L	56GW07	1/8	0.049U - 0.049U	0.056	ND	1.50E+02	N/A	N/A	NO	BSL
	86-73-7	Fluorene	0.055 J	0.055 J	µg/L	56GW07	1/8	0.018U - 0.018U	0.055	ND	1.50E+02	N/A	N/A	NO	BSL
	85-01-8	Phenanthrene	0.05 J	0.39	µg/L	56GW07	2/8	0.017U - 0.017U	0.39	ND	1.10E+02 (7)	N/A	N/A	NO	BSL
		Dissolved Metals (ug/L)													
	d7440-36-0	Antimony	0.38 J	0.38 J	µg/L	56GW03	1/8	0.36U - 0.39U	0.38	ND	1.50E+00	6		NO	BSL
	d7440-38-2	Arsenic	0.5 J	0.5 J	µg/L	56GW03	1/8	0.28U - 1.6U	0.5	ND	4.50E-02	10		YES	ASL
	d7440-39-3	Barium	7.1	140	µg/L	56GW08	8/8	(6)	140	ND	7.30E+02	2000		NO	BSL
	d7440-48-4	Cobalt	1.4 J	31	µg/L	56GW08	5/6	0.45UJ - 0.45UJ	31	ND	1.10E+00	N/A	N/A	YES	ASL
	d7439-97-6	Mercury	0.098 J	0.098 J	µg/L	56GW04	1/8	0.08U - 0.08U	0.098	ND	5.70E-02	2		YES	ASL
	d7440-02-0	Nickel	0.4 J	2.6	µg/L	56GW08	7/8	0.32U - 0.32U	2.6	ND	7.30E+01	N/A	N/A	NO	BSL
	d7782-49-2	Selenium	0.65 J	0.7 J	µg/L	56GW05	2/8	0.6U - 0.6U	0.7	ND	1.80E+01	50		NO	BSL
	d7440-62-2	Vanadium	1.7 J	14 J	µg/L	56GW02, 56GW03	6/8	2.5U - 3.6U	14	ND	2.60E-01	N/A	N/A	YES	ASL
	d7440-66-6	Zinc	7.4 J	8 J	µg/L	56GW08	2/8	6.5U - 6.5U	8	ND	1.10E+03	N/A	N/A	NO	BSL
		Total Metals (ug/L)													
	7440-38-2	Arsenic	0.42 J	0.52 J	µg/L	56GW03	2/8	0.31U - 1.9U	0.52	ND	4.50E-02	10		YES	ASL
	7440-39-3	Barium	7.1	170	µg/L	56GW08	8/8	(6)	170	ND	7.30E+02	2000		NO	BSL
	7440-47-3	Chromium	2.3 J	2.3 J	µg/L	56GW08	1/8	0.6U - 2.4U	2.3	ND	5.50E+03 (8)	100		NO	BSL
	7440-48-4	Cobalt	1.2 J	38	µg/L	56GW08	5/6	0.29U - 0.29U	38	ND	1.10E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	8.3	8.3	µg/L	56GW08	1/8	1.2U - 2.7U	8.3	ND	1.50E+02	1300		NO	BSL
	7440-02-0	Nickel	0.35 J	3.9	µg/L	56GW08	5/8	0.32U - 0.32U	3.9	ND	7.30E+01	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.79 J	0.79 J	µg/L	56GW04	1/8	0.6U - 0.6U	0.79	ND	1.80E+01	50		NO	BSL
	7440-62-2	Vanadium	7.9	20	µg/L	56GW04	7/8	2.7U - 2.7U	20	ND	2.60E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	8.7 J	18 J	µg/L	56GW08	2/8	6.5U - 6.5U	18	ND	1.10E+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

Definitions: N/A = Not Applicable
ND = Not Detected
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, 2008): 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)

ug/L = microgram per liter

(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.
(8) Value for chromium III used as a surrogate.

TABLE 2.4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Water
Exposure Medium: Surface Water

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	Screening Toxicity Value (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Surface Water		**Dissolved Metals (ug/L)**													
	d7440-39-3	Barium	12	84	µg/L	56SW05	5/5	(5)	84	ND	7.30E+02	N/A	N/A	NO	BSL
	d7440-48-4	Cobalt	3.7	3.7	µg/L	56SW01	1/1	(5)	3.7	ND	1.10E+00	N/A	N/A	YES	ASL
	d7440-50-8	Copper	1.9 J	2.6 J	µg/L	56SW03	3/5	1.2U - 1.5U	2.6	ND	1.50E+02	N/A	N/A	NO	BSL
	d7439-92-1	Lead	0.17 J	0.47 J	µg/L	56SW04	2/5	0.15U - 0.43U	0.47	ND	1.50E+01 (6)	N/A	N/A	NO	BSL
	d7440-02-0	Nickel	0.82 J	2.1	µg/L	56SW01	5/5	(5)	2.1	ND	7.30E+01	N/A	N/A	NO	BSL
	d7440-66-6	Zinc	6.7 J	8.8 J	µg/L	56SW01	2/5	6.5U - 6.5U	8.8	ND	1.10E+03	N/A	N/A	NO	BSL
		Total Metals (ug/L)													
	7440-38-2	Arsenic	3.2	3.2	µg/L	56SW01	1/5	1.4U - 2.4U	3.2	ND	4.50E-02	N/A	N/A	YES	ASL
	7440-39-3	Barium	13	86	µg/L	56SW05	5/5	(5)	86	ND	7.30E+02	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	1.1 J	1.1 J	µg/L	56SW01	1/5	0.12UJ - 0.12UJ	1.1	ND	1.80E+00	N/A	N/A	NO	BSL
	7440-47-3	Chromium	6.3	6.3	µg/L	56SW01	1/5	1.5U - 1.7U	6.3	ND	5.50E+03 (7)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	3.1	3.1	µg/L	56SW01	1/1	(5)	3.1	ND	1.10E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	1.4 J	13	µg/L	56SW01	5/5	(5)	13	ND	1.50E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	0.21 J	16	µg/L	56SW01	5/5	(5)	16	ND	1.50E+01 (6)	N/A	N/A	YES	ASL
	7440-02-0	Nickel	0.43 J	3.8	µg/L	56SW01	5/5	(5)	3.8	ND	7.30E+01	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.71 J	0.71 J	µg/L	56SW01	1/5	0.6U - 0.6U	0.71	ND	1.80E+01	N/A	N/A	NO	BSL
	7440-62-2	Vanadium	5.2	22	µg/L	56SW01	4/5	5U - 5U	22	ND	2.60E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	6.5 J	46	µg/L	56SW01	4/5	6.5U - 6.5U	46	ND	1.10E+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

(2) Maximum concentration used for screening
(3) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Regional Screening Levels, Tapwater (Nov 2010)

(4) Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

(5) No detection limits given; analyte detected in every sample.
(6) Value for MCL
(7) Value for chromium III used as a surrogate.

Definitions: N/A = Not Applic
ND = Not Detecte
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

ug/L = microgram per liter

TABLE 2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment

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		**Volatile Organic Compounds (ug/kg)**													
	78-93-3	2-Butanone (MEK)	65 J	65 J	µg/kg	56SD03	1/3	35UJ - 110UJ	65	ND	2.80E+06	N/A	N/A	NO	BSL
	67-64-1	Acetone	200 J	1,200 J	µg/kg	56SD05	3/3	(6)	1,200	ND	6.10E+06	N/A	N/A	NO	BSL
	75-15-0	Carbon disulfide	19 J	800 J	µg/kg	56SD05	2/3	0.29UJ - 0.29UJ	800	ND	8.20E+04	N/A	N/A	NO	BSL
	74-88-4	Iodomethane	36 J	36 J	µg/kg	56SD05	1/3	0.58UJ - 2.9UJ	36	ND	N/A	N/A	N/A	YES	NSC
		Semivolatile Organic Compound (ug/kg)													
	56-55-3	Benzo[a]anthracene	58 J	270 J	µg/kg	56SD03	2/3	9.8UJ - 9.8UJ	270	ND	1.50E+02	N/A	N/A	YES	ASL
	50-32-8	Benzo[a]pyrene	85 J	300 J	µg/kg	56SD03	2/3	3.8UJ - 3.8UJ	300	ND	1.50E+01	N/A	N/A	YES	ASL
	205-99-2	Benzo[b]fluoranthene	77 J	77 J	µg/kg	56SD04	1/3	1.6UJ - 4.4UJ	77	ND	1.50E+02	N/A	N/A	YES	CHEM
	191-24-2	Benzo[g,h,i]perylene	46 J	150 J	µg/kg	56SD03	2/3	9.8UJ - 9.8UJ	150	ND	1.70E+05 (7)	N/A	N/A	NO	BSL
	207-08-9	Benzo[k]fluoranthene	160 J	630 J	µg/kg	56SD03	2/3	5.7UJ - 5.7UJ	630	ND	1.50E+03	N/A	N/A	YES	CHEM
	100-51-6	Benzyl alcohol	47 J	47 J	µg/kg	56SD05	1/3	17UJ - 32UJ	47	ND	6.10E+05	N/A	N/A	NO	BSL
	117-81-7	Bis(2-ethylhexyl) phthalate	260 J	260 J	µg/kg	56SD03	1/3	79U - 160U	260	ND	3.50E+04	N/A	N/A	NO	BSL
	85-68-7	Butyl benzyl phthalate	22 J	22 J	µg/kg	56SD03	1/3	29UJ - 41UJ	22	ND	2.60E+05	N/A	N/A	NO	BSL
	218-01-9	Chrysene	7.1 J	410 J	µg/kg	56SD03	3/3	(6)	410	ND	1.50E+04	N/A	N/A	YES	CHEM
	53-70-3	Dibenz(a,h)anthracene	52 J	52 J	µg/kg	56SD03	1/3	2.4UJ - 3.4UJ	52	ND	1.50E+01	N/A	N/A	YES	ASL
	206-44-0	Fluoranthene	79 J	350 J	µg/kg	56SD03	2/3	9.8UJ - 9.8UJ	350	ND	2.30E+05	N/A	N/A	NO	BSL
	193-39-5	Indeno[1,2,3-cd]pyrene	32 J	110 J	µg/kg	56SD03	2/3	6.9UJ - 6.9UJ	110	ND	1.50E+02	N/A	N/A	YES	CHEM
	85-01-8	Phenanthrene	19 J	21 J	µg/kg	56SD03	2/3	9.8UJ - 9.8UJ	21	ND	1.70E+05 (7)	N/A	N/A	NO	BSL
	108-95-2	Phenol	19 J	19 J	µg/kg	56SD04	1/3	9.9UJ - 28UJ	19	ND	1.80E+06	N/A	N/A	NO	BSL
	129-00-0	Pyrene	110 J	570 J	µg/kg	56SD03	2/3	9.8UJ - 9.8UJ	570	ND	1.70E+05	N/A	N/A	NO	BSL
		Total Metals (mg/kg)													
	7440-36-0	Antimony	0.92 J	0.92 J	mg/kg	56SD18	1/14	0.29UJ - 1.4UJ	0.92	ND	3.10E+00	N/A	N/A	NO	BSL
	7440-38-2	Arsenic	0.96 J	10.4 J	mg/kg	56SD22	13/14	1.1UJ - 1.1UJ	10.4	ND	3.90E-01	N/A	N/A	YES	ASL
	7440-39-3	Barium	42	571 J	mg/kg	56SD22	14/14	(6)	571	ND	1.50E+03	N/A	N/A	NO	BSL
	7440-41-7	Beryllium	0.21 J	0.3 J	mg/kg	56SD14	4/14	0.25UJ - 1.2UJ	0.3	ND	1.60E+01	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.39 J	3.9 J	mg/kg	56SD04	6/14	0.04U - 0.13UJ	3.9	ND	7.00E+00	N/A	N/A	NO	BSL
	7440-47-3	Chromium	19.8 J	51 J	mg/kg	56SD14	14/14	(6)	51	ND	1.20E+04 (8)	N/A	N/A	NO	BSL
	7440-48-4	Cobalt	18 J	91.4 J	mg/kg	56SD22	14/14	(6)	91.4	ND	2.30E+00	N/A	N/A	YES	ASL
	7440-50-8	Copper	75.1 J	130 J	mg/kg	56SD03, 56SD04	14/14	(6)	130	ND	3.10E+02	N/A	N/A	NO	BSL
	7439-92-1	Lead	13 J	280 J	mg/kg	56SD03	14/14	(6)	280	ND	4.00E+02 (9)	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.052 J	0.38 J	mg/kg	56SD16	13/14	0.039UJ - 0.039UJ	0.38	ND	5.60E-01	N/A	N/A	NO	BSL
	7440-02-0	Nickel	8.7 J	19.1 J	mg/kg	56SD22	14/14	(6)	19.1	ND	1.50E+02	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.99 J	4.2 J	mg/kg	56SD04	9/14	0.46UJ - 1.4UJ	4.2	ND	3.90E+01	N/A	N/A	NO	BSL
	7440-22-4	Silver	0.18 J	4.6 J	mg/kg	56SD15	6/14	0.05U - 0.16UJ	4.6	ND	3.90E+01	N/A	N/A	NO	BSL
	7440-31-5	Tin	4.6 J	16 J	mg/kg	56SD22	8/14	7.8UJ - 23UJ	16	ND	4.70E+03	N/A	N/A	NO	BSL
	7440-62-2	Vanadium	147 J	260 J	mg/kg	56SD14	14/14	(6)	260	ND	5.50E-01	N/A	N/A	YES	ASL
	7440-66-6	Zinc	69.2 J	140 J	mg/kg	56SD04	14/14	(6)	140	ND	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

(2) Maximum concentration used for screening
(3) Revised Final II Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2008): 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)

Definitions: N/A = Not Applic
ND = Not Detecte
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
mg/kg = milligrams per kilogram
ug/kg = microgram per kilogram

(6) No detection limits given; analyte detected in every sample.
(7) Value for pyrene used as a surrogate.
(8) Value for chromium III used as a surrogate.
(9) USEPA Residential Soil Action Level

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Iodomethane	0.00185	mg/kg	95% UCL (NP)	95% KM (t) UCL
SS	Benzo[a]anthracene	0.00920	mg/kg	Max	Less than 4 detections
SS	Benzo[a]pyrene	0.020	mg/kg	Max	Less than 4 detections
SS	Benzo[b]fluoranthene	0.0440	mg/kg	Max	Less than 4 detections
TS	Benzo[k]fluoranthene	0.00860	mg/kg	Max	Less than 4 detections
SS	Chrysene	0.0360	mg/kg	Max	Less than 4 detections
SS	Dibenz(a,h)anthracene	0.00290	mg/kg	Max	Less than 4 detections
SS	Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	Max	Less than 4 detections
SS	Arsenic	2.88	mg/kg	95% UCL (N)	95% Student's-t UCL
SS	Cobalt	30.3	mg/kg	95% UCL (N)	95% Student's-t UCL
TS	Mercury	0.202	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
TS	Thallium	0.650	mg/kg	Max	UCL>Max
SS	Vanadium	267	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 detect
(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 3.2.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: 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									
	Arsenic	µg/L	0.593	Not Determined	0.52 J	0.00052	mg/L	Max	Less than 4 detections
	Cobalt	µg/L	8.17	Not Determined	38	0.0380	mg/L	Max	Less than 8 samples
	Vanadium	µg/L	11.7	15.7 (NP)	20	0.0157	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.

TABLE 3.3.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Water
Exposure Medium: Surface Water

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 Water									
	Arsenic	µg/L	1.33	Not Determined	3.2	0.00320	mg/kg	Max	Less than 8 samples
	Cobalt	µg/L	3.10	Not Determined	3.1	0.00310	mg/kg	Max	Less than 8 samples
	Lead	µg/L	3.52	Not Determined	16	0.0160	mg/kg	Max	Less than 8 samples
	Vanadium	µg/L	8.20	Not Determined	22	0.0220	mg/kg	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 3.4.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment

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									
	Iodomethane	µg/kg	12.6	Not Determined	36 J	0.0360	mg/kg	Max	Less than 8 samples
	Benzo[a]anthracene	µg/kg	111	Not Determined	270 J	0.270	mg/kg	Max	Less than 8 samples
	Benzo[a]pyrene	µg/kg	129	Not Determined	300 J	0.30	mg/kg	Max	Less than 8 samples
	Benzo[b]fluoranthene	µg/kg	26.7	Not Determined	77 J	0.0770	mg/kg	Max	Less than 8 samples
	Benzo[k]fluoranthene	µg/kg	264	Not Determined	630 J	0.630	mg/kg	Max	Less than 8 samples
	Chrysene	µg/kg	168	Not Determined	410 J	0.410	mg/kg	Max	Less than 8 samples
	Dibenz(a,h)anthracene	µg/kg	18.3	Not Determined	52 J	0.0520	mg/kg	Max	Less than 8 samples
	Indeno[1,2,3-cd]pyrene	µg/kg	48.5	Not Determined	110 J	0.110	mg/kg	Max	Less than 8 samples
	Arsenic	mg/kg	3.12	6.48 (NP)	10.4 J	6.48	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
	Cobalt	mg/kg	40.2	54.7 (N)	91.4 J	54.7	mg/kg	95% UCL (N)	95% Student's-t UCL
	Vanadium	mg/kg	196	208 (N)	260 J	208	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 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
Exposure Medium: Soil

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	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	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	USEPA, 1991	
				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	
	Future Residents	Adult	Soil	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	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	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Future Industrial / Commercial Workers	Adult	Soil	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, 1997	
				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	Soil	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	
	Current and Future On-Site Workers	Adult	Soil	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, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
Dermal									Dermally Adjusted Dose (DAD) Equations
	Current and Future Trespassers	Adult	Soil	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	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
		Youth	Soil	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	USEPA, 1991	
				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	
	Future Residents	Adult	Soil	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	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	
	Future Industrial / Commercial Workers	Adult	Soil	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, 1997	
				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 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Future Construction Workers	Adult	Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	DAD (mg/kg-day) = C x CF x SA x AF x ABS x EF x ED x 1/BW x1/AT
				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	
				ABS	Absorption Factor	CS	NA	USEPA, 2004	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				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	
	Current and Future On-Site Workers	Adult	Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	DAD (mg/kg-day) = C x CF x SA x AF x ABS x EF x ED x 1/BW x1/AT
				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	
				ABS	Absorption Factor	CS	NA	USEPA, 2004	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	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
(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
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 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
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	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)	96,360	hours	USEPA, 1989	
	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 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 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Future Construction Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	EC (mg/m3) = (Ca*ET*EF*ED)/AT
				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)	
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	hours	USEPA, 1989	
	Current and Future On-Site Workers	Adult	Fugitive dust	Ca	Contaminant Concentration in Air	Chemical Specific	mg/m3	Chemical Specific	EC (mg/m3) = (Ca*ET*EF*ED)/AT
				ET	Exposure Time	8	hours/day	Prof Judge (7)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				PEF	Particulate Emission Factor	1.36E+09	m3/kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	613,200	hours	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	219,000	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
(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:

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 56 (HANGER 200 APRON)
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									<u>Chronic Daily Intake (CDI) Equations</u>
	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, 1993	
				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	Prof Judge (17)	
				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, 1997	
				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, 2009	
				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									<u>Dermally Adjusted Dose (DAD) Equations</u>
	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	<u>Inorganics</u>
				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	<u>Organics: ET <= t*</u>
				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	<u>Organics: ET > t*</u>
				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 56 (HANGER 200 APRON)
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
		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	
	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 3.3

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.
(17) Ingestion rate assumed per work day

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, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993
USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa

TABLE 4.3.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Water
Exposure Medium: Surface Water

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	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.05	L/hour	USEPA, 1989 (16)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	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	
		Youth	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.05	L/hour	USEPA, 1989 (16)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	CDI (mg/kg-day) =
				ED	Exposure Duration	11	years	USEPA, 1991	C x IR-W x EF x ED x 1/BW x 1/AT
				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	
	Future Residents	Adult	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.05	L/hour	USEPA, 1989 (16)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	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	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.05	L/hour	USEPA, 1989 (16)	
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	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	
	Current and Future On-Site Workers	Adult	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				IR-W	Ingestion Rate of Groundwater	0.005	L/hour	VDEQ, 2010 (15)	
				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, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	

TABLE 4.3.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future Medium: Surface Water Exposure Medium: Surface Water

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	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	18,000	cm2	Prof Judge	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	DAD (mg/kg-day) =
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	C x CF x SA x PC x ET 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	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	6,600	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	DAD (mg/kg-day) =
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	C x CF x SA x PC x ET x EF x ED x
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	1/BW x1/AT
				ED	Exposure Duration	11	years	USEPA, 1991	
				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	
	Future Residents	Adult	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	18,000	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	DAD (mg/kg-day) =
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	C x CF x SA x PC x ET 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	
		Young Child	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	6,600	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	DAD (mg/kg-day) =
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	C x CF x SA x PC x ET x EF x ED x
				EF	Exposure Frequency	52	days/year	Prof Judge (3)	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 4.3.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Current and Future On-Site Workers	Adult	Surface Water	C	Contaminant Concentration in Surface Water	Chemical Specific	mg/L	Chemical Specific	DAD (mg/kg-day) = C x CF x SA x PC x ET x EF x ED x 1/BW x1/AT
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	3,300	cm2	USEPA, 2004	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2004	
				ET	Exposure Time	2	hours/day	USEPA, 1997 (6)	
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	

Notes

Chemical Specific - See Table 3.4

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
(6) Recommended outdoor activity factor for adults.
(16) Ingestion rate for swimming.

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 4.4.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment

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	Sediment	C	Contaminant Concentration in Sediment	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Sediment	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	Sediment	C	Contaminant Concentration in Sediment	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Sediment	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	USEPA, 1991	
				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	
	Future Residents	Adult	Sediment	C	Contaminant Concentration in Sediment	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Sediment	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	
		Young Child	Sediment	C	Contaminant Concentration in Sediment	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Sediment	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	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	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 4.4.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Current and Future On-Site Workers	Adult	Sediment	C	Contaminant Concentration in Sediment	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Sediment	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, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	
Dermal									Dermally Adjusted Dose (DAD) Equations
	Current and Future Trespassers	Adult	Sediment	C	Contaminant Concentration in Sediment	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	Sediment to Skin Adherence Factor	0.3	mg/cm2	VDEQ, 2011	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	Sediment	C	Contaminant Concentration in Sediment	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	Sediment to Skin Adherence Factor	0.3	mg/cm2	VDEQ, 2011	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	USEPA, 1991	
				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	
	Future Residents	Adult	Sediment	C	Contaminant Concentration in Sediment	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	Sediment to Skin Adherence Factor	0.3	mg/cm2	VDEQ, 2011	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	

TABLE 4.4.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 56 (HANGER 200 APRON)
CORRECTIVE MEASURES STUDY REPORT
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Current, Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
		Young Child	Sediment	C	Contaminant Concentration in Sediment	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	Sediment to Skin Adherence Factor	0.3	mg/cm2	VDEQ, 2011	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	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	
	Current and Future On-Site Workers	Adult	Sediment	C	Contaminant Concentration in Sediment	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	Sediment to Skin Adherence Factor	0.3	mg/cm2	VDEQ, 2011	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, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	USEPA, 1989	

Notes

Chemical Specific - See Table 3.5

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 th

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, 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 201

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
SWMU 56 (HANGER 200 APRON)
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)
Iodomethane	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	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
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
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
Mercury	Chronic	1.60E-04	mg/kg/day	7%	1.12E-05	mg/kg/day	ImS	1000/1	Cal EPA	3/9/2007
Thallium	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
ImS = Immune System

Sources:
IRIS = Integrated Risk Information System
PPRTV = Provisional Peer Reviewed Toxicity Values
Cal EPA = California Environmental Protection Agency

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
SWMU 56 (HANGER 200 APRON)
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)
Iodomethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	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
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
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
Mercury	Chronic	3.00E-04	mg/m3	NA	NA	CNS	30/1	IRIS	11/22/2010
Thallium	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:
CNS = Central Nervous System
RsS = Respiratory System

Sources:
IRIS = Integrated Risk Information System
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 56 (HANGER 200 APRON)
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)
Iodomethane	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	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
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
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	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 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 56 (HANGER 200 APRON)
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)
Iodomethane	NA	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	1.10E-04	1/(μg/m3)	NA	NA	D	Cal EPA	NA
Benzo[a]pyrene	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
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
Cobalt	9.00E-03	1/(μg/m3)	NA	NA	D	PPRTV	3/16/2001
Lead	NA	NA	NA	NA	NA	NA	NA
Mercury	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 av
- 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 HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	1.3E-10	mg/kg-day	NA	--	--	3.8E-10	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	6.4E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.7E-10	1.9E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	1.4E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.0E-08	4.1E-09	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	3.1E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.2E-09	9.0E-09	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	6.0E-10	mg/kg-day	7.3E-02	1/(mg/kg-day)	4.4E-11	1.8E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	2.5E-09	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.8E-11	7.3E-09	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	2.0E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.5E-09	5.9E-10	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	5.2E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.8E-10	1.5E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	2.0E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.0E-07	5.9E-07	mg/kg-day	3.0E-04	mg/kg-day	2.0E-03
				Cobalt	30.3	mg/kg	2.1E-06	mg/kg-day	NA	--	--	6.2E-06	mg/kg-day	3.0E-04	mg/kg-day	2.1E-02
				Mercury	0.202	mg/kg	1.4E-08	mg/kg-day	NA	--	--	4.1E-08	mg/kg-day	1.6E-04	mg/kg-day	2.6E-04
				Thallium	0.650	mg/kg	4.5E-08	mg/kg-day	NA	--	--	1.3E-07	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	1.9E-05	mg/kg-day	NA	--	--	5.4E-05	mg/kg-day	7.0E-05	mg/kg-day	7.8E-01
			Ingestion Total								3.2E-07					8.0E-01
			Dermal													
				Iodomethane	0.00185	mg/kg	5.2E-10	mg/kg-day	NA	--	--	1.5E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	3.3E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.4E-10	9.7E-10	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	7.2E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.3E-09	2.1E-09	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.6E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.2E-09	4.6E-09	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	3.1E-10	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.3E-11	9.1E-10	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.3E-09	mg/kg-day	7.3E-03	1/(mg/kg-day)	9.5E-12	3.8E-09	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.0E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	7.7E-10	3.1E-10	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	2.7E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-10	7.9E-10	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	2.4E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.6E-08	7.0E-08	mg/kg-day	3.0E-04	mg/kg-day	2.3E-04
				Cobalt	30.3	mg/kg	8.4E-08	mg/kg-day	NA	--	--	2.5E-07	mg/kg-day	3.0E-04	mg/kg-day	8.2E-04
				Mercury	0.202	mg/kg	5.6E-10	mg/kg-day	NA	--	--	1.6E-09	mg/kg-day	1.1E-05	mg/kg-day	1.5E-04
				Thallium	0.650	mg/kg	1.8E-09	mg/kg-day	NA	--	--	5.3E-09	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	7.4E-07	mg/kg-day	NA	--	--	2.2E-06	mg/kg-day	1.8E-06	mg/kg-day	**1.2E+00**
			Dermal Total								4.4E-08					**1.2E+00**
		Exposure Point Total									3.6E-07					**2.0E+00**
	Exposure Medium Total										3.6E-07					**2.0E+00**

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	5.5E-15	mg/m3	NA	--	--	1.6E-14	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	2.1E-12	mg/m3	1.1E-04	1/(µg/m3)	2.3E-13	6.1E-12	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	2.4E-12	mg/m3	1.1E-03	1/(µg/m3)	2.6E-12	6.9E-12	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	8.6E-12	mg/m3	1.1E-04	1/(µg/m3)	9.5E-13	2.5E-11	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	8.0E-13	mg/m3	1.1E-04	1/(µg/m3)	8.8E-14	2.3E-12	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	5.4E-11	mg/m3	1.1E-05	1/(µg/m3)	5.9E-13	1.6E-10	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.4E-13	mg/m3	1.2E-03	1/(µg/m3)	1.7E-13	4.2E-13	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	3.9E-13	mg/m3	1.1E-04	1/(µg/m3)	4.3E-14	1.2E-12	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	8.6E-12	mg/m3	4.3E-03	1/(µg/m3)	3.7E-11	2.5E-11	mg/m3	1.5E-05	mg/m3	1.7E-06
				Cobalt	30.3	mg/kg	9.1E-11	mg/m3	9.0E-03	1/(µg/m3)	8.2E-10	2.6E-10	mg/m3	6.0E-06	mg/m3	4.4E-05
				Mercury	0.202	mg/kg	1.8E-10	mg/m3	NA	--	--	5.3E-10	mg/m3	3.0E-04	mg/m3	1.8E-06
				Thallium	0.650	mg/kg	1.9E-12	mg/m3	NA	--	--	5.7E-12	mg/m3	NA	--	--
				Vanadium	267	mg/kg	8.0E-10	mg/m3	NA	--	--	2.3E-09	mg/m3	1.0E-04	mg/m3	2.3E-05
			Inhalation Total								8.6E-10					7.1E-05
		Exposure Point Total									8.6E-10					7.1E-05
	Exposure Medium Total										8.6E-10					7.1E-05
Soil Total											3.6E-07					**2.0E+00**
Surface Water	Surface Water	Surface Water	Ingestion													
				Arsenic	0.00320	mg/kg	2.2E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.3E-07	6.5E-07	mg/kg-day	3.0E-04	mg/kg-day	2.2E-03
				Cobalt	0.00310	mg/kg	2.2E-07	mg/kg-day	NA	--	--	6.3E-07	mg/kg-day	3.0E-04	mg/kg-day	2.1E-03
				Lead	0.0160	mg/kg	1.1E-06	mg/kg-day	NA	--	--	3.3E-06	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	1.5E-06	mg/kg-day	NA	--	--	4.5E-06	mg/kg-day	7.0E-05	mg/kg-day	6.4E-02
			Ingestion Total								3.3E-07					6.8E-02
			Dermal													
				Arsenic	0.00320	mg/kg	1.5E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.3E-08	4.5E-08	mg/kg-day	3.0E-04	mg/kg-day	1.5E-04
				Cobalt	0.00310	mg/kg	1.8E-08	mg/kg-day	NA	--	--	5.3E-08	mg/kg-day	3.0E-04	mg/kg-day	1.8E-04
				Lead	0.0160	mg/kg	1.4E-08	mg/kg-day	NA	--	--	4.1E-08	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	1.4E-07	mg/kg-day	NA	--	--	4.2E-07	mg/kg-day	1.8E-06	mg/kg-day	2.3E-01
			Dermal Total								2.3E-08					2.3E-01
		Exposure Point Total									3.6E-07					3.0E-01
	Exposure Medium Total										3.6E-07					3.0E-01
Surface Water Total											3.6E-07					3.0E-01

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Sediment	Sediment	Ingestion													
				Iodomethane	0.0360	mg/kg	2.5E-09	mg/kg-day	NA	--	--	7.3E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	1.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.4E-08	5.5E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	2.1E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.5E-07	6.1E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	5.4E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.9E-09	1.6E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	4.4E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.2E-09	1.3E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	2.9E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	2.1E-10	8.3E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	3.6E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.6E-08	1.1E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	7.7E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.6E-09	2.2E-08	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	4.5E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	6.8E-07	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	4.4E-03
				Cobalt	54.7	mg/kg	3.8E-06	mg/kg-day	NA	--	--	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	3.7E-02
				Vanadium	208	mg/kg	1.5E-05	mg/kg-day	NA	--	--	4.2E-05	mg/kg-day	7.0E-05	mg/kg-day	6.0E-01
			Ingestion Total								8.8E-07					6.5E-01
			Dermal													
				Iodomethane	0.0360	mg/kg	4.3E-08	mg/kg-day	NA	--	--	1.3E-07	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	4.2E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.1E-08	1.2E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	4.7E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.4E-07	1.4E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	1.2E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	8.7E-09	3.5E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	9.8E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	7.1E-09	2.9E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	6.4E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	4.6E-10	1.9E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	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	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	1.7E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.2E-08	5.0E-08	mg/kg-day	NA	--	--
				Arsenic	6.48	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
				Cobalt	54.7	mg/kg	6.5E-07	mg/kg-day	NA	--	--	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.3E-03
				Vanadium	208	mg/kg	2.5E-06	mg/kg-day	NA	--	--	7.2E-06	mg/kg-day	1.8E-06	mg/kg-day	**4.0E+00**
			Dermal Total								8.1E-07					**4.0E+00**
		Exposure Point Total									1.7E-06					**4.6E+00**
	Exposure Medium Total										1.7E-06					**4.6E+00**
Sediment Total											1.7E-06					**4.6E+00**
										Total of Receptor Risks Across All Media	2.4E-06	Total of Receptor Hazards Across All Media				**6.9E+00**

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	9.2E-11	mg/kg-day	NA	--	--	5.9E-10	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	4.6E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.3E-10	2.9E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	9.9E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	7.3E-09	6.3E-09	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	2.2E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.6E-09	1.4E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	4.3E-10	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.1E-11	2.7E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.8E-09	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.3E-11	1.1E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.4E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.1E-09	9.2E-10	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	3.7E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.7E-10	2.4E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.4E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.1E-07	9.1E-07	mg/kg-day	3.0E-04	mg/kg-day	3.0E-03
				Cobalt	30.3	mg/kg	1.5E-06	mg/kg-day	NA	--	--	9.6E-06	mg/kg-day	3.0E-04	mg/kg-day	3.2E-02
				Mercury	0.202	mg/kg	1.0E-08	mg/kg-day	NA	--	--	6.4E-08	mg/kg-day	1.6E-04	mg/kg-day	4.0E-04
				Thallium	0.650	mg/kg	3.2E-08	mg/kg-day	NA	--	--	2.1E-07	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	1.3E-05	mg/kg-day	NA	--	--	8.5E-05	mg/kg-day	7.0E-05	mg/kg-day	**1.2E+00**
			Ingestion Total								2.3E-07					**1.2E+00**
			Dermal													
				Iodomethane	0.00185	mg/kg	5.9E-10	mg/kg-day	NA	--	--	3.7E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	3.8E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.8E-10	2.4E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	8.3E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	6.0E-09	5.3E-09	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.8E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.3E-09	1.2E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	3.6E-10	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.6E-11	2.3E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.5E-09	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.1E-11	9.5E-09	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.2E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	8.8E-10	7.6E-10	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	3.1E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.3E-10	2.0E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	2.8E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.1E-08	1.8E-07	mg/kg-day	3.0E-04	mg/kg-day	5.8E-04
				Cobalt	30.3	mg/kg	9.6E-08	mg/kg-day	NA	--	--	6.1E-07	mg/kg-day	3.0E-04	mg/kg-day	2.0E-03
				Mercury	0.202	mg/kg	6.4E-10	mg/kg-day	NA	--	--	4.1E-09	mg/kg-day	1.1E-05	mg/kg-day	3.7E-04
				Thallium	0.650	mg/kg	2.1E-09	mg/kg-day	NA	--	--	1.3E-08	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	8.5E-07	mg/kg-day	NA	--	--	5.4E-06	mg/kg-day	1.8E-06	mg/kg-day	**3.0E+00**
			Dermal Total								5.0E-08					**3.0E+00**
		Exposure Point Total									2.8E-07					**4.2E+00**
	Exposure Medium Total										2.8E-07					**4.2E+00**

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	2.5E-15	mg/m3	NA	--	--	3.0E-14	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	9.6E-13	mg/m3	1.1E-04	1/(µg/m3)	1.1E-13	1.1E-11	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	1.1E-12	mg/m3	1.1E-03	1/(µg/m3)	1.2E-12	1.3E-11	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	3.9E-12	mg/m3	1.1E-04	1/(µg/m3)	4.3E-13	4.6E-11	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	3.7E-13	mg/m3	1.1E-04	1/(µg/m3)	4.0E-14	4.3E-12	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	2.5E-11	mg/m3	1.1E-05	1/(µg/m3)	2.7E-13	2.9E-10	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	6.6E-14	mg/m3	1.2E-03	1/(µg/m3)	8.0E-14	7.8E-13	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	1.8E-13	mg/m3	1.1E-04	1/(µg/m3)	2.0E-14	2.1E-12	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	4.0E-12	mg/m3	4.3E-03	1/(µg/m3)	1.7E-11	4.6E-11	mg/m3	1.5E-05	mg/m3	3.1E-06
				Cobalt	30.3	mg/kg	4.2E-11	mg/m3	9.0E-03	1/(µg/m3)	3.7E-10	4.8E-10	mg/m3	6.0E-06	mg/m3	8.1E-05
				Mercury	0.202	mg/kg	8.4E-11	mg/m3	NA	--	--	9.8E-10	mg/m3	3.0E-04	mg/m3	3.3E-06
				Thallium	0.650	mg/kg	8.9E-13	mg/m3	NA	--	--	1.0E-11	mg/m3	NA	--	--
				Vanadium	267	mg/kg	3.7E-10	mg/m3	NA	--	--	4.3E-09	mg/m3	1.0E-04	mg/m3	4.3E-05
			Inhalation Total								3.9E-10					1.3E-04
		Exposure Point Total									3.9E-10					1.3E-04
	Exposure Medium Total										3.9E-10					1.3E-04
Soil Total											2.8E-07					**4.2E+00**
Surface Water	Surface Water	Surface Water	Ingestion													
				Arsenic	0.00320	mg/kg	1.6E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.4E-07	1.0E-06	mg/kg-day	3.0E-04	mg/kg-day	3.4E-03
				Cobalt	0.00310	mg/kg	1.5E-07	mg/kg-day	NA	--	--	9.8E-07	mg/kg-day	3.0E-04	mg/kg-day	3.3E-03
				Lead	0.0160	mg/kg	8.0E-07	mg/kg-day	NA	--	--	5.1E-06	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	1.1E-06	mg/kg-day	NA	--	--	7.0E-06	mg/kg-day	7.0E-05	mg/kg-day	9.9E-02
			Ingestion Total								2.4E-07					1.1E-01
			Dermal													
				Arsenic	0.00320	mg/kg	6.1E-09	mg/kg-day	1.5E+00	1/(mg/kg-day)	9.2E-09	3.9E-08	mg/kg-day	3.0E-04	mg/kg-day	1.3E-04
				Cobalt	0.00310	mg/kg	7.3E-09	mg/kg-day	NA	--	--	4.7E-08	mg/kg-day	3.0E-04	mg/kg-day	1.6E-04
				Lead	0.0160	mg/kg	5.6E-09	mg/kg-day	NA	--	--	3.6E-08	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	5.8E-08	mg/kg-day	NA	--	--	3.7E-07	mg/kg-day	1.8E-06	mg/kg-day	2.0E-01
			Dermal Total								9.2E-09					2.0E-01
		Exposure Point Total									2.5E-07					3.1E-01
	Exposure Medium Total										2.5E-07					3.1E-01
Surface Water Total											2.5E-07					3.1E-01

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Sediment	Sediment	Ingestion													
				Iodomethane	0.0360	mg/kg	1.8E-09	mg/kg-day	NA	--	--	1.1E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	1.3E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.8E-09	8.5E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	1.5E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.1E-07	9.5E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	3.8E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.8E-09	2.4E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	3.1E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.3E-09	2.0E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	2.0E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.5E-10	1.3E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	2.6E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.9E-08	1.6E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	5.5E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.0E-09	3.5E-08	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	3.2E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.8E-07	2.1E-06	mg/kg-day	3.0E-04	mg/kg-day	6.8E-03
				Cobalt	54.7	mg/kg	2.7E-06	mg/kg-day	NA	--	--	1.7E-05	mg/kg-day	3.0E-04	mg/kg-day	5.8E-02
				Vanadium	208	mg/kg	1.0E-05	mg/kg-day	NA	--	--	6.6E-05	mg/kg-day	7.0E-05	mg/kg-day	9.4E-01
			Ingestion Total								6.3E-07					**1.0E+00**
			Dermal													
				Iodomethane	0.0360	mg/kg	1.7E-08	mg/kg-day	NA	--	--	1.1E-07	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	1.7E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.2E-08	1.1E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	1.9E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.4E-07	1.2E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	4.8E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.5E-09	3.0E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	3.9E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.9E-09	2.5E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	2.5E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.9E-10	1.6E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	3.2E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.4E-08	2.1E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	6.8E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.0E-09	4.3E-08	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	9.3E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.4E-07	5.9E-07	mg/kg-day	3.0E-04	mg/kg-day	2.0E-03
				Cobalt	54.7	mg/kg	2.6E-07	mg/kg-day	NA	--	--	1.7E-06	mg/kg-day	3.0E-04	mg/kg-day	5.5E-03
				Vanadium	208	mg/kg	9.9E-07	mg/kg-day	NA	--	--	6.3E-06	mg/kg-day	1.8E-06	mg/kg-day	**3.5E+00**
			Dermal Total								3.2E-07					**3.5E+00**
		Exposure Point Total									9.5E-07					**4.5E+00**
	Exposure Medium Total										9.5E-07					**4.5E+00**
Sediment Total											9.5E-07					**4.5E+00**
										Total of Receptor Risks Across All Media	1.5E-06				Total of Receptor Hazards Across All Media	**9.0E+00**

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	8.7E-10	mg/kg-day	NA	--	--	2.5E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	1.5E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-07	1.3E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	3.2E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.4E-06	2.7E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	7.1E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.2E-07	6.0E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	1.4E-07	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.0E-08	1.2E-08	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	5.8E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	4.2E-09	4.9E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	4.7E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.4E-07	4.0E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	1.5E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-07	1.0E-08	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.4E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.0E-06	3.9E-06	mg/kg-day	3.0E-04	mg/kg-day	1.3E-02
				Cobalt	30.3	mg/kg	1.4E-05	mg/kg-day	NA	--	--	4.2E-05	mg/kg-day	3.0E-04	mg/kg-day	1.4E-01
				Mercury	0.202	mg/kg	9.5E-08	mg/kg-day	NA	--	--	2.8E-07	mg/kg-day	1.6E-04	mg/kg-day	1.7E-03
				Thallium	0.650	mg/kg	3.1E-07	mg/kg-day	NA	--	--	8.9E-07	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	1.3E-04	mg/kg-day	NA	--	--	3.7E-04	mg/kg-day	7.0E-05	mg/kg-day	**5.2E+00**
			Ingestion Total								5.5E-06					**5.4E+00**
			Dermal													
				Iodomethane	0.00185	mg/kg	3.5E-09	mg/kg-day	NA	--	--	1.0E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	5.7E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.1E-08	6.5E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	1.2E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	9.0E-07	1.4E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	2.7E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-07	3.1E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	5.3E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.9E-09	6.1E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	2.2E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.6E-09	2.6E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.8E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.3E-07	2.1E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	4.6E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.4E-08	5.3E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.6E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.4E-07	4.7E-07	mg/kg-day	3.0E-04	mg/kg-day	1.6E-03
				Cobalt	30.3	mg/kg	5.7E-07	mg/kg-day	NA	--	--	1.7E-06	mg/kg-day	3.0E-04	mg/kg-day	5.5E-03
				Mercury	0.202	mg/kg	3.8E-09	mg/kg-day	NA	--	--	1.1E-08	mg/kg-day	1.1E-05	mg/kg-day	9.9E-04
				Thallium	0.650	mg/kg	1.2E-08	mg/kg-day	NA	--	--	3.6E-08	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	5.0E-06	mg/kg-day	NA	--	--	1.5E-05	mg/kg-day	1.8E-06	mg/kg-day	**8.0E+00**
			Dermal Total								1.6E-06					**8.0E+00**
		Exposure Point Total									7.0E-06					**1.3E+01**
	Exposure Medium Total										7.0E-06					**1.3E+01**

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	4.5E-13	mg/m3	NA	--	--	1.3E-12	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	1.2E-09	mg/m3	1.1E-04	1/(µg/m3)	1.3E-10	4.9E-10	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	1.4E-09	mg/m3	1.1E-03	1/(µg/m3)	1.5E-09	5.6E-10	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	5.0E-09	mg/m3	1.1E-04	1/(µg/m3)	5.5E-10	2.0E-09	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	4.7E-10	mg/m3	1.1E-04	1/(µg/m3)	5.2E-11	1.9E-10	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	3.2E-08	mg/m3	1.1E-05	1/(µg/m3)	3.5E-10	1.3E-08	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	8.5E-11	mg/m3	1.2E-03	1/(µg/m3)	1.0E-10	3.4E-11	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	2.3E-10	mg/m3	1.1E-04	1/(µg/m3)	2.5E-11	9.3E-11	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	7.0E-10	mg/m3	4.3E-03	1/(µg/m3)	3.0E-09	2.0E-09	mg/m3	1.5E-05	mg/m3	1.4E-04
				Cobalt	30.3	mg/kg	7.3E-09	mg/m3	9.0E-03	1/(µg/m3)	6.6E-08	2.1E-08	mg/m3	6.0E-06	mg/m3	3.6E-03
				Mercury	0.202	mg/kg	1.5E-08	mg/m3	NA	--	--	4.3E-08	mg/m3	3.0E-04	mg/m3	1.4E-04
				Thallium	0.650	mg/kg	1.6E-10	mg/m3	NA	--	--	4.6E-10	mg/m3	NA	--	--
				Vanadium	267	mg/kg	6.5E-08	mg/m3	NA	--	--	1.9E-07	mg/m3	1.0E-04	mg/m3	1.9E-03
			Inhalation Total								7.2E-08					5.7E-03
		Exposure Point Total									7.2E-08					5.7E-03
	Exposure Medium Total										7.2E-08					5.7E-03
Soil Total											7.1E-06					**1.3E+01**
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00052	mg/L	4.9E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	7.3E-06	1.4E-05	mg/kg-day	3.0E-04	mg/kg-day	4.7E-02
				Cobalt	0.0380	mg/L	3.6E-04	mg/kg-day	NA	--	--	1.0E-03	mg/kg-day	3.0E-04	mg/kg-day	**3.5E+00**
				Vanadium	0.0157	mg/L	1.5E-04	mg/kg-day	NA	--	--	4.3E-04	mg/kg-day	7.0E-05	mg/kg-day	**6.1E+00**
			Ingestion Total								7.3E-06					**9.7E+00**
			Dermal													
				Arsenic	0.00052	mg/L	1.5E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.3E-08	4.5E-08	mg/kg-day	3.0E-04	mg/kg-day	1.5E-04
				Cobalt	0.0380	mg/L	1.4E-06	mg/kg-day	NA	--	--	4.0E-06	mg/kg-day	3.0E-04	mg/kg-day	1.3E-02
				Vanadium	0.0157	mg/L	6.3E-07	mg/kg-day	NA	--	--	1.8E-06	mg/kg-day	1.8E-06	mg/kg-day	**1.0E+00**
			Dermal Total								2.3E-08					**1.0E+00**
		Exposure Point Total									7.3E-06					**1.1E+01**
	Exposure Medium Total										7.3E-06					**1.1E+01**
Groundwater Total											7.3E-06					**1.1E+01**

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 Value	EPC Units	Cancer Risk Calculations: Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	CSF / Unit Risk Value	CSF / Unit Risk Units	Cancer Risk	Non-Cancer Hazard Calculations: Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	RfD / RfC Value	RfD / RfC Units	Quotient
Surface Water	Surface Water	Surface Water	Ingestion													
				Arsenic	0.00320	mg/kg	2.2E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.3E-07	6.5E-07	mg/kg-day	3.0E-04	mg/kg-day	2.2E-03
				Cobalt	0.00310	mg/kg	2.2E-07	mg/kg-day	NA	--	--	6.3E-07	mg/kg-day	3.0E-04	mg/kg-day	2.1E-03
				Lead	0.0160	mg/kg	1.1E-06	mg/kg-day	NA	--	--	3.3E-06	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	1.5E-06	mg/kg-day	NA	--	--	4.5E-06	mg/kg-day	7.0E-05	mg/kg-day	6.4E-02
			Ingestion Total								3.3E-07					6.8E-02
			Dermal													
				Arsenic	0.00320	mg/kg	1.5E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.3E-08	4.5E-08	mg/kg-day	3.0E-04	mg/kg-day	1.5E-04
				Cobalt	0.00310	mg/kg	1.8E-08	mg/kg-day	NA	--	--	5.3E-08	mg/kg-day	3.0E-04	mg/kg-day	1.8E-04
				Lead	0.0160	mg/kg	1.4E-08	mg/kg-day	NA	--	--	4.1E-08	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	1.4E-07	mg/kg-day	NA	--	--	4.2E-07	mg/kg-day	1.8E-06	mg/kg-day	2.3E-01
			Dermal Total								2.3E-08					2.3E-01
		Exposure Point Total									3.6E-07					3.0E-01
	Exposure Medium Total										3.6E-07					3.0E-01
Surface Water Total											3.6E-07					3.0E-01

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 Value	EPC Units	Cancer Intake/Exposure Concentration Value	Cancer Intake/Exposure Concentration Units	CSF / Unit Risk Value	CSF / Unit Risk Units	Cancer Risk	Non-Cancer Intake/Exposure Concentration Value	Non-Cancer Intake/Exposure Concentration Units	RfD / RfC Value	RfD / RfC Units	Quotient
Sediment	Sediment	Sediment	Ingestion													
				Iodomethane	0.0360	mg/kg	2.5E-09	mg/kg-day	NA	--	--	7.3E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	6.5E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.7E-07	5.5E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	7.2E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.2E-06	6.1E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	1.8E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.3E-07	1.6E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	1.5E-06	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.1E-07	1.3E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	9.8E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	7.2E-09	8.3E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	1.2E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	9.1E-07	1.1E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	2.6E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.9E-07	2.2E-08	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	4.5E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	6.8E-07	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	4.4E-03
				Cobalt	54.7	mg/kg	3.8E-06	mg/kg-day	NA	--	--	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	3.7E-02
				Vanadium	208	mg/kg	1.5E-05	mg/kg-day	NA	--	--	4.2E-05	mg/kg-day	7.0E-05	mg/kg-day	6.0E-01
			Ingestion Total								7.8E-06					6.5E-01
			Dermal													
				Iodomethane	0.0360	mg/kg	4.3E-08	mg/kg-day	NA	--	--	1.3E-07	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	4.8E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.5E-07	1.2E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	5.3E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.9E-06	1.4E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	1.4E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.0E-07	3.5E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	1.1E-06	mg/kg-day	7.3E-02	1/(mg/kg-day)	8.2E-08	2.9E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	7.3E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	5.3E-09	1.9E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	9.2E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	6.7E-07	2.4E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	2.0E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.4E-07	5.0E-08	mg/kg-day	NA	--	--
				Arsenic	6.48	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
				Cobalt	54.7	mg/kg	6.5E-07	mg/kg-day	NA	--	--	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.3E-03
				Vanadium	208	mg/kg	2.5E-06	mg/kg-day	NA	--	--	7.2E-06	mg/kg-day	1.8E-06	mg/kg-day	**4.0E+00**
			Dermal Total								5.6E-06					**4.0E+00**
		Exposure Point Total									1.3E-05					**4.6E+00**
	Exposure Medium Total										1.3E-05					**4.6E+00**
Sediment Total											1.3E-05					**4.6E+00**
										Total of Receptor Risks Across All Media	2.8E-05	Total of Receptor Hazards Across All Media				**2.9E+01**

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 Value	EPC Units	Cancer Intake/Exposure Concentration Value	Cancer Intake/Exposure Concentration Units	CSF / Unit Risk Value	CSF / Unit Risk Units	Cancer Risk	Non-Cancer Intake/Exposure Concentration Value	Non-Cancer Intake/Exposure Concentration Units	RfD / RfC Value	RfD / RfC Units	Hazard Quotient
Soil	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	2.0E-09	mg/kg-day	NA	--	--	2.4E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	1.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.6E-08	1.2E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	2.8E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.1E-06	2.6E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	6.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.6E-07	5.6E-07	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	1.2E-07	mg/kg-day	7.3E-02	1/(mg/kg-day)	8.9E-09	1.1E-07	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	5.1E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	3.7E-09	4.6E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	4.1E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.0E-07	3.7E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	1.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.6E-08	9.6E-08	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	3.2E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.7E-06	3.7E-05	mg/kg-day	3.0E-04	mg/kg-day	1.2E-01
				Cobalt	30.3	mg/kg	3.3E-05	mg/kg-day	NA	--	--	3.9E-04	mg/kg-day	3.0E-04	mg/kg-day	**1.3E+00**
				Mercury	0.202	mg/kg	2.2E-07	mg/kg-day	NA	--	--	2.6E-06	mg/kg-day	1.6E-04	mg/kg-day	1.6E-02
				Thallium	0.650	mg/kg	7.1E-07	mg/kg-day	NA	--	--	8.3E-06	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	2.9E-04	mg/kg-day	NA	--	--	3.4E-03	mg/kg-day	7.0E-05	mg/kg-day	**4.9E+01**
			Ingestion Total								7.8E-06					**5.0E+01**
			Dermal													
				Iodomethane	0.00185	mg/kg	5.7E-09	mg/kg-day	NA	--	--	6.6E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	4.8E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.5E-08	4.3E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	1.0E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	7.6E-07	9.3E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	2.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.7E-07	2.0E-07	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	4.5E-08	mg/kg-day	7.3E-02	1/(mg/kg-day)	3.3E-09	4.0E-08	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.9E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.4E-09	1.7E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.5E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.1E-07	1.3E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	3.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.8E-08	3.5E-08	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	2.7E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.0E-07	3.1E-06	mg/kg-day	3.0E-04	mg/kg-day	1.0E-02
				Cobalt	30.3	mg/kg	9.3E-07	mg/kg-day	NA	--	--	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	3.6E-02
				Mercury	0.202	mg/kg	6.2E-09	mg/kg-day	NA	--	--	7.2E-08	mg/kg-day	1.1E-05	mg/kg-day	6.5E-03
				Thallium	0.650	mg/kg	2.0E-08	mg/kg-day	NA	--	--	2.3E-07	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	8.2E-06	mg/kg-day	NA	--	--	9.6E-05	mg/kg-day	1.8E-06	mg/kg-day	**5.3E+01**
			Dermal Total								1.5E-06					**5.3E+01**
		Exposure Point Total									9.3E-06					**1.0E+02**
	Exposure Medium Total										9.3E-06					**1.0E+02**

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	1.1E-13	mg/m3	NA	--	--	1.3E-12	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	5.5E-10	mg/m3	1.1E-04	1/(µg/m3)	6.0E-11	4.9E-10	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	6.2E-10	mg/m3	1.1E-03	1/(µg/m3)	6.8E-10	5.6E-10	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	2.3E-09	mg/m3	1.1E-04	1/(µg/m3)	2.5E-10	2.0E-09	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	2.1E-10	mg/m3	1.1E-04	1/(µg/m3)	2.3E-11	1.9E-10	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	1.4E-08	mg/m3	1.1E-05	1/(µg/m3)	1.6E-10	1.3E-08	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	3.8E-11	mg/m3	1.2E-03	1/(µg/m3)	4.6E-11	3.4E-11	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	1.0E-10	mg/m3	1.1E-04	1/(µg/m3)	1.1E-11	9.3E-11	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	1.7E-10	mg/m3	4.3E-03	1/(µg/m3)	7.5E-10	2.0E-09	mg/m3	1.5E-05	mg/m3	1.4E-04
				Cobalt	30.3	mg/kg	1.8E-09	mg/m3	9.0E-03	1/(µg/m3)	1.6E-08	2.1E-08	mg/m3	6.0E-06	mg/m3	3.6E-03
				Mercury	0.202	mg/kg	3.7E-09	mg/m3	NA	--	--	4.3E-08	mg/m3	3.0E-04	mg/m3	1.4E-04
				Thallium	0.650	mg/kg	3.9E-11	mg/m3	NA	--	--	4.6E-10	mg/m3	NA	--	--
				Vanadium	267	mg/kg	1.6E-08	mg/m3	NA	--	--	1.9E-07	mg/m3	1.0E-04	mg/m3	1.9E-03
			Inhalation Total								1.8E-08					5.7E-03
		Exposure Point Total									1.8E-08					5.7E-03
	Exposure Medium Total										1.8E-08					5.7E-03
Soil Total											9.3E-06					**1.0E+02**
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00052	mg/L	2.8E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.3E-06	3.3E-05	mg/kg-day	3.0E-04	mg/kg-day	1.1E-01
				Cobalt	0.0380	mg/L	2.1E-04	mg/kg-day	NA	--	--	2.4E-03	mg/kg-day	3.0E-04	mg/kg-day	**8.1E+00**
				Vanadium	0.0157	mg/L	8.6E-05	mg/kg-day	NA	--	--	1.0E-03	mg/kg-day	7.0E-05	mg/kg-day	**1.4E+01**
			Ingestion Total								4.3E-06					**2.3E+01**
			Dermal													
				Arsenic	0.00052	mg/L	1.1E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.7E-08	1.3E-07	mg/kg-day	3.0E-04	mg/kg-day	4.4E-04
				Cobalt	0.0380	mg/L	1.0E-06	mg/kg-day	NA	--	--	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	4.0E-02
				Vanadium	0.0157	mg/L	4.7E-07	mg/kg-day	NA	--	--	5.4E-06	mg/kg-day	1.8E-06	mg/kg-day	**3.0E+00**
			Dermal Total								1.7E-08					**3.0E+00**
		Exposure Point Total									4.3E-06					**2.6E+01**
	Exposure Medium Total										4.3E-06					**2.6E+01**
Groundwater Total											4.3E-06					**2.6E+01**

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 Value	EPC Units	Cancer Intake/Exposure Concentration Value	Cancer Intake/Exposure Concentration Units	CSF / Unit Risk Value	CSF / Unit Risk Units	Cancer Risk	Non-Cancer Intake/Exposure Concentration Value	Non-Cancer Intake/Exposure Concentration Units	RfD / RfC Value	RfD / RfC Units	Quotient
Surface Water	Surface Water	Surface Water	Ingestion													
				Arsenic	0.00320	mg/kg	2.6E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.9E-07	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	1.0E-02
				Cobalt	0.00310	mg/kg	2.5E-07	mg/kg-day	NA	--	--	2.9E-06	mg/kg-day	3.0E-04	mg/kg-day	9.8E-03
				Lead	0.0160	mg/kg	1.3E-06	mg/kg-day	NA	--	--	1.5E-05	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	1.8E-06	mg/kg-day	NA	--	--	2.1E-05	mg/kg-day	7.0E-05	mg/kg-day	3.0E-01
			Ingestion Total								3.9E-07					3.2E-01
			Dermal													
				Arsenic	0.00320	mg/kg	8.8E-09	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.3E-08	1.0E-07	mg/kg-day	3.0E-04	mg/kg-day	3.4E-04
				Cobalt	0.00310	mg/kg	1.0E-08	mg/kg-day	NA	--	--	1.2E-07	mg/kg-day	3.0E-04	mg/kg-day	4.1E-04
				Lead	0.0160	mg/kg	8.0E-09	mg/kg-day	NA	--	--	9.4E-08	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	8.2E-08	mg/kg-day	NA	--	--	9.6E-07	mg/kg-day	1.8E-06	mg/kg-day	5.3E-01
			Dermal Total								1.3E-08					5.3E-01
		Exposure Point Total									4.0E-07					8.5E-01
	Exposure Medium Total										4.0E-07					8.5E-01
Surface Water Total											4.0E-07					8.5E-01

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
Sediment	Sediment	Sediment	Ingestion													
				Iodomethane	0.0360	mg/kg	5.9E-09	mg/kg-day	NA	--	--	6.8E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	5.7E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	4.2E-07	5.1E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	6.3E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.6E-06	5.7E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	1.6E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.2E-07	1.5E-07	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	1.3E-06	mg/kg-day	7.3E-02	1/(mg/kg-day)	9.7E-08	1.2E-06	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	8.7E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	6.3E-09	7.8E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	1.1E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	8.0E-07	9.9E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	2.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.7E-07	2.1E-07	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	1.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.6E-06	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	4.1E-02
				Cobalt	54.7	mg/kg	8.9E-06	mg/kg-day	NA	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	3.5E-01
				Vanadium	208	mg/kg	3.4E-05	mg/kg-day	NA	--	--	4.0E-04	mg/kg-day	7.0E-05	mg/kg-day	**5.6E+00**
			Ingestion Total								7.8E-06					**6.0E+00**
			Dermal													
				Iodomethane	0.0360	mg/kg	2.5E-08	mg/kg-day	NA	--	--	2.9E-07	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	3.1E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.3E-07	2.8E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	3.5E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.5E-06	3.1E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	8.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	6.5E-08	8.0E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	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	0.410	mg/kg	4.7E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	3.5E-09	4.3E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	6.0E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.4E-07	5.4E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	1.3E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.3E-08	1.1E-07	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	1.3E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.0E-07	1.6E-06	mg/kg-day	3.0E-04	mg/kg-day	5.2E-03
				Cobalt	54.7	mg/kg	3.7E-07	mg/kg-day	NA	--	--	4.4E-06	mg/kg-day	3.0E-04	mg/kg-day	1.5E-02
				Vanadium	208	mg/kg	1.4E-06	mg/kg-day	NA	--	--	1.7E-05	mg/kg-day	1.8E-06	mg/kg-day	**9.1E+00**
			Dermal Total								3.6E-06					**9.1E+00**
		Exposure Point Total									1.1E-05					**1.5E+01**
	Exposure Medium Total										1.1E-05					**1.5E+01**
Sediment Total											1.1E-05					**1.5E+01**
										Total of Receptor Risks Across All Media	2.5E-05				Total of Receptor Hazards Across All Media	**1.4E+02**

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	6.5E-10	mg/kg-day	NA	--	--	1.8E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	3.2E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.3E-09	9.0E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	7.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.1E-08	2.0E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.5E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-08	4.3E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	3.0E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.2E-10	8.4E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.3E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	9.2E-11	3.5E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	7.4E-09	2.8E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	2.6E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.9E-09	7.3E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.0E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.5E-06	2.8E-06	mg/kg-day	3.0E-04	mg/kg-day	9.4E-03
				Cobalt	30.3	mg/kg	1.1E-05	mg/kg-day	NA	--	--	3.0E-05	mg/kg-day	3.0E-04	mg/kg-day	9.9E-02
				Mercury	0.202	mg/kg	7.1E-08	mg/kg-day	NA	--	--	2.0E-07	mg/kg-day	1.6E-04	mg/kg-day	1.2E-03
				Thallium	0.650	mg/kg	2.3E-07	mg/kg-day	NA	--	--	6.4E-07	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	9.3E-05	mg/kg-day	NA	--	--	2.6E-04	mg/kg-day	7.0E-05	mg/kg-day	**3.7E+00**
			Ingestion Total								1.6E-06					**3.8E+00**
			Dermal													
				Iodomethane	0.00185	mg/kg	4.3E-09	mg/kg-day	NA	--	--	1.2E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	2.8E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-09	7.7E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	6.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.4E-08	1.7E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.3E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.6E-09	3.7E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	2.6E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.9E-10	7.2E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.1E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	7.9E-11	3.0E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	8.7E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	6.3E-09	2.4E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	2.2E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.6E-09	6.3E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	2.0E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.0E-07	5.6E-07	mg/kg-day	3.0E-04	mg/kg-day	1.9E-03
				Cobalt	30.3	mg/kg	7.0E-07	mg/kg-day	NA	--	--	2.0E-06	mg/kg-day	3.0E-04	mg/kg-day	6.5E-03
				Mercury	0.202	mg/kg	4.7E-09	mg/kg-day	NA	--	--	1.3E-08	mg/kg-day	1.1E-05	mg/kg-day	1.2E-03
				Thallium	0.650	mg/kg	1.5E-08	mg/kg-day	NA	--	--	4.2E-08	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	6.2E-06	mg/kg-day	NA	--	--	1.7E-05	mg/kg-day	1.8E-06	mg/kg-day	**9.6E+00**
			Dermal Total								3.6E-07					**9.6E+00**
		Exposure Point Total									1.9E-06					**1.3E+01**
	Exposure Medium Total										1.9E-06					**1.3E+01**

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	1.1E-13	mg/m3	NA	--	--	3.1E-13	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	4.2E-11	mg/m3	1.1E-04	1/(µg/m3)	4.6E-12	1.2E-10	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	4.7E-11	mg/m3	1.1E-03	1/(µg/m3)	5.2E-11	1.3E-10	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.7E-10	mg/m3	1.1E-04	1/(µg/m3)	1.9E-11	4.8E-10	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	1.6E-11	mg/m3	1.1E-04	1/(µg/m3)	1.8E-12	4.5E-11	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	1.1E-09	mg/m3	1.1E-05	1/(µg/m3)	1.2E-11	3.0E-09	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	2.9E-12	mg/m3	1.2E-03	1/(µg/m3)	3.5E-12	8.1E-12	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	7.9E-12	mg/m3	1.1E-04	1/(µg/m3)	8.7E-13	2.2E-11	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	1.7E-10	mg/m3	4.3E-03	1/(µg/m3)	7.4E-10	4.8E-10	mg/m3	1.5E-05	mg/m3	3.2E-05
				Cobalt	30.3	mg/kg	1.8E-09	mg/m3	9.0E-03	1/(µg/m3)	1.6E-08	5.1E-09	mg/m3	6.0E-06	mg/m3	8.5E-04
				Mercury	0.202	mg/kg	3.7E-09	mg/m3	NA	--	--	1.0E-08	mg/m3	3.0E-04	mg/m3	3.4E-05
				Thallium	0.650	mg/kg	3.9E-11	mg/m3	NA	--	--	1.1E-10	mg/m3	NA	--	--
				Vanadium	267	mg/kg	1.6E-08	mg/m3	NA	--	--	4.5E-08	mg/m3	1.0E-04	mg/m3	4.5E-04
			Inhalation Total								1.7E-08					1.4E-03
		Exposure Point Total									1.7E-08					1.4E-03
	Exposure Medium Total										1.7E-08					1.4E-03
Soil Total											2.0E-06					**1.3E+01**
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00052	mg/L	1.8E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.7E-06	5.1E-06	mg/kg-day	3.0E-04	mg/kg-day	1.7E-02
				Cobalt	0.0380	mg/L	1.3E-04	mg/kg-day	NA	--	--	3.7E-04	mg/kg-day	3.0E-04	mg/kg-day	**1.2E+00**
				Vanadium	0.0157	mg/L	5.5E-05	mg/kg-day	NA	--	--	1.5E-04	mg/kg-day	7.0E-05	mg/kg-day	**2.2E+00**
			Ingestion Total								2.7E-06					**3.5E+00**
		Exposure Point Total									2.7E-06					**3.5E+00**
	Exposure Medium Total										2.7E-06					**3.5E+00**
Groundwater Total											2.7E-06					**3.5E+00**
										Total of Receptor Risks Across All Media	4.7E-06				Total of Receptor Hazards Across All Media	**1.7E+01**

TABLE 7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 Value	EPC Units	Cancer Intake/Exposure Concentration Value	Cancer Intake/Exposure Concentration Units	CSF / Unit Risk Value	CSF / Unit Risk Units	Cancer Risk	Non-Cancer Intake/Exposure Concentration Value	Non-Cancer Intake/Exposure Concentration Units	RfD / RfC Value	RfD / RfC Units	Quotient
Soil	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	8.5E-11	mg/kg-day	NA	--	--	6.0E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	4.2E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.1E-10	3.0E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	9.2E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	6.7E-09	6.5E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	2.0E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.5E-09	1.4E-07	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	4.0E-10	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.9E-11	2.8E-08	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.7E-09	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.2E-11	1.2E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.3E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	9.8E-10	9.4E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	3.5E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.5E-10	2.4E-08	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.3E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	2.0E-07	9.3E-06	mg/kg-day	3.0E-04	mg/kg-day	3.1E-02
				Cobalt	30.3	mg/kg	1.4E-06	mg/kg-day	NA	--	--	9.8E-05	mg/kg-day	3.0E-04	mg/kg-day	3.3E-01
				Mercury	0.202	mg/kg	9.3E-09	mg/kg-day	NA	--	--	6.5E-07	mg/kg-day	1.6E-04	mg/kg-day	4.1E-03
				Thallium	0.650	mg/kg	3.0E-08	mg/kg-day	NA	--	--	2.1E-06	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	1.2E-05	mg/kg-day	NA	--	--	8.6E-04	mg/kg-day	7.0E-05	mg/kg-day	**1.2E+01**
			Ingestion Total								2.1E-07					**1.3E+01**
			Dermal													
				Iodomethane	0.00185	mg/kg	2.6E-10	mg/kg-day	NA	--	--	1.8E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	1.7E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.2E-10	1.2E-08	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	3.6E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	2.6E-09	2.5E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	7.9E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	5.8E-10	5.5E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	1.5E-10	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.1E-11	1.1E-08	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	6.5E-10	mg/kg-day	7.3E-03	1/(mg/kg-day)	4.7E-12	4.5E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	5.2E-11	mg/kg-day	7.3E+00	1/(mg/kg-day)	3.8E-10	3.7E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	1.3E-10	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.8E-11	9.4E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.2E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.8E-08	8.4E-07	mg/kg-day	3.0E-04	mg/kg-day	2.8E-03
				Cobalt	30.3	mg/kg	4.2E-08	mg/kg-day	NA	--	--	2.9E-06	mg/kg-day	3.0E-04	mg/kg-day	9.8E-03
				Mercury	0.202	mg/kg	2.8E-10	mg/kg-day	NA	--	--	2.0E-08	mg/kg-day	1.1E-05	mg/kg-day	1.7E-03
				Thallium	0.650	mg/kg	9.0E-10	mg/kg-day	NA	--	--	6.3E-08	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	3.7E-07	mg/kg-day	NA	--	--	2.6E-05	mg/kg-day	1.8E-06	mg/kg-day	**1.4E+01**
			Dermal Total								2.2E-08					**1.4E+01**
		Exposure Point Total									2.3E-07					**2.7E+01**
	Exposure Medium Total										2.3E-07					**2.7E+01**

TABLE 7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARD
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	1.1E-12	mg/m3	NA	--	--	7.6E-11	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	7.0E-12	mg/m3	1.1E-04	1/(µg/m3)	7.7E-13	4.9E-10	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	1.4E-11	mg/m3	1.1E-03	1/(µg/m3)	1.5E-11	9.5E-10	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	3.2E-11	mg/m3	1.1E-04	1/(µg/m3)	3.6E-12	2.3E-09	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	5.6E-12	mg/m3	1.1E-04	1/(µg/m3)	6.2E-13	3.9E-10	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	6.4E-11	mg/m3	1.1E-05	1/(µg/m3)	7.0E-13	4.5E-09	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.8E-12	mg/m3	1.2E-03	1/(µg/m3)	2.2E-12	1.3E-10	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	4.7E-12	mg/m3	1.1E-04	1/(µg/m3)	5.1E-13	3.3E-10	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	1.7E-09	mg/m3	4.3E-03	1/(µg/m3)	7.2E-09	1.2E-07	mg/m3	1.5E-05	mg/m3	7.8E-03
				Cobalt	30.3	mg/kg	1.8E-08	mg/m3	9.0E-03	1/(µg/m3)	1.6E-07	1.2E-06	mg/m3	6.0E-06	mg/m3	2.1E-01
				Mercury	0.202	mg/kg	2.6E-10	mg/m3	NA	--	--	1.8E-08	mg/m3	3.0E-04	mg/m3	6.2E-05
				Thallium	0.650	mg/kg	3.8E-10	mg/m3	NA	--	--	2.7E-08	mg/m3	NA	--	--
				Vanadium	267	mg/kg	1.6E-07	mg/m3	NA	--	--	1.1E-05	mg/m3	1.0E-04	mg/m3	1.1E-01
			Inhalation Total								1.7E-07					3.2E-01
		Exposure Point Total									1.7E-07					3.2E-01
	Exposure Medium Total										1.7E-07					3.2E-01
Soil Total											4.0E-07					**2.7E+01**
Groundwater	Groundwater	Tap	Ingestion													
				Arsenic	0.00052	mg/L	2.9E-10	mg/kg-day	1.5E+00	1/(mg/kg-day)	4.4E-10	2.0E-08	mg/kg-day	3.0E-04	mg/kg-day	6.8E-05
				Cobalt	0.0380	mg/L	2.1E-08	mg/kg-day	NA	--	--	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	5.0E-03
				Vanadium	0.0157	mg/L	8.8E-09	mg/kg-day	NA	--	--	6.1E-07	mg/kg-day	7.0E-05	mg/kg-day	8.8E-03
			Ingestion Total								4.4E-10					1.4E-02
			Dermal													
				Arsenic	0.00052	mg/L	5.8E-11	mg/kg-day	1.5E+00	1/(mg/kg-day)	8.7E-11	4.0E-09	mg/kg-day	3.0E-04	mg/kg-day	1.3E-05
				Cobalt	0.0380	mg/L	5.2E-09	mg/kg-day	NA	--	--	3.6E-07	mg/kg-day	3.0E-04	mg/kg-day	1.2E-03
				Vanadium	0.0157	mg/L	2.4E-09	mg/kg-day	NA	--	--	1.7E-07	mg/kg-day	1.8E-06	mg/kg-day	9.2E-02
			Dermal Total								8.7E-11					9.3E-02
		Exposure Point Total									5.2E-10					1.1E-01
	Exposure Medium Total										5.2E-10					1.1E-01
Groundwater Total											5.2E-10					1.1E-01
										Total of Receptor Risks Across All Media	4.0E-07	Total of Receptor Hazards Across All Media				**2.7E+01**

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Ingestion													
				Iodomethane	0.00185	mg/kg	6.5E-10	mg/kg-day	NA	--	--	1.8E-09	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	3.2E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.3E-09	9.0E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	7.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	5.1E-08	2.0E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.5E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.1E-08	4.3E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	3.0E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.2E-10	8.4E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.3E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	9.2E-11	3.5E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	1.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	7.4E-09	2.8E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	2.6E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.9E-09	7.3E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	1.0E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.5E-06	2.8E-06	mg/kg-day	3.0E-04	mg/kg-day	9.4E-03
				Cobalt	30.3	mg/kg	1.1E-05	mg/kg-day	NA	--	--	3.0E-05	mg/kg-day	3.0E-04	mg/kg-day	9.9E-02
				Mercury	0.202	mg/kg	7.1E-08	mg/kg-day	NA	--	--	2.0E-07	mg/kg-day	1.6E-04	mg/kg-day	1.2E-03
				Thallium	0.650	mg/kg	2.3E-07	mg/kg-day	NA	--	--	6.4E-07	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	9.3E-05	mg/kg-day	NA	--	--	2.6E-04	mg/kg-day	7.0E-05	mg/kg-day	**3.7E+00**
			Ingestion Total								1.6E-06					**3.8E+00**
			Dermal													
				Iodomethane	0.00185	mg/kg	4.3E-09	mg/kg-day	NA	--	--	1.2E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	2.8E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-09	7.7E-09	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	6.0E-09	mg/kg-day	7.3E+00	1/(mg/kg-day)	4.4E-08	1.7E-08	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.3E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	9.6E-09	3.7E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	2.6E-09	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.9E-10	7.2E-09	mg/kg-day	NA	--	--
				Chrysene	0.0360	mg/kg	1.1E-08	mg/kg-day	7.3E-03	1/(mg/kg-day)	7.9E-11	3.0E-08	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	8.7E-10	mg/kg-day	7.3E+00	1/(mg/kg-day)	6.3E-09	2.4E-09	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	2.2E-09	mg/kg-day	7.3E-01	1/(mg/kg-day)	1.6E-09	6.3E-09	mg/kg-day	NA	--	--
				Arsenic	2.88	mg/kg	2.0E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.0E-07	5.6E-07	mg/kg-day	3.0E-04	mg/kg-day	1.9E-03
				Cobalt	30.3	mg/kg	7.0E-07	mg/kg-day	NA	--	--	2.0E-06	mg/kg-day	3.0E-04	mg/kg-day	6.5E-03
				Mercury	0.202	mg/kg	4.7E-09	mg/kg-day	NA	--	--	1.3E-08	mg/kg-day	1.1E-05	mg/kg-day	1.2E-03
				Thallium	0.650	mg/kg	1.5E-08	mg/kg-day	NA	--	--	4.2E-08	mg/kg-day	NA	--	--
				Vanadium	267	mg/kg	6.2E-06	mg/kg-day	NA	--	--	1.7E-05	mg/kg-day	1.8E-06	mg/kg-day	**9.6E+00**
			Dermal Total								3.6E-07					**9.6E+00**
		Exposure Point Total									1.9E-06					**1.3E+01**
	Exposure Medium Total										1.9E-06					**1.3E+01**

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	
	Air	Fugative Dust	Inhalation													
				Iodomethane	0.00185	mg/kg	1.1E-13	mg/m3	NA	--	--	3.1E-13	mg/m3	NA	--	--
				Benzo[a]anthracene	0.00920	mg/kg	4.2E-11	mg/m3	1.1E-04	1/(μg/m3)	4.6E-12	1.2E-10	mg/m3	NA	--	--
				Benzo[a]pyrene	0.020	mg/kg	4.7E-11	mg/m3	1.1E-03	1/(μg/m3)	5.2E-11	1.3E-10	mg/m3	NA	--	--
				Benzo[b]fluoranthene	0.0440	mg/kg	1.7E-10	mg/m3	1.1E-04	1/(μg/m3)	1.9E-11	4.8E-10	mg/m3	NA	--	--
				Benzo[k]fluoranthene	0.00860	mg/kg	1.6E-11	mg/m3	1.1E-04	1/(μg/m3)	1.8E-12	4.5E-11	mg/m3	NA	--	--
				Chrysene	0.0360	mg/kg	1.1E-09	mg/m3	1.1E-05	1/(μg/m3)	1.2E-11	3.0E-09	mg/m3	NA	--	--
				Dibenz(a,h)anthracene	0.00290	mg/kg	2.9E-12	mg/m3	1.2E-03	1/(μg/m3)	3.5E-12	8.1E-12	mg/m3	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.00750	mg/kg	7.9E-12	mg/m3	1.1E-04	1/(μg/m3)	8.7E-13	2.2E-11	mg/m3	NA	--	--
				Arsenic	2.88	mg/kg	1.7E-10	mg/m3	4.3E-03	1/(μg/m3)	7.4E-10	4.8E-10	mg/m3	1.5E-05	mg/m3	3.2E-05
				Cobalt	30.3	mg/kg	1.8E-09	mg/m3	9.0E-03	1/(μg/m3)	1.6E-08	5.1E-09	mg/m3	6.0E-06	mg/m3	8.5E-04
				Mercury	0.202	mg/kg	3.7E-09	mg/m3	NA	--	--	1.0E-08	mg/m3	3.0E-04	mg/m3	3.4E-05
				Thallium	0.650	mg/kg	3.9E-11	mg/m3	NA	--	--	1.1E-10	mg/m3	NA	--	--
				Vanadium	267	mg/kg	1.6E-08	mg/m3	NA	--	--	4.5E-08	mg/m3	NA	1.0E-04	--
			Inhalation Total								1.7E-08					9.1E-04
		Exposure Point Total									1.7E-08					9.1E-04
	Exposure Medium Total										1.7E-08					9.1E-04
Soil Total											2.0E-06					**1.3E+01**
Surface Water	Surface Water	Surface Water	Ingestion													
				Arsenic	0.00320	mg/kg	1.1E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.7E-06	3.1E-06	mg/kg-day	3.0E-04	mg/kg-day	1.0E-02
				Cobalt	0.00310	mg/kg	1.1E-06	mg/kg-day	NA	--	--	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	1.0E-02
				Lead	0.0160	mg/kg	5.6E-06	mg/kg-day	NA	--	--	1.6E-05	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	7.7E-06	mg/kg-day	NA	--	--	2.2E-05	mg/kg-day	7.0E-05	mg/kg-day	3.1E-01
			Ingestion Total								1.7E-06					3.3E-01
			Dermal													
				Arsenic	0.00320	mg/kg	7.4E-08	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.1E-07	2.1E-07	mg/kg-day	3.0E-04	mg/kg-day	6.9E-04
				Cobalt	0.00310	mg/kg	2.9E-08	mg/kg-day	NA	--	--	8.0E-08	mg/kg-day	3.0E-04	mg/kg-day	2.7E-04
				Lead	0.0160	mg/kg	3.7E-08	mg/kg-day	NA	--	--	1.0E-07	mg/kg-day	NA	--	--
				Vanadium	0.0220	mg/kg	5.1E-07	mg/kg-day	NA	--	--	1.4E-06	mg/kg-day	1.8E-06	mg/kg-day	7.9E-01
			Dermal Total								1.1E-07					7.9E-01
		Exposure Point Total									1.8E-06					**1.1E+00**
	Exposure Medium Total										1.8E-06					**1.1E+00**
Surface Water Total											1.8E-06					**1.1E+00**

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 Value	EPC Units	Cancer Risk Calculations: Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	CSF / Unit Risk Value	CSF / Unit Risk Units	Cancer Risk	Non-Cancer Hazard Calculations: Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	RfD / RfC Value	RfD / RfC Units	Quotient
Sediment	Sediment	Sediment	Ingestion													
				Iodomethane	0.0360	mg/kg	1.3E-08	mg/kg-day	NA	--	--	3.5E-08	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	9.4E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	6.9E-08	2.6E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	1.0E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	7.7E-07	2.9E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	2.7E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.0E-08	7.5E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	2.2E-07	mg/kg-day	7.3E-02	1/(mg/kg-day)	1.6E-08	6.2E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	1.4E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.0E-09	4.0E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	1.8E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.3E-07	5.1E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	3.8E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.8E-08	1.1E-07	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	2.3E-06	mg/kg-day	1.5E+00	1/(mg/kg-day)	3.4E-06	6.3E-06	mg/kg-day	3.0E-04	mg/kg-day	2.1E-02
				Cobalt	54.7	mg/kg	1.9E-05	mg/kg-day	NA	--	--	5.4E-05	mg/kg-day	3.0E-04	mg/kg-day	1.8E-01
				Vanadium	208	mg/kg	7.3E-05	mg/kg-day	NA	--	--	2.0E-04	mg/kg-day	7.0E-05	mg/kg-day	**2.9E+00**
			Ingestion Total								4.4E-06					**3.1E+00**
			Dermal													
				Iodomethane	0.0360	mg/kg	1.2E-07	mg/kg-day	NA	--	--	3.5E-07	mg/kg-day	NA	--	--
				Benzo[a]anthracene	0.270	mg/kg	1.2E-07	mg/kg-day	7.3E-01	1/(mg/kg-day)	8.9E-08	3.4E-07	mg/kg-day	NA	--	--
				Benzo[a]pyrene	0.30	mg/kg	1.3E-07	mg/kg-day	7.3E+00	1/(mg/kg-day)	9.8E-07	3.8E-07	mg/kg-day	NA	--	--
				Benzo[b]fluoranthene	0.0770	mg/kg	3.5E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	2.5E-08	9.7E-08	mg/kg-day	NA	--	--
				Benzo[k]fluoranthene	0.630	mg/kg	2.8E-07	mg/kg-day	7.3E-02	1/(mg/kg-day)	2.1E-08	7.9E-07	mg/kg-day	NA	--	--
				Chrysene	0.410	mg/kg	1.8E-07	mg/kg-day	7.3E-03	1/(mg/kg-day)	1.3E-09	5.2E-07	mg/kg-day	NA	--	--
				Dibenz(a,h)anthracene	0.0520	mg/kg	2.3E-08	mg/kg-day	7.3E+00	1/(mg/kg-day)	1.7E-07	6.5E-08	mg/kg-day	NA	--	--
				Indeno[1,2,3-cd]pyrene	0.110	mg/kg	4.9E-08	mg/kg-day	7.3E-01	1/(mg/kg-day)	3.6E-08	1.4E-07	mg/kg-day	NA	--	--
				Arsenic	6.48	mg/kg	6.7E-07	mg/kg-day	1.5E+00	1/(mg/kg-day)	1.0E-06	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.3E-03
				Cobalt	54.7	mg/kg	1.9E-06	mg/kg-day	NA	--	--	5.3E-06	mg/kg-day	3.0E-04	mg/kg-day	1.8E-02
				Vanadium	208	mg/kg	7.2E-06	mg/kg-day	NA	--	--	2.0E-05	mg/kg-day	1.8E-06	mg/kg-day	**1.1E+01**
			Dermal Total								2.3E-06					**1.1E+01**
		Exposure Point Total									6.8E-06					**1.4E+01**
	Exposure Medium Total										6.8E-06					**1.4E+01**
Sediment Total											6.8E-06					**1.4E+01**
Total of Receptor Risks Across All Media											1.1E-05	Total of Receptor Hazards Across All Media				**2.9E+01**

TABLE 8.1.RME
CALCULATION OF RADIATION CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	2.3E-09	--	2.0E-09	--	4.4E-09	NA	--	--	--	--
			Benzo[a]pyrene	5.1E-08	--	4.4E-08	--	9.5E-08	NA	--	--	--	--
			Benzo[b]fluoranthene	1.1E-08	--	9.6E-09	--	2.1E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	2.2E-10	--	1.9E-10	--	4.1E-10	NA	--	--	--	--
			Chrysene	9.2E-11	--	7.9E-11	--	1.7E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	7.4E-09	--	6.3E-09	--	1.4E-08	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.9E-09	--	1.6E-09	--	3.6E-09	NA	--	--	--	--
			Arsenic	1.5E-06	--	3.0E-07	--	1.8E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.11
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.73	--	9.58	**13.31**
			Chemical Total	1.6E-06	--	3.6E-07	--	1.9E-06		3.84	--	9.59	**13.43**
		Exposure Point Total						1.9E-06					**13.43**
	Exposure Medium Total							1.9E-06					**13.43**
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	4.6E-12	--	--	4.6E-12	NA	--	--	--	--
			Benzo[a]pyrene	--	5.2E-11	--	--	5.2E-11	NA	--	--	--	--
			Benzo[b]fluoranthene	--	1.9E-11	--	--	1.9E-11	NA	--	--	--	--
			Benzo[k]fluoranthene	--	1.8E-12	--	--	1.8E-12	NA	--	--	--	--
			Chrysene	--	1.2E-11	--	--	1.2E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	3.5E-12	--	--	3.5E-12	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	8.7E-13	--	--	8.7E-13	NA	--	--	--	--
			Arsenic	--	7.4E-10	--	--	7.4E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Soil Total								**1.96E-06**					**13.43**

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	2.7E-06	--	0.0E+00	--	2.7E-06	Skin / CVS	0.02	--	<0.01	0.02
			Cobalt	--	--	0.0E+00	--	0.0E+00	CVS	1.24	--	<0.01	**1.24**
			Vanadium	--	--	0.0E+00	--	0.0E+00	GIS / Kidney	2.19	--	<0.01	**2.19**
			Chemical Total	2.7E-06	--	--	--	2.7E-06		3.45	--	--	**3.45**
		Exposure Point Total						2.7E-06					**3.45**
	Exposure Medium Total							2.7E-06					**3.45**
Groundwater Total								**2.73E-06**					**3.45**
Industrial / Commercial Workers Total								**4.69E-06**					**16.88**

Total Risk Across Soil	2.0E-06
Total Risk Across Groundwater	2.7E-06
Total Risk Across All Media and All Exposure Routes	4.7E-06

Total Hazard Index Across Soil	**13.4**
Total Hazard Index Across Groundwater	**3.5**
Total Hazard Index Across All Media and All Exposure Routes	**16.9**

Notes:

Target Organ Abbreviations:

CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**15.5**	**15.5**
Cardiovascular System HI =		**1.4**	**1.4**
Skin HI =		0.03	0.03
Kidney HI =		**15.5**	**15.5**
Central Nervous System HI =	<0.01		<0.01
Respiratory System HI =	<0.01		<0.01

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	3.1E-10	--	1.2E-10	--	4.3E-10	NA	--	--	--	--
			Benzo[a]pyrene	6.7E-09	--	2.6E-09	--	9.4E-09	NA	--	--	--	--
			Benzo[b]fluoranthene	1.5E-09	--	5.8E-10	--	2.1E-09	NA	--	--	--	--
			Benzo[k]fluoranthene	2.9E-11	--	1.1E-11	--	4.0E-11	NA	--	--	--	--
			Chrysene	1.2E-11	--	4.7E-12	--	1.7E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	9.8E-10	--	3.8E-10	--	1.4E-09	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	2.5E-10	--	9.8E-11	--	3.5E-10	NA	--	--	--	--
			Arsenic	2.0E-07	--	1.8E-08	--	2.2E-07	Skin / CVS	0.03	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.33	--	<0.01	0.34
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	12.32	--	14.21	26.53
			Chemical Total	2.1E-07	--	2.2E-08	--	2.3E-07		12.68	--	14.23	26.90
		Exposure Point Total						2.3E-07					26.90
	Exposure Medium Total							2.3E-07					26.90
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	7.7E-13	--	--	7.7E-13	NA	--	--	--	--
			Benzo[a]pyrene	--	1.5E-11	--	--	1.5E-11	NA	--	--	--	--
			Benzo[b]fluoranthene	--	3.6E-12	--	--	3.6E-12	NA	--	--	--	--
			Benzo[k]fluoranthene	--	6.2E-13	--	--	6.2E-13	NA	--	--	--	--
			Chrysene	--	7.0E-13	--	--	7.0E-13	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	2.2E-12	--	--	2.2E-12	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	5.1E-13	--	--	5.1E-13	NA	--	--	--	--
			Arsenic	--	7.2E-09	--	--	7.2E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-07	--	--	1.6E-07	RsS	--	0.21	--	0.21
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	0.11	--	0.11
			Chemical Total	--	1.7E-07	--	--	1.7E-07		--	0.32	--	0.32
		Exposure Point Total						1.7E-07					0.32
	Exposure Medium Total							1.7E-07					0.32
Soil Total								**3.97E-07**					**27.23**

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	4.4E-10	--	8.7E-11	--	5.2E-10	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	<0.01	--	<0.01	<0.01
			Vanadium	--	--	--	--	--	GIS / Kidney	<0.01	--	0.09	0.10
			Chemical Total	4.4E-10	--	8.7E-11	--	5.2E-10		0.01	--	0.09	0.11
		Exposure Point Total						5.2E-10					0.11
	Exposure Medium Total							5.2E-10					0.11
Groundwater Total								**5.23E-10**					**0.11**
Construction Workers Total								**3.98E-07**					**27.33**

Notes:

Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

Total Risk Across Soil	4.0E-07
Total Risk Across Groundwater	5.2E-10
Total Risk Across All Media and All Exposure Routes	4.0E-07

Total Hazard Index Across Soil	**27.2**
Total Hazard Index Across Groundwater	0.11
Total Hazard Index Across All Media and All Exposure Routes	**27.3**

	Inhalation	Oral/Dermal	Total
Central Nervous System HI =	<0.01		<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**26.6**	**26.6**
Cardiovascular System HI =		0.38	0.38
Skin HI =		0.03	0.03
Kidney HI =		**26.6**	**26.6**
Respiratory System HI =	0.21		0.21

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	2.3E-09	--	2.0E-09	--	4.4E-09	NA	--	--	--	--
			Benzo[a]pyrene	5.1E-08	--	4.4E-08	--	9.5E-08	NA	--	--	--	--
			Benzo[b]fluoranthene	1.1E-08	--	9.6E-09	--	2.1E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	2.2E-10	--	1.9E-10	--	4.1E-10	NA	--	--	--	--
			Chrysene	9.2E-11	--	7.9E-11	--	1.7E-10	NA	--	--	--	--
			Dibenz(a,h)anthracene	7.4E-09	--	6.3E-09	--	1.4E-08	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	1.9E-09	--	1.6E-09	--	3.6E-09	NA	--	--	--	--
			Arsenic	1.5E-06	--	3.0E-07	--	1.8E-06	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.11
			Mercury	--	--	--	--	--	ImS	<0.01	--	<0.01	<0.01
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	3.73	--	9.58	**13.31**
			Chemical Total	1.6E-06	--	3.6E-07	--	1.9E-06		3.84	--	9.59	**13.43**
		Exposure Point Total						1.9E-06					**13.43**
	Exposure Medium Total							1.9E-06					**13.43**
	Air	Fugative Dust											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	--	4.6E-12	--	--	4.6E-12	NA	--	--	--	--
			Benzo[a]pyrene	--	5.2E-11	--	--	5.2E-11	NA	--	--	--	--
			Benzo[b]fluoranthene	--	1.9E-11	--	--	1.9E-11	NA	--	--	--	--
			Benzo[k]fluoranthene	--	1.8E-12	--	--	1.8E-12	NA	--	--	--	--
			Chrysene	--	1.2E-11	--	--	1.2E-11	NA	--	--	--	--
			Dibenz(a,h)anthracene	--	3.5E-12	--	--	3.5E-12	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	--	8.7E-13	--	--	8.7E-13	NA	--	--	--	--
			Arsenic	--	7.4E-10	--	--	7.4E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.6E-08	--	--	1.6E-08	RsS	--	<0.01	--	<0.01
			Mercury	--	--	--	--	--	CNS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Soil Total								**1.96E-06**					**13.43**

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
Surface Water	Surface Water	Surface Water											
			Arsenic	1.7E-06	--	1.1E-07	--	1.8E-06	Skin / CVS	0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.01	--	<0.01	0.01
			Lead	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.31	--	0.79	**1.10**
			Chemical Total	1.7E-06	--	1.1E-07	--	1.8E-06		0.33	--	0.79	**1.12**
		Exposure Point Total						1.8E-06					**1.12**
	Exposure Medium Total							1.8E-06					**1.12**
Surface Water Total								**1.79E-06**					**1.12**
Sediment	Sediment	Sediment											
			Iodomethane	--	--	--	--	--	NA	--	--	--	--
			Benzo[a]anthracene	6.9E-08	--	8.9E-08	--	1.6E-07	NA	--	--	--	--
			Benzo[a]pyrene	7.7E-07	--	9.8E-07	--	1.8E-06	NA	--	--	--	--
			Benzo[b]fluoranthene	2.0E-08	--	2.5E-08	--	4.5E-08	NA	--	--	--	--
			Benzo[k]fluoranthene	1.6E-08	--	2.1E-08	--	3.7E-08	NA	--	--	--	--
			Chrysene	1.0E-09	--	1.3E-09	--	2.4E-09	NA	--	--	--	--
			Dibenz(a,h)anthracene	1.3E-07	--	1.7E-07	--	3.0E-07	NA	--	--	--	--
			Indeno[1,2,3-cd]pyrene	2.8E-08	--	3.6E-08	--	6.4E-08	NA	--	--	--	--
			Arsenic	3.4E-06	--	1.0E-06	--	4.4E-06	Skin / CVS	0.02	--	<0.01	0.03
			Cobalt	--	--	--	--	--	CVS	0.18	--	0.02	0.20
			Vanadium	--	--	--	--	--	GIS / Kidney	2.91	--	11.19	**14.10**
			Chemical Total	4.4E-06	--	2.3E-06	--	6.8E-06		3.11	--	11.22	**14.32**
		Exposure Point Total						6.8E-06					**14.32**
	Exposure Medium Total							6.8E-06					**14.32**
Sediment Total								**6.76E-06**					**14.32**

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
On-Site Workers Total								**1.05E-05**					**28.87**

Total Risk Across Soil	2.0E-06	Total Hazard Index Across Soil	**13.4**
Total Risk Across Surface Water	1.8E-06	Total Hazard Index Across Surface Water	**1.1**
Total Risk Across Sediment	6.8E-06	Total Hazard Index Across Sediment	**14.3**
Total Risk Across All Media and All Exposure Routes	1.1E-05	Total Hazard Index Across All Media and All Exposure Routes	**28.9**

Notes:
Target Organ Abbreviations:
CNS = Central Nervous System
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**28.5**	**28.5**
Cardiovascular System HI =		0.36	0.36
Skin HI =		0.05	0.05
Kidney HI =		**28.5**	**28.5**
Liver HI =			ND
Central Nervous System HI =	<0.01		<0.01
Respiratory System HI =	<0.01		<0.01

TABLE 10.1.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Vanadium						GIS / Kidney	0.78	--	1.19	1.97
			Chemical Total							0.78	--	1.19	1.97
		Exposure Point Total											1.97
	Exposure Medium Total												1.97
Soil Total													**1.97**
Surface Water	Surface Water	Surface Water	Vanadium						GIS / Kidney	0.06	--	0.23	0.29
			Chemical Total							0.06	--	0.23	0.29
		Exposure Point Total											0.29
	Exposure Medium Total												0.29
Surface Water Total													**0.29**
Sediment	Sediment	Sediment	Vanadium						GIS / Kidney	0.60	--	3.98	4.58
			Chemical Total							0.60	--	3.98	4.58
		Exposure Point Total											4.58
	Exposure Medium Total												4.58
Sediment Total													**4.58**
Adult Trespassers Total													**6.84**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil	**2.0**
Total Hazard Index Across Surface Water	0.29
Total Hazard Index Across Sediment	**4.6**
Total Hazard Index Across All Media and All Exposure Routes	**6.8**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**6.8**	**6.8**
Kidney HI =		**6.8**	**6.8**

TABLE 10.2.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Vanadium						GIS / Kidney	1.21	--	2.97	4.18
			Chemical Total							1.21	--	2.97	4.18
		Exposure Point Total											4.18
	Exposure Medium Total												4.18
Soil Total													**4.18**
Surface Water	Surface Water	Surface Water	Vanadium						GIS / Kidney	0.10	--	0.20	0.30
			Chemical Total							0.10	--	0.20	0.30
		Exposure Point Total											0.30
	Exposure Medium Total												0.30
Surface Water Total													**0.30**
Sediment	Sediment	Sediment	Vanadium						GIS / Kidney	0.94	--	3.47	4.41
			Chemical Total							0.94	--	3.47	4.41
		Exposure Point Total											4.41
	Exposure Medium Total												4.41
Sediment Total													**4.41**
Youth Trespassers Total													**8.90**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

Total Hazard Index Across Soil	**4.2**
Total Hazard Index Across Surface Water	0.30
Total Hazard Index Across Sediment	**4.4**
Total Hazard Index Across All Media and All Exposure Routes	**8.9**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**8.9**	**8.9**
Kidney HI =		**8.9**	**8.9**

TABLE 10.3.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Vanadium						GIS / Kidney	5.23	--	8.02	13.24
			Chemical Total							5.23	--	8.02	13.24
		Exposure Point Total											13.24
	Exposure Medium Total												13.24
Soil Total													**13.24**
Groundwater	Groundwater	Tap	Cobalt						CVS	3.47	--	0.01	3.48
			Vanadium						GIS / Kidney	6.14	--	1.01	7.16
			Chemical Total							9.62	--	1.03	10.64
		Exposure Point Total											10.64
	Exposure Medium Total												10.64
Groundwater Total													**10.64**
Surface Water	Surface Water	Surface Water	Vanadium						GIS / Kidney	0.06	--	0.23	0.29
			Chemical Total							0.06	--	0.23	0.29
		Exposure Point Total											0.29
	Exposure Medium Total												0.29
Surface Water Total													**0.29**

TABLE 10.3.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Sediment	Sediment	Vanadium						GIS / Kidney	0.60	--	3.98	4.58
			Chemical Total							0.60	--	3.98	4.58
		Exposure Point Total											4.58
	Exposure Medium Total												4.58
Sediment Total													**4.58**
Adult Residents Total													**28.76**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Total Hazard Index Across Soil	**13.2**
Total Hazard Index Across Groundwater	**10.6**
Total Hazard Index Across Surface Water	0.29
Total Hazard Index Across Sediment	**4.6**
Total Hazard Index Across All Media and All Exposure Routes	**28.8**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**25.3**	**25.3**
Cardiovascular System HI =		**3.5**	**3.5**
Kidney HI =		**25.3**	**25.3**

TABLE 10.4.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Cobalt						CVS	1.29	--	0.04	1.33
			Vanadium						GIS / Kidney	48.77	--	52.52	101.29
			Chemical Total							50.06	--	52.55	102.61
		Exposure Point Total											102.61
	Exposure Medium Total												102.61
Soil Total													**102.61**
Groundwater	Groundwater	Tap	Cobalt						CVS	8.10	--	0.04	8.14
			Vanadium						GIS / Kidney	14.34	--	2.99	17.33
			Chemical Total							22.44	--	3.03	25.47
		Exposure Point Total											25.47
	Exposure Medium Total												25.47
Groundwater Total													**25.47**
Surface Water	Surface Water	Surface Water	Vanadium						GIS / Kidney	0.30	--	0.53	0.83
			Chemical Total							0.30	--	0.53	0.83
		Exposure Point Total											0.83
	Exposure Medium Total												0.83
Surface Water Total													**0.83**

TABLE 10.4.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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
Sediment	Sediment	Sediment	Vanadium						GIS / Kidney	5.64	--	9.12	14.76
			Chemical Total							5.64	--	9.12	14.76
		Exposure Point Total											14.76
	Exposure Medium Total												14.76
Sediment Total													**14.76**
Young Child Residents Total													**143.67**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Total Hazard Index Across Soil	**103**
Total Hazard Index Across Groundwater	**25.5**
Total Hazard Index Across Surface Water	0.83
Total Hazard Index Across Sediment	**14.8**
Total Hazard Index Across All Media and All Exposure Routes	**144**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**134**	**134**
Cardiovascular System HI =		**9.5**	**9.5**
Kidney HI =		**134**	**134**

TABLE 10.5.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Vanadium						GIS / Kidney	3.73	--	9.58	**13.31**
			Chemical Total							3.73	--	9.58	**13.31**
		Exposure Point Total											**13.31**
	Exposure Medium Total												**13.31**
Soil Total								--					**13.31**
Groundwater	Groundwater	Tap	Cobalt						CVS	1.24	--	<0.01	**1.24**
			Vanadium						GIS / Kidney	2.19	--	<0.01	**2.19**
			Chemical Total							3.43	--	--	**3.43**
		Exposure Point Total											**3.43**
	Exposure Medium Total												**3.43**
Groundwater Total													**3.43**
Industrial / Commercial Workers Total													**16.75**

Total Hazard Index Across Soil	**13.3**
Total Hazard Index Across Groundwater	**3.4**
Total Hazard Index Across All Media and All Exposure Routes	**16.7**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**15.5**	**15.5**
Cardiovascular System HI =		**1.2**	**1.2**
Kidney HI =		**15.5**	**15.5**

Notes:
<u>Target Organ Abbreviations:</u>
GIS = Gastrointestinal System

TABLE 10.6.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Vanadium						GIS / Kidney	12.32	--	14.21	26.53
			Chemical Total							12.32	--	14.21	26.53
		Exposure Point Total											26.53
	Exposure Medium Total												26.53
Soil Total													**26.53**
Construction Workers Total													**26.53**

Notes:
<u>Target Organ Abbreviations:</u>
GIS = Gastrointestinal System

Total Hazard Index Across Soil	**26.5**
Total Hazard Index Across All Media and All Exposure Routes	**26.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**26.5**	**26.5**
Kidney HI =		**26.5**	**26.5**

TABLE 10.7.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 56 (HANGER 200 APRON)
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	Soil	Soil	Vanadium						GIS / Kidney	3.73	--	9.58	**13.31**
			Chemical Total							3.73	--	9.58	**13.31**
		Exposure Point Total											**13.31**
	Exposure Medium Total												**13.31**
Soil Total													**13.31**
Surface Water	Surface Water	Surface Water	Vanadium						GIS / Kidney	0.31	--	0.79	**1.10**
			Chemical Total							0.31	--	0.79	**1.10**
		Exposure Point Total											**1.10**
	Exposure Medium Total												**1.10**
Surface Water Total													**1.10**
Sediment	Sediment	Sediment	Vanadium						GIS / Kidney	2.91	--	11.19	**14.10**
			Chemical Total							2.91	--	11.19	**14.10**
		Exposure Point Total											**14.10**
	Exposure Medium Total												**14.10**
Sediment Total													**14.10**
On-Site Workers Total													**28.51**

Total Hazard Index Across Soil	**13.3**
Total Hazard Index Across Surface Water	**1.1**
Total Hazard Index Across Sediment	**14.1**
Total Hazard Index Across All Media and All Exposure Routes	**28.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**28.5**	**28.5**
Kidney HI =		**28.5**	**28.5**

Notes:
Target Organ Abbreviations:
GIS = Gastrointestinal System

APPENDIX M
BACKGROUND RISK CALCULATIONS

TABLE M-1
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
Exposure Medium: Total 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)
Total Soil									
	Arsenic	mg/kg	0.991	1.18 (NP)	2.5 J	1.18	mg/kg	95% UCL (NP)	95% KM (t) UCL
	Cobalt	mg/kg	19.0	31.1 (NP)	78	31.1	mg/kg	95% UCL (NP)	95% KM (Chebyshev) UCL
	Thallium	mg/kg	0.240	Not Determined	0.29 J	0.290	mg/kg	Max	Less than 4 detections
	Vanadium	mg/kg	176	207 (G)	410	207	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.
(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 M-2
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: 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	10.3	7.93 (NP)	14.2 J	0.00793	mg/L	95% UCL (NP)	95% KM (t) UCL
	Arsenic	µg/L	5.44	9.03 (NP)	22.4 J	0.00903	mg/L	95% UCL (NP)	95% KM (t) UCL
	Cadmium	µg/L	9.97	19.1 (NP)	53.1	0.0191	mg/L	95% UCL (NP)	95% KM (t) UCL
	Cobalt	µg/L	161	559 (NP)	778	0.559	mg/L	95% UCL (NP)	97.5% KM (Chebyshev) UCL
	Copper	µg/L	106	161 (NP)	352	0.161	mg/L	95% UCL (NP)	95% KM (t) UCL
	Lead	µg/L	6.43	13.0 (NP)	32.5 J	0.0130	mg/L	95% UCL (NP)	95% KM (BCA) UCL
	Mercury	µg/L	0.0653	Not Determined	0.21	0.00021	mg/L	Max	Less than 4 detections
	Nickel	µg/L	37.3	52.9 (NP)	86.9	0.0529	mg/L	95% UCL (NP)	95% KM (t) UCL
	Selenium	µg/L	6.17	Not Determined	42.7 J	0.0427	mg/L	Max	Less than 4 detections
	Silver	µg/L	3.38	Not Determined	30.1	0.0301	mg/L	Max	Less than 4 detections
	Vanadium	µg/L	149	232 (NP)	549	0.232	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.

TABLE M-3
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: Sediment
Exposure Medium: Sediment

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									
	Antimony	mg/kg	2.11	3.49 (NP)	12.2 J	3.49	mg/kg	95% UCL (NP)	95% KM (t) UCL
	Arsenic	mg/kg	1.16	1.51 (NP)	3.8	1.51	mg/kg	95% UCL (NP)	95% KM (Percentile Bootstrap) UCL
	Cobalt	mg/kg	21.0	25.2 (G)	65.8	25.2	mg/kg	95% UCL (G)	95% Approximate Gamma UCL
	Thallium	mg/kg	0.541	0.649 (NP)	1.6 J	0.649	mg/kg	95% UCL (NP)	95% KM (t) UCL
	Vanadium	mg/kg	149	166 (N)	230	166	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
(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 M-4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Total Soil	Total Soil	Total Soil	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	0.60	--	0.92	**1.53**
			Chemical Total	1.2E-07	--	1.5E-08	--	1.4E-07		0.62	--	0.92	1.55
		Exposure Point Total						1.4E-07					1.55
	Exposure Medium Total							1.4E-07					1.55
	Air	Fugative Dust	Arsenic	--	1.5E-11	--	--	1.5E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	8.4E-10	--	--	8.4E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	8.5E-10	--	--	8.5E-10		--	<0.01	--	<0.01
		Exposure Point Total						8.5E-10					<0.01
	Exposure Medium Total							8.5E-10					<0.01
Total Soil Total								**1.39E-07**					**1.55**

Notes:

Target Organ Abbreviations:

CVS = Cardiovascular System

GIS = Gastrointestinal System

RsS = Respiratory System

Total Risk Across Total Soil	1.4E-07
Total Risk Across All Media and All Exposure Routes	1.4E-07
Total Hazard Index Across Total Soil	**1.5**
otal Hazard Index Across All Media and All Exposure Routes	**1.5**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**1.5**	**1.5**
Cardiovascular System HI =		0.02	0.02
Skin HI =		<0.01	<0.01
Kidney HI =		**1.5**	**1.5**
Respiratory System HI =	<0.01		<0.01

TABLE M-5
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Sediment	Sediment	Sediment	Antimony	--	--	--	--	--	Whole Body, CVS	<0.01	--	<0.01	<0.01
			Arsenic	1.6E-07	--	8.1E-08	--	2.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.48	--	3.17	**3.66**
			Chemical Total	1.6E-07	--	8.1E-08	--	2.4E-07		0.50	--	3.18	**3.68**
		Exposure Point Total						2.4E-07					**3.68**
	Exposure Medium Total							2.4E-07					**3.68**
Sediment Total								**2.39E-07**					**3.68**

Total Risk Across Sediment	2.4E-07	Total Hazard Index Across Sediment	**3.7**
Total Risk Across All Media and All Exposure Routes	2.4E-07	Total Hazard Index Across All Media and All Exposure Routes	**3.7**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

	Inhalation	Oral/Dermal	Total
Whole Body HI =		<0.01	<0.01
Gastrointestinal System HI =		**3.7**	**3.7**
Cardiovascular System HI =		0.03	0.03
Skin HI =		<0.01	<0.01
Kidney HI =		**3.7**	**3.7**

TABLE M-6
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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	Total Soil	Total Soil	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	0.94	--	2.30	**3.24**
			Chemical Total	8.8E-08	--	1.7E-08	--	1.0E-07		0.97	--	2.31	3.28
		Exposure Point Total						1.0E-07					3.28
	Exposure Medium Total							1.0E-07					3.28
	Air	Fugative Dust	Arsenic	--	7.0E-12	--	--	7.0E-12	NA	--	<0.01	--	<0.01
			Cobalt	--	3.8E-10	--	--	3.8E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	3.9E-10	--	--	3.9E-10		--	<0.01	--	<0.01
		Exposure Point Total						3.9E-10					<0.01
	Exposure Medium Total							3.9E-10					<0.01
Total Soil Total								**1.05E-07**					**3.28**

Total Risk Across Total Soil	1.1E-07	Total Hazard Index Across Total Soil	**3.3**
Total Risk Across All Media and All Exposure Routes	1.1E-07	otal Hazard Index Across All Media and All Exposure Routes	**3.3**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**3.2**	**3.2**
Cardiovascular System HI =		0.04	0.04
Skin HI =		<0.01	<0.01
Kidney HI =		**3.2**	**3.2**
Respiratory System HI =	<0.01		<0.01

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

TABLE M-7
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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
Sediment	Sediment	Sediment	Antimony	--	--	--	--	--	Whole Body, CVS	<0.01	--	<0.01	<0.01
			Arsenic	1.1E-07	--	3.2E-08	--	1.5E-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	--	2.77	**3.52**
			Chemical Total	1.1E-07	--	3.2E-08	--	1.5E-07		0.78	--	2.78	**3.56**
		Exposure Point Total						1.5E-07					**3.56**
	Exposure Medium Total							1.5E-07					**3.56**
Sediment Total								**1.45E-07**					**3.56**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Total Risk Across Sediment	1.5E-07
Total Risk Across All Media and All Exposure Routes	1.5E-07
Total Hazard Index Across Sediment	**3.6**
Total Hazard Index Across All Media and All Exposure Routes	**3.6**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		<0.01	<0.01
Gastrointestinal System HI =		**3.5**	**3.5**
Cardiovascular System HI =		0.04	0.04
Skin HI =		<0.01	<0.01
Kidney HI =		**3.5**	**3.5**

TABLE M-8
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Total Soil	Total Soil	Total Soil	Arsenic	8.3E-07	--	1.0E-07	--	9.3E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.14	--	<0.01	0.15
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	4.05	--	6.22	**10.3**
			Chemical Total	8.3E-07	--	1.0E-07	--	9.3E-07		4.20	--	6.22	**10.4**
		Exposure Point Total						9.3E-07					**10.4**
	Exposure Medium Total							9.3E-07					**10.4**
	Air	Fugative Dust	Arsenic	--	1.2E-09	--	--	1.2E-09	NA	--	<0.01	--	<0.01
			Cobalt	--	6.8E-08	--	--	6.8E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	6.9E-08	--	--	6.9E-08		--	<0.01	--	<0.01
		Exposure Point Total						6.9E-08					<0.01
	Exposure Medium Total							6.9E-08					<0.01
Total Soil Total								**1.00E-06**					**10.4**

Total Risk Across Total Soil	1.0E-06
Total Risk Across All Media and All Exposure Routes	1.0E-06
Total Hazard Index Across Total Soil	**10.4**
otal Hazard Index Across All Media and All Exposure Routes	**10.4**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**10.3**	**10.3**
Cardiovascular System HI =		0.15	0.15
Skin HI =		<0.01	<0.01
Kidney HI =		**10.3**	**10.3**
Respiratory System HI =	<0.01		<0.01

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

TABLE M-9
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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											
			Antimony	--	--	--	--	--	Whole Body, CVS	0.54	--	<0.01	0.55
			Arsenic	1.3E-04	--	4.0E-07	--	1.3E-04	Skin / CVS	0.82	--	<0.01	0.83
			Cadmium	--	--	--	--	--	Kidney	1.05	--	0.07	**1.11**
			Cobalt	--	--	--	--	--	CVS	51.05	--	0.20	**51.2**
			Copper	--	--	--	--	--	GIS	0.11	--	<0.01	0.11
			Lead	--	--	--	--	--	NA	--	--	--	--
			Mercury	--	--	--	--	--	ImS	0.04	--	<0.01	0.04
			Nickel	--	--	--	--	--	Whole Body	0.07	--	<0.01	0.08
			Selenium	--	--	--	--	--	Skin	0.23	--	<0.01	0.23
			Silver	--	--	--	--	--	Skin	0.16	--	<0.01	0.17
			Vanadium	--	--	--	--	--	GIS / Kidney	90.80	--	14.98	**106**
			Chemical Total	1.3E-04	--	4.0E-07	--	1.3E-04		144.88	--	15.27	**160**
		Exposure Point Total						1.3E-04					**160**
	Exposure Medium Total							1.3E-04					**160**
Groundwater Total								**1.28E-04**					**160**

Total Risk Across Groundwater	**1.3E-04**	al Hazard Index Across Groundwater	**160**
Total Risk Across All Media and All Exposure Routes	**1.3E-04**	Total Hazard Index Across All Media and All Exposure Routes	**160**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System

	Inhalation	Oral/Dermal	Total
Whole Body HI =		0.63	0.63
Immune System HI =		0.04	0.04
Gastrointestinal System HI =		**106**	**106**
Cardiovascular System HI =		**52.6**	**52.6**
Skin HI =		**1.2**	**1.2**
Kidney HI =		**107**	**107**

TABLE M-10
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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	Sediment	Sediment	Antimony	--	--	--	--	--	Whole Body, CVS	<0.01	--	<0.01	<0.01
			Arsenic	1.6E-07	--	8.1E-08	--	2.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.02	--	<0.01	0.02
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	0.48	--	3.17	**3.66**
			Chemical Total	1.6E-07	--	8.1E-08	--	2.4E-07		0.50	--	3.18	**3.68**
		Exposure Point Total						2.4E-07					**3.68**
	Exposure Medium Total							2.4E-07					**3.68**
Sediment Total								**2.39E-07**					**3.68**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

Total Risk Across Sediment	2.4E-07	Total Hazard Index Across Sediment	**3.7**
Total Risk Across All Media and All Exposure Routes	2.4E-07	Total Hazard Index Across All Media and All Exposure Routes	**3.7**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		<0.01	<0.01
Gastrointestinal System HI =		**3.7**	**3.7**
Cardiovascular System HI =		0.03	0.03
Skin HI =		<0.01	<0.01
Kidney HI =		**3.7**	**3.7**

TABLE M-11
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Total Soil	Total Soil	Total Soil	Arsenic	1.9E-06	--	1.6E-07	--	2.1E-06	Skin / CVS	0.05	--	<0.01	0.05
			Cobalt	--	--	--	--	--	CVS	1.33	--	0.04	**1.36**
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	37.81	--	40.72	**78.5**
			Chemical Total	1.9E-06	--	1.6E-07	--	2.1E-06		39.18	--	40.76	**79.9**
		Exposure Point Total						2.1E-06					**79.9**
	Exposure Medium Total							2.1E-06					**79.9**
	Air	Fugative Dust	Arsenic	--	3.1E-10	--	--	3.1E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.7E-08	--	--	1.7E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Total Soil Total								**2.12E-06**					**79.9**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Total Soil	2.1E-06
Total Risk Across All Media and All Exposure Routes	2.1E-06
Total Hazard Index Across Total Soil	**79.9**
otal Hazard Index Across All Media and All Exposure Routes	**79.9**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**78.5**	**78.5**
Cardiovascular System HI =		**1.4**	**1.4**
Skin HI =		0.05	0.05
Kidney HI =		**78.5**	**78.5**
Respiratory System HI =	<0.01		<0.01

TABLE M-12
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Groundwater	Groundwater	Tap											
			Antimony	--	--	--	--	--	Whole Body, CVS	1.27	--	0.02	**1.29**
			Arsenic	7.4E-05	--	3.0E-07	--	7.5E-05	Skin / CVS	1.92	--	<0.01	**1.93**
			Cadmium	--	--	--	--	--	Kidney	2.44	--	0.20	**2.64**
			Cobalt	--	--	--	--	--	CVS	119.12	--	0.58	**120**
			Copper	--	--	--	--	--	GIS	0.26	--	<0.01	0.26
			Lead	--	--	--	--	--	NA	--	--	--	--
			Mercury	--	--	--	--	--	ImS	0.08	--	<0.01	0.09
			Nickel	--	--	--	--	--	Whole Body	0.17	--	0.02	0.19
			Selenium	--	--	--	--	--	Skin	0.55	--	<0.01	0.55
			Silver	--	--	--	--	--	Skin	0.38	--	0.03	0.41
			Vanadium	--	--	--	--	--	GIS / Kidney	211.87	--	44.19	**256**
			Chemical Total	7.4E-05	--	3.0E-07	--	7.5E-05		338.06	--	45.05	**383**
		Exposure Point Total						7.5E-05					**383**
	Exposure Medium Total							7.5E-05					**383**
Groundwater Total								**7.45E-05**					**383**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System

Total Risk Across Groundwater	7.5E-05	Total Hazard Index Across Groundwater	**383**
Total Risk Across All Media and All Exposure Routes	7.5E-05	Total Hazard Index Across All Media and All Exposure Routes	**383**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		**1.5**	**1.5**
Immune System HI =		0.09	0.09
Gastrointestinal System HI =		**256**	**256**
Cardiovascular System HI =		**123**	**123**
Skin HI =		**2.9**	**2.9**
Kidney HI =		**259**	**259**

TABLE M-13
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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	Sediment	Sediment											
			Antimony	--	--	--	--	--	Whole Body, CVS	0.02	--	<0.01	0.02
			Arsenic	3.7E-07	--	4.6E-08	--	4.2E-07	Skin / CVS	<0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.16	--	<0.01	0.17
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	4.50	--	7.28	**11.8**
			Chemical Total	3.7E-07	--	4.6E-08	--	4.2E-07		4.69	--	7.29	**12.0**
		Exposure Point Total						4.2E-07					**12.0**
	Exposure Medium Total							4.2E-07					**12.0**
Sediment Total								**4.15E-07**					**12.0**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System

	Risk		Hazard Index
Total Risk Across Sediment	4.2E-07	Total Hazard Index Across Sediment	**12.0**
Total Risk Across All Media and All Exposure Routes	4.2E-07	Total Hazard Index Across All Media and All Exposure Routes	**12.0**

	Inhalation	Oral/Dermal	Total
Whole Body HI =		0.02	0.02
Gastrointestinal System HI =		**11.8**	**11.8**
Cardiovascular System HI =		0.20	0.20
Skin HI =		0.01	0.01
Kidney HI =		**11.8**	**11.8**

TABLE M-14
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Total Soil	Total Soil	Total Soil	Arsenic	6.2E-07	--	1.2E-07	--	7.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.11
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.89	--	7.35	**10.2**
			Chemical Total	6.2E-07	--	1.2E-07	--	7.4E-07		3.00	--	7.35	**10.4**
		Exposure Point Total						7.4E-07					**10.4**
	Exposure Medium Total							7.4E-07					**10.4**
	Air	Fugative Dust	Arsenic	--	3.0E-10	--	--	3.0E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.7E-08	--	--	1.7E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Total Soil Total								**7.58E-07**					**10.4**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

Total Risk Across Total Soil	7.6E-07
Total Risk Across All Media and All Exposure Routes	7.6E-07
Total Hazard Index Across Total Soil	**10.4**
Total Hazard Index Across All Media and All Exposure Routes	**10.4**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**10.2**	**10.2**
Cardiovascular System HI =		0.11	0.11
Skin HI =		<0.01	<0.01
Kidney HI =		**10.2**	**10.2**
Respiratory System HI =	<0.01		<0.01

TABLE M-15
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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											
			Antimony	--	--	--	--	--	Whole Body, CVS	0.19	--	--	0.19
			Arsenic	4.7E-05	--	--	--	4.7E-05	Skin / CVS	0.29	--	--	0.29
			Cadmium	--	--	--	--	--	Kidney	0.37	--	--	0.37
			Cobalt	--	--	--	--	--	CVS	18.23	--	--	**18.23**
			Copper	--	--	--	--	--	GIS	0.04	--	--	0.04
			Lead	--	--	--	--	--	NA	--	--	--	--
			Mercury	--	--	--	--	--	ImS	0.01	--	--	0.01
			Nickel	--	--	--	--	--	Whole Body	0.03	--	--	0.03
			Selenium	--	--	--	--	--	Skin	0.08	--	--	0.08
			Silver	--	--	--	--	--	Skin	0.06	--	--	0.06
			Vanadium	--	--	--	--	--	GIS / Kidney	32.43	--	--	**32.43**
			Chemical Total	4.7E-05	--	--	--	4.7E-05		51.74	--	--	**51.74**
		Exposure Point Total						4.7E-05					**51.74**
	Exposure Medium Total							4.7E-05					**51.74**
Groundwater Total								**4.73E-05**					**51.74**
Industrial / Commercial Workers Total								**4.73E-05**					**51.74**

Total Risk Across Groundwater	4.7E-05	Total Hazard Index Across Groundwater	**51.7**
Total Risk Across All Media and All Exposure Routes	4.7E-05	Total Hazard Index Across All Media and All Exposure Routes	**51.7**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System

	Inhalation	Oral/Dermal	Total
Whole Body HI =		0.22	0.22
Immune System HI =		0.01	0.01
Gastrointestinal System HI =		**32.5**	**32.5**
Cardiovascular System HI =		**18.7**	**18.7**
Skin HI =		0.44	0.44
Kidney HI =		**32.8**	**32.8**

TABLE M-16
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Total Soil	Total Soil	Total Soil	Arsenic	8.2E-08	--	7.3E-09	--	8.9E-08	Skin / CVS	0.01	--	<0.01	0.01
			Cobalt	--	--	--	--	--	CVS	0.33	--	0.01	0.34
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	9.55	--	11.02	**20.6**
			Chemical Total	8.2E-08	--	7.3E-09	--	8.9E-08		9.90	--	11.03	**20.9**
		Exposure Point Total						8.9E-08					**20.9**
	Exposure Medium Total							8.9E-08					**20.9**
	Air	Fugative Dust	Arsenic	--	1.2E-11	--	--	1.2E-11	NA	--	<0.01	--	<0.01
			Cobalt	--	6.7E-10	--	--	6.7E-10	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	6.8E-10	--	--	6.8E-10		--	<0.01	--	<0.01
		Exposure Point Total						6.8E-10					<0.01
	Exposure Medium Total							6.8E-10					<0.01
Total Soil Total								**8.97E-08**					**20.9**

Total Risk Across Total Soil	9.0E-08
Total Risk Across All Media and All Exposure Routes	9.0E-08
Total Hazard Index Across Total Soil	**20.9**
otal Hazard Index Across All Media and All Exposure Routes	**20.9**

	Inhalation	Oral/Dermal	Total
Gastrointestinal System HI =		**20.6**	**20.6**
Cardiovascular System HI =		0.36	0.36
Skin HI =		0.01	0.01
Kidney HI =		**20.6**	**20.6**
Respiratory System HI =	<0.01		<0.01

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
RsS = Respiratory System

TABLE M-17
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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											
			Antimony	--	--	--	--	--	Whole Body, CVS	<0.01	--	<0.01	<0.01
			Arsenic	7.6E-09	--	1.5E-09	--	9.1E-09	Skin / CVS	<0.01	--	<0.01	<0.01
			Cadmium	--	--	--	--	--	Kidney	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.07	--	0.02	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	0.13	--	1.35	**1.48**
			Chemical Total	7.6E-09	--	1.5E-09	--	9.1E-09		0.21	--	1.38	**1.59**
		Exposure Point Total						9.1E-09					**1.59**
	Exposure Medium Total							9.1E-09					**1.59**
Groundwater Total								**9.08E-09**					**1.59**

Total Risk Across Groundwater	9.1E-09	Total Hazard Index Across Groundwater	**1.6**
Total Risk Across All Media and All Exposure Routes	9.1E-09	Total Hazard Index Across All Media and All Exposure Routes	**1.6**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System

	Inhalation	Oral/Dermal	Total
Whole Body HI =		<0.01	<0.01
Immune System HI =		<0.01	<0.01
Gastrointestinal System HI =		**1.5**	**1.5**
Cardiovascular System HI =		0.09	0.09
Skin HI =		<0.01	<0.01
Kidney HI =		**1.5**	**1.5**

TABLE M-18
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Total Soil	Total Soil	Total Soil	Arsenic	6.2E-07	--	1.2E-07	--	7.4E-07	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.10	--	<0.01	0.11
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.89	--	7.43	**10.32**
			Chemical Total	6.2E-07	--	1.2E-07	--	7.4E-07		3.00	--	7.43	**10.43**
		Exposure Point Total						7.4E-07					**10.43**
	Exposure Medium Total							7.4E-07					**10.43**
	Air	Fugative Dust	Arsenic	--	3.0E-10	--	--	3.0E-10	NA	--	<0.01	--	<0.01
			Cobalt	--	1.7E-08	--	--	1.7E-08	RsS	--	<0.01	--	<0.01
			Thallium	--	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	--	NA	--	<0.01	--	<0.01
			Chemical Total	--	1.7E-08	--	--	1.7E-08		--	<0.01	--	<0.01
		Exposure Point Total						1.7E-08					<0.01
	Exposure Medium Total							1.7E-08					<0.01
Total Soil Total								**7.58E-07**					**10.43**
On-Site Workers Total								**7.58E-07**					**10.43**

Total Risk Across Total Soil	7.6E-07	Total Hazard Index Across Total Soil	**10.4**
Total Risk Across All Media and All Exposure Routes	7.6E-07	Total Hazard Index Across All Media and All Exposure Routes	**10.4**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System

TABLE M-19
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
BACKGROUND
RISK EVALUATION OF BACKGROUND CONSTITUENTS
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
Sediment	Sediment	Sediment	Antimony	--	--	--	--	--	Whole Body, CVS	<0.01	--	<0.01	0.01
			Arsenic	7.9E-07	--	2.4E-07	--	1.0E-06	Skin / CVS	<0.01	--	<0.01	<0.01
			Cobalt	--	--	--	--	--	CVS	0.08	--	<0.01	0.09
			Thallium	--	--	--	--	--	Liver / CVS / Skin	--	--	--	--
			Vanadium	--	--	--	--	--	GIS / Kidney	2.32	--	8.93	**11.25**
			Chemical Total	7.9E-07	--	2.4E-07	--	1.0E-06		2.42	--	8.95	**11.36**
		Exposure Point Total						1.0E-06					**11.36**
	Exposure Medium Total							1.0E-06					**11.36**
Sediment Total								**1.03E-06**					**11.36**
On-Site Workers Total								**1.03E-06**					**11.36**

Total Risk Across Sediment	1.0E-06	Total Hazard Index Across Sediment	**11.4**
Total Risk Across All Media and All Exposure Routes	1.0E-06	Total Hazard Index Across All Media and All Exposure Routes	**11.4**

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System
GIS = Gastrointestinal System
ImS = Immune System
RsS = Respiratory System