# *FINAL ADDITIONAL DATA COLLECTION WORK PLAN IN SUPPORT OF THE ECOLOGICAL RISK ASSESSMENT SWMU 14*

## *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:*

Michael Baker Jr., Inc.
Moon Township, PA

Contract No. N62470-07-D-0502
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November 9, 2007

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

**FINAL**

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**DEPARTMENT OF THE NAVY**
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*North Charleston, SC*

*Under:*

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**DELIVERY ORDER 0002**

*Prepared by:*

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*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** ______________________

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**Title:___BRAC Env. Coordinator_**

**Date:___November 9, 2007________**

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| | |
|---|---|
| AFFF | Aqueous Film Forming Foam |
| AQUIRE | Aquatic Toxicity Information Retrieval |
| AUF | Area Use Factor |
| BAF | Bioaccumulation Factor |
| Baker | Baker Environmental Inc. or Michael Baker Jr., Inc. |
| BCF | Bioconcentration Factor |
| BERA | Baseline Ecological Risk Assessment |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| CCME | Canadian Council of Ministers of the Environment |
| CNO | Chief of Naval Operations |
| COPC | Chemical of Potential Concern |
| DO | Delivery Order |
| DRO | Diesel Range Organics |
| $EC_{50}$ | Median Effective Concentration |
| Eco-SSL | Ecological Soil Screening Level |
| ERA | Ecological Risk Assessment |
| FCV | Final Chronic Value |
| FMTUD | Facility Management Transportation and Utility Division |
| GRO | Gasoline Range Organics |
| GPS | Global Positioning System |
| HHRA | Human Health Risk Assessment |
| HSWA | Hazardous and Solid Waste Amendments (to RCRA) |
| IAS | Initial Assessment Study |
| IDW | Investigation Derived Waste |
| JP-5 | Jet Propellant-5 |
| $LC_{50}$ | Median Lethal Concentration |
| LOAEL | Lowest Observed Adverse Effect Level |
| LOEC | Lowest Observed Effect Concentration |
| LOEL | Lowest Observed Effect Level |
| MATC | Maximum Acceptable Toxicant Concentration |
| MHSPE | Ministry of Housing, Spatial Planning and Environment |
| MS/MSD | Matrix Spike/Matrix Spike Duplicate |
| NACIP | Navy Assessment and Control of Installation Pollutants |
| NAPR | Naval Activity Puerto Rico |

**LIST OF ACRONYMS AND ABBREVIATIONS**
(Continued)

| | |
|---|---|
| NAVFAC | Naval Facilities |
| NAWQC | National Ambient Water Quality Criteria |
| NEESA | Naval Energy and Environmental Support |
| NFESC | Naval Facilities Engineering Service Center |
| NOEC | No Observed Effect Concentration |
| NOAA | National Oceaninc and Atmospheric Administration |
| NOAEL | No Observed Adverse Effect Level |
| NOEL | No Observed Effect Level |
| NSRR | Naval Station Roosevelt Roads |
| NTR | Navy Technical Representative |
| | |
| PAH | Polynuclear Aromatic Hydrocarbon |
| PCB | Polychlorinated Biphenyl |
| PEM1 | Palustrine Emergent Persistent |
| PID | Photoionization Detector |
| PMO | Project Management Office |
| PPE | Personal Protective Equipment |
| | |
| ppm | parts per million |
| Purple K | Potassium Bicarbonate |
| | |
| QA/QC | Quality Assurance/Quality Control |
| | |
| RAGS | Risk Assessment Guidance for Superfund |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| | |
| SCV | Secondary Chronic Value |
| SE | Southeast |
| SERA | Screening-Level Ecological Risk Assessment |
| SOP | Standard Operating Procedure |
| SQUIRT | Screening Quick Reference Table |
| SWMU | Solid Waste Management Unit |
| SVOC | Semi-Volatile Organic Compound |
| | |
| TOC | Total Organic Carbon |
| TPH | Total Petroleum Hydrocarbons |
| | |
| USEPA | United States Environmental Protection Agency |
| | |
| VOC | Volatile Organic Compound |

# 1.0 INTRODUCTION

This work plan presents the technical approach for collecting and analyzing field samples to address a data gap identified in the screening-level ecological risk assessment (SERA) for Solid Waste Management Unit (SWMU) 14 - Fire Training Pit at Crash Crew Area located at Naval Activity Puerto Rico (NAPR), formerly Naval Station Roosevelt Roads (NSRR), Ceiba, Puerto Rico. Analytical data generated by the field investigation will be used to revise the SERA, which was previously presented in the Final Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for SWMU 14 (Baker Environmental, Inc [Baker], 2007). Step 3a of the baseline ecological risk assessment (BERA) also will be conducted and included with the revised SERA.

This document was 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 (NAVFAC) SE (Contract No. N62470-07-D-0502, Delivery Order [DO] 0002).

## 1.1 Objective

The objective of this work plan is to present the technical approach for the collection and analysis of field samples at SWMU 14 to address a data gap identified in the SERA. The data gap is associated with the original fire training pit, which was connected to a drainage ditch via a swale. Fluids associated with fire training operations may have discharged to the drainage ditch. The drainage ditch eventually terminates within a freshwater wetland unit. Soil samples were not collected from the drainage ditch, nor were surface water or sediment samples collected from the PEM1 wetland during previous field investigations (1996 and 2006 RFIs [see Section 2.2]). Because the PEM1 wetland unit represents a potential exposure point where ecological receptors could contact affected media (i.e., surface water and sediment), the lack of ditch soil analytical data (which can be used to indicate if a release to the drainage ditch has occurred) or surface water and sediment analytical data (which would indicate if chemicals associated with fire training operations have migrated to the wetland) prevented an evaluation of this potential transport pathway in the SERA. The sampling and analysis program proposed within this work plan will involve the collection and analysis of drainage ditch soil samples (surface and subsurface). Analytical data for the soil samples will be used to determine if the drainage ditch represents a potential transport pathway for the migration of chemicals associated with fire training operations to the PEM1 wetland unit.

The drainage ditch soil analytical data generated by the additional data collection field investigation will be used to revise the SERA previously presented in the Final RFI report (Baker, 2007). The existing surface and subsurface soil analytical data and the drainage ditch soil analytical data also will be used to conduct Step 3a of the BERA. If the drainage ditch soil analytical data indicate that fire training chemicals may have migrated to the Palustrine Emergent Persistent (PEM1) wetland unit at ecologically important concentrations, the ecological risk assessment (ERA) will recommend additional data collection activities within the PEM1 wetland unit. Migration at ecologically important concentrations will be based on a comparison of the drainage way analytical data to soil screening values in Step 2 and Step 3a of the Navy ERA process (see Section 2.2.1 for a discussion of the Navy ERA process and Section 4.1 for a discussion of screening values), as well as statistical comparisons of the drainage ditch soil analytical data to background soil data contained within the Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2006). Statistical evaluations will be conducted in Step 3a of the Navy ERA process in accordance with Navy guidance (Naval Facilities Engineering Service Center [NFESC], 2002; see Section 4.2 for description of statistical methods). The spatial distribution of detections greater than soil screening values will be taken into consideration.

## 1.2 Organization of the Work Plan

This work plan is organized into seven sections. Section 1.0 of this document includes the SWMU history and objectives of the additional data collection to support the ERA. Section 2.0 provides a description of current conditions and a summary of previous investigations, including the SERA. Section 3.0 provides a description of the activities that will be performed during the proposed field investigation (drainage ditch soil sampling and analysis program). The reporting activities that will be conducted following the completion of the field investigation are described in Section 4.0. Section 5.0 discusses the proposed project schedule for the field investigation and reporting activities. The site management structure that will be utilized during this investigation, including project team responsibilities and field reporting requirements, is presented in Section 6.0, while Section 7.0 presents the report references.

## 2.0 NAPR AND SWMU 14 BACKGROUND

The following sections provide a description and history NAPR and SWMU 14, current conditions at the SWMU, and previous investigations that have been conducted at SWMU 14.

### 2.1 NAPR Description and History

NAPR occupies over 8,600 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 1-1). The north entrance to NAPR is about 35 miles east along the coast road (Route 3) from San Juan. The closest large town is Farjardo (population approximately 37,000), which is located approximately 10 miles north of NAPR off Route 3. Ceiba (population approximately 17,000) adjoins the western boundary of NAPR (see Figure 1-1). NAPR was commissioned in 1943 as a Naval Operations Base and re-designated a Naval Station in 1957. NAPR continued in this status until 1957 when it was re-designated NSRR with the mission of providing full support for Atlantic Fleet weapons training and development activities. NSSR operated as a Naval Station until March 31, 2004 at which time NSRR underwent operational closure. On April 1, 2004, NSSR 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 disposition of the property.

### 2.2 SWMU 14 Description and History

SWMU 14 (Fire Training Pit Area) is located north of the base airport runway, adjacent to the airport fire station (see Figure 1-2). The SWMU was operated by the Air Operations Department from the early 1960s through 1983. The SWMU includes three different fire training pits, described as the original pit, temporary pit, and current pit (see Figure 1-3). The original fire training pit was an unlined pit approximately 40 feet in diameter that was used from the early 1960s through the beginning of 1983. The Initial Assessment Study (IAS) conducted in 1984 estimated that approximately 120,000 gallons of waste solvents, fuels, and oils were placed in the pit and set on fire for fire fighting training during the nearly 20 years of operation (Naval Energy and Environmental Support Activity [NEESA], 1984). Wood, trash, plastic, fuel filter elements, oily rags, and other debris also were burned. The fires were extinguished using aqueous film forming foam (AFFF) and potassium bicarbonate (Purple K). Past aerial photographs show drainage from this pit via a swale to a drainage ditch along the runway shoulder. The drainage ditch runs from the southern portion of SWMU 14 southwestward along the airfield runway for approximately 3,100 feet. At the southwestern end of the runway, the drainage ditch continues in a southern direction for approximately an additional 3,600 feet before terminating within a wetland unit classified as Palustrine Emergent Persistent (PEM1) by the Cowardin Wetland Classification System (Cowardin et al., 1979).

The original pit was taken out of operation at the beginning of 1983 for the construction of a new concrete-lined fire training pit. The new/current training pit, approximately 40 feet in diameter, was constructed at the same location as the original fire training pit, and includes a 10-foor wide concrete apron. Fluids from the fire training operations were contained in the pit and passed through an oil/water separator (SWMU 12) before entering the Forestall Wastewater Treatment system. (It is noted that the RCRA Section 7003 Administrative Order states that the corrective action for SWMU 12 is complete without controls). A drainage system encircling the apron intercepted any overtopping, which also was directed to the oil/water separator. When the new/current pit was built, all of the visibly oil-stained, contaminated soil was excavated in the immediate vicinity of the old pit. There are no records of ultimate disposal for this contaminated material. A sample of this soil was colleted and no polychlorinated biphenyls (PCBs) were detected (NEESA, 1984). No other specific information is available concerning the depth and aerial extent of soil contamination identified and excavated in 1983. The drainage swale connecting the original pit to the drainage ditch (identified in the description of the original pit above) was graded over during the construction of the new pit and is no longer present at this site.

The new/current fire training pit was utilized for training purposes until March 31, 2004 when operations ceased. The training consisted of Navy personnel simulating an aircraft crash by igniting pieces of aircraft with two or three 55-gallon containers of jet fuel (JP-5[Jet Propellant-5]) per training session. Personnel were required to use water (only) to extinguish the training fires developed at this pit. On average, fire training activities lasted from three to four hours and were conducted two to three times per month.

A temporary fire training pit was constructed to the north of the original pit location and was in operation during the construction of the current fire training pit in 1983. This temporary pit was an unlined gravel pit with an approximate diameter of about 2,000 feet and was used approximately six times. An estimated 3,000 gallons of waste fuel, oil, and solvents were burned in this area. Only small amounts of fuel were allowed to soak into the ground (NEESA, 1984). The temporary fire training pit is currently covered with grass and is maintained via grass cutting operations.

## 2.3 Current Conditions

Fire training operations ceased on March 31, 2004, which corresponds to the operational closure of NSRR. The current fire training pit is a concrete structure, constructed below grade, with a concrete apron. The area contiguous to the current fire training pit is covered with grass and maintained via grass cutting operations. The temporary pit utilized in 1983 also is covered with maintained grasses. Future land use as an airport is not anticipated to change (i.e., the upland vegetative community at SWMU 14 will continue to be limited to maintained grasses). Photographs of the drainage ditch historically connected to the original fire training pit are included as Appendix A.

## 2.4 Previous Investigations

Various investigations have been conducted at SWMU 14, including an IAS (NEESA, 1984), a Phase I RFI (Baker, 1996), a preliminary human health risk assessment (HHRA) (Baker, 2000a), a Draft Interim Decision Document (Baker, 2000b), and a RFI (Baker, 2007). These investigations, as well as other miscellaneous items are discussed below.

The Navy conducted an IAS in 1984 to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous waste operations (NEESA, 1984). The IAS reviewed historical records, aerial photographs, surface and aerial surveys, and personnel interviews. Because contaminated soils associated with the original fire pit were removed during construction of the new pit and no PCBs were detected, and because the temporary pit was used so little, the IAS team concluded that there is no threat to human health or the environment from this site. No further action under the Navy Assessment and Control of Installation Pollutants (NACIP) Program was warranted.

The 1994 RCRA/Hazardous and Solid Waste Amendments (HSWA) Permit issued to NSRR requested that a Phase I RFI be conducted to encompass subsurface soils down to the water table. A groundwater investigation was contingent on the subsurface soil sampling results. Project Plans were developed and approved by the United States Environmental Protection Agency (USEPA) to conduct the Phase I RFI for SWMU 14. The Final Phase I RFI document (Baker, 1995) contains the entire set of project plans including a Project Management Plan, Data Collection Quality Assurance Plan, and the Health and Safety Plan.

The Phase I RFI field investigation was conducted in March 1996. This field investigation included the performance of a limited soil gas survey along the perimeter of the original/current fire training pit and surface soil sampling from those areas identified from the soil gas survey exhibiting the highest photoionization detector (PID) readings. As part of the 1996 Phase I RFI, a total of five surface soil samples were collected at the soil gas sampling locations which exhibited the highest PID readings, which ranged from 21.1 parts per million (ppm) to 79.2 ppm. Fourteen semi-volatile organic compounds (SVOCs), twelve being Polynuclear Aromatic Hydrocarbons (PAHs), one PCB (Aroclor-1260), and total petroleum hydrocarbon (TPH) diesel range organics (DRO) and gasoline range organics (GRO) were detected in the surface soil samples. The 1996 Phase I RFI Report was submitted to the USEPA on July 1, 1996 (Baker, 1996). On January 28, 2000, the Navy informed the USEPA of an omission in the data set contained in the report. Due to this omission, an initial HHRA (Baker, 2000a) was developed utilizing the data set from the 1996 Phase I RFI investigation at SWMU 14. The results of the initial HHRA did not indicate an unacceptable cancer risk for any of the exposure scenarios or pathways. This HHRA report was submitted to the USEPA for review and comment on February 4, 2000.

The USEPA provided comments on the Draft HHRA Report for SWMU 14 on July 5, 2000, finding that the preliminary HHRA evaluation for exposure to surface soils is generally adequate and identified deficiencies in site characterization. The USEPA requested that a supplemental site characterization work plan be submitted to adequately characterize all media. The Navy responded to the USEPA comments dated July 5, 2000 in a letter dated August 22, 2000. These responses were followed up by the submission of a Draft Interim Decision Document (Baker, 2000b) that was submitted to the USEPA on November 22, 2000. The purpose of this document was to provide information to support the Navy's recommendation to postpone final site disposition until the site was no longer utilized for training activities.

The USEPA approved the Interim Decision Document on May 4, 2001 based on the recommendations given in Section 4.0 of the document, that "once fire training operations cease (at this unit), additional site characterization of the site will be conducted". Fire training operations ceased on March 31, 2004, at which time funding for the implementation of the 2006 RFI Work Plan for SWMU 14 was procured. The 2007 Final RFI Report (Baker, 2007) was prepared to document the findings of the post-closure 2006 RFI field work and to consolidate this information with data generated during the 1996 Phase I RFI effort targeting potential impacts to surface soils associated with SWMU 14.

As discussed in Section 1.0, the Final RFI Report (Baker, 2007) included a SERA. The sections that follow provide a description of the ERA process conducted at SWMU 14, analytical data used in the SERA, as well as results of the screening-level risk calculation.

### 2.4.1 Ecological Risk Assessment Process

The SERA at SWMU 14 was performed in accordance with Navy policy for conducting ERAs (Chief of Naval Operations [CNO], 1999) and the 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 2-1) 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, which consists of the following steps:

- 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 may also include consideration of background data, chemical bioavailability, and the frequency of detection. If the re-evaluation of the conservative exposure assumptions does not support an acceptable risk determination, the site continues through the BERA process (Step 3b BERA problem formulation).

The Revised Final RFI Work Plan (Baker, 2005) outlined the approach for conducting the ERA at SWMU 14. The risk assessment process for SWMU 14 was to include Step 3a of the Navy ERA process (refinement of conservative exposure assumptions). However, during preparation of the screening-level problem formulation, a data gap was identified which prevented an estimation of risk in the Step 2 screening-level risk calculation for certain potentially complete exposure pathways. Specifically, a potential migration pathway from a source of contamination to relevant abiotic media (surface water and/or sediment) was not addressed by the 1996 and 2006 RFIs. Screening-level risk estimates were provided for those exposure pathways with adequate analytical data on which to base a risk estimate (media-pathway-receptor combinations involving surface and subsurface soil). However, additional data are necessary to determine if exposure pathways involving surface water and sediment are complete. For this reason, the ERA process was terminated after Step 2 (screening-level exposure estimate and risk calculation) with a recommendation for the collection of additional data (drainage ditch surface and subsurface soil).

### 2.4.2 Data Used in the Screening-Level Ecological Risk Assessment

The SERA used soil analytical data generated during the 1996 and 2006 RFIs. Field work associated with the Phase I RFI, conducted in 1996, consisted of a limited soil gas survey along the perimeter of the new/current fire training pit. A total of 50 sampling nodes were established and spaced along two concentric rings. The first ring was established three feet from the edge of the concrete apron, while the second ring was established at a distance of 10 feet from the edge of the apron. Each ring contained 25 sampling nodes. Each sampling node (generated by driving a metal pin one to two feet into the ground) was screened by inserting the tip of a PID and recording the results. A total of five surface soil samples were collected at the locations which exhibited the highest PID readings. The five surface soil samples (designated 14SS04 through 14SS08) were analyzed for Appendix IX volatile organic compounds (VOCs), SVOCs, PCBs, and TPH DRO and GRO. The Phase I RFI Report describing the findings of this investigation was submitted to the USEPA on July, 1, 1996 (Baker, 1996).

Field work associated with the full RFI, conducted in March 2006, included the collection of four surface soil samples (designated 14SB01-00, 14SB02-00, 14SB03-00, and 14SB07-00; collected at depth from 0 to 1 foot below ground surface (bgs), fourteen subsurface soil samples (designated 14SB01-06, 14SB01-11, 14SB02-03, 14SB02-08, 14SB03-06, 14SB03-11, 14SB04-01, 14SB04-10, 14SB05-02, 14SB05-09, 14SB06-01, 14SB06-07, 14SB07-06, and 14SB07-08; collected at various depths ranging from 1.5 to 3.0 feet bgs to 21.0 to 23.0 feet bgs), and three groundwater samples (designated 14TW01, 14TW02, and 14TW07). Each surface soil, subsurface soil, and groundwater sample was analyzed for Appendix IX VOCs, SVOCs, and metals, as well as TPH DRO and GRO.

Three subsurface soil samples (14SB04-01, 14SB05-09, and 14SB06-07) also were analyzed for dioxins/furans.

Analytical data for soil samples collected from the surface to a depth of one-foot bgs during the 1996 and 2006 RFIs were quantitatively evaluated as surface soil in the SERA. This depth range 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, subsurface soil samples were collected from various depth intervals during the 2006 RFI. Specific depth intervals sampled were 1.5 to 3.0 feet bgs, 3.5 to 5.0 feet bgs, 5.0 to 7.0 feet bgs, 11.0 to 13.0 feet bgs, 13.0 to 15.0 feet bgs, 15.0 to 17.0 feet bgs, 17.0 to 19.0 feet bgs, 19.0 to 21.0 feet bgs, and 21.0 to 23.0 feet below ground surface (bgs). Analytical data for soil samples collected from the 1.5 to 3.0-foot depth interval (14SB04-01 and 14SB06-01) were quantitatively evaluated as subsurface soil in the SERA. Analytical data for subsurface samples collected from deeper depth intervals were not evaluated since these depths are not likely to represent a significant exposure point for ecological receptors.

Analytical data for groundwater samples collected during the RFI field investigations were excluded from evaluation in the SERA for the following reasons (Baker, 2007):

- Groundwater does not represent an exposure point for ecological receptors.

- Depth to groundwater at the site ranges from 14.5 feet bgs (14TW01) to 17.4 feet bgs (14TW08). As such, groundwater expressions (e.g., seeps) are not likely present. Furthermore, based on the depth to groundwater, the various PEM1 wetland units contiguous to SWMU 14 do not likely represent groundwater discharge points.

- A likely discharge point for groundwater originating from the site is the Ensenada Honda, given that SWMU 14 is approximately 1.3 miles from the Ensenada Honda, any chemicals detected in groundwater would be expected to undergo significant attenuation prior to reaching this surface water body.

Because quantitative groundwater flow information is not available for SWMU 14, there is uncertainty associated with the exclusion of groundwater data from evaluation in the SERA. Therefore, the revised SERA will include a quantitative evaluation of groundwater data collected during the 2006 RFI field investigation.

The 1996 and 2006 RFI surface soil, subsurface soil, and groundwater sampling locations are depicted on Figure 2-2. The soil analytical data used in the SERA are provided as Appendix B, while groundwater analytical data are provided as Appendix C.

### 2.4.3 Screening-Level Ecological Risk Assessment Summary

The results of the SERA for SWMU 14 indicated that, based on a set of conservative exposure assumptions, there are multiple chemicals in surface and subsurface soil that may present risks to one or more receptors species/receptor groups (see Table 2-1). Under Navy policy, if the results of the Steps 1 and 2 (Tier 1 screening-level ERA) 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). Based on the presence of multiple chemicals in surface and subsurface soil that may present risks to one or more of the receptor species/receptor groups evaluated by the ERA, the SERA concluded that further evaluation in Step 3a is warranted. However, prior to proceeding to Step 3a, The SERA recommended that soil samples be collected from a drainage ditch that was historically connected to the original fire training pit to determine if a release of fluids associated with fire training operations has occurred. The drainage ditch terminates within a freshwater wetland (classified as a PEM1 by the Cowardin Wetland Classification System [Cowardin et al., 1979]). Soil samples were not collected from the drainage ditch, nor were surface water or sediment samples collected from the PEM1 wetland during previous field investigations (i.e., 1996 and 2006 RFIs). If analytical results indicate that site-related chemicals are present along the length of the ditch at ecologically important concentrations (i.e., concentrations that are greater than soil screening values and statistically elevated above background concentrations), additional sampling within the PEM1 wetland unit would be necessary to allow for an evaluation of potential risks associated with the surface water and sediment exposure pathways.

# 3.0 SCOPE OF INVESTIGATION

The additional investigation at SWMU 14 will consist of the following:

- Collection and analysis of surface and subsurface soil from seven locations within the drainage ditch historically connected to the original fire training pit.

- Collection and analysis of surface and subsurface soil from four drainage ways that originate in the town of Ceiba and are connected to the drainage ditch downgradient of the location of the original fire training pit. One location will be established within each drainage way. Analytical data for these four samples will indicate if drainage ditch soil quality is being impacted by off-site sources.

A sample matrix for this investigation is provided in Table 3-1. The various investigation elements are described in detail in the subsections that follow.

## 3.1 Soil Sampling and Analysis Program

Surface and subsurface soil samples will be collected at seven locations (14D-SB01 through 14D-SB07) within the drainage ditch historically connected to the original fire training pit. Surface and subsurface soil samples (14D-SB08 through 14D-SB11) also will be collected from four drainage ways that originate in the town of Ceiba and are connected to the drainage ditch downgradient of the location of the original training pit (one location will be established within each drainage way). Proposed drainage ditch and drainage way sample locations are depicted on Figure 3-1.

One surface soil sample (0 to 1 foot bgs) and one subsurface soil sample (1-2 feet bgs) will be collected at each location using stainless steel hand augers (see Standard Operating Procedure [SOP] F102 in Baker, 1995). For a given location and depth interval, soil will be composited in an aluminum pan using a stainless steel spoon prior to their distribution to appropriate sample containers. Samples will be collected using dedicated equipment (i.e., equipment will not be re-used). Each surface and subsurface sample will be analyzed for Appendix IX Low-level PAHs and total metals (see Table 3-1). Surface soil samples will additionally be analyzed for total organic carbon (TOC), and pH. In addition, the sample location established closest to the original fire training pit (14D-SB01) will be analyzed for dioxin/furan congeners. These chemical groups include the individual chemicals detected in SWMU 14 surface and/or subsurface soil at concentrations greater than soil screening values and/or at concentrations resulting in maximum exposure doses for upper trophic level receptors greater than ingestion-based screening values (see Table 2-1). The decision to limit the analysis of dioxin/furan chemicals to a single drainage ditch surface soil sample is based on the specific congeners that were detected in soil samples collected during the 2006 RFI field investigation. Two dioxin/furan chemicals (1,2,3,4,6,7,8-HpCDD and OCDD) were detected in a single subsurface soil sample (Baker, 2007). Hazard Quotient values greater than 1.0 for upper trophic level receptors can be attributed to the inclusion of non-detected congener results in the derivation of the 2,3,7,8-TCDD equivalent concentration (the maximum hazard quotient value using detected results is 0.27). It is noted that the drainage ditch surface soil sample that will be analyzed for dioxin/furan chemicals is located immediately downgradient from the location of the original fire training pit. Therefore, any release from the original fire training pit would be indicated by this sample.

The soil sample designations will be as follows. For example, one of the soil borings will be designated 14D-SB01. Extensions to the sample identification will reflect the depth at which the sample was obtained. Sample identification extensions will follow the pattern shown below.

14D-SB01-00 - 0 to 1 foot bgs (surface soil)
14D-SB01-01 - 1 to 2 feet bgs (subsurface soil)

Samples will be packed in ice and shipped next day air to the “fixed base” laboratory. At least one member of the field team will remain on the island until verification by the laboratory of receipt of all shipments. This will minimize any potential re-sampling costs associated with mobilization. Tracking numbers for each shipment will be forwarded to the project manager for assisting in verification of receipt.

All analysis at the laboratory will be performed using current methodologies as presented in Table 3-2. The specific laboratory and third party validator, as well as a certified licensed chemist from Puerto Rico, will be determined at a later date.

## 3.2 Quality Assurance/Quality Control Samples (QA/QC)

QA/QC requirements for the investigations are presented in the sections that follow and are identified within sample matrix presented in Table 3-3.

### 3.2.1 Trip Blanks

Trip blank samples will not be required to accompany the samples to the laboratory because the soil samples will not be analyzed for VOCs.

### 3.2.2 Equipment Rinsates

Equipment rinsate samples are collected from analyte-free water rinse of decontaminated equipment. Equipment rinsate blanks will be collected and submitted to a fixed-base analytical laboratory for analysis. The results from the blanks will be used to determine if the sampling equipment was free of contamination. The equipment rinsate samples are analyzed for the same parameters as the related samples.

It is anticipated that a minimum of three equipment rinsates will be collected. The proposed rate of equipment rinsate blank collection will be dependent on the number of field days, the sample count, and the various media collected as defined in EPA guidance. This guidance defines frequency as one sample per day per media or one sample per 20 individual media samples collected, whichever is more frequent. These samples will be associated with the surface and subsurface soil sampling equipment. The samples will be obtained from a bucket auger used for collection of surface and subsurface soil, as well as a stainless steel spoon and aluminum pan used to composite each soil sample prior to distribution to appropriate sample containers. These samples will be analyzed for the analytes presented in Table 3-3.

### 3.2.3 Field Blanks

Field blank samples consist of the source water used in equipment decontamination procedures. Since this field event will use disposable/dedicated sampling equipment, only one field blank will be collected and analyzed for the same parameters as the related samples. It is anticipated that one source of water (laboratory-grade de-ionized water) will be utilized for this investigation as shown in Table 3-3.

### 3.2.4 Field Duplicates

Field duplicate samples of the surface and subsurface soil will be collected during the same time the corresponding environmental sample is collected. One duplicate sample will be collected for every 10 environmental samples collected per media.

### 3.2.5 Matrix Spike/Matrix Spike Duplicates

Matrix Spike/Matrix Spike Duplicates (MS/MSDs) are laboratory derived and are collected to evaluate the matrix effect of the sample upon the analytical methodology. One MS/MSD will be collected for every 20 samples collected of a similar matrix. The sample matrices in the preceding paragraphs specified the collection and analysis of these samples.

## 3.3 Other Investigation Considerations

### 3.3.1 Utility Clearance

Fifteen days prior to the initiation of the proposed fieldwork, a digging permit request will be submitted by Baker to the Facility Management Transportation and Utility Division (FMTUD) of the Public Works Department at NAPR. All proposed soil borings locations will be cleared by the base utility department.

### 3.3.2 Investigation Derived Wastes

Investigation Derived Wastes (IDW) generated during the field investigation will only include miscellaneous items such as gloves and used personal protective equipment (PPE). No decontamination fluid IDW will be generated due to the use of dedicated sampling equipment. Soil cuttings from the sampling activities will be returned to the areas sampled. Items of PPE that have come in contact with potentially contaminated materials, such as disposable gloves, as well as dedicated sampling equipment (e.g., stainless steel spoons and aluminum pans) will be placed in garbage bags and disposed in trash dump boxes.

As stated, the use of dedicated equipment or materials negates the requirement of decontamination of any equipment or materials. As such, no IDW sampling or analysis will be required.

### 3.3.3 Decontamination

The use of dedicated equipment or materials negates the requirement of decontamination.

### 3.3.4 Surveying

All soil sampling locations have been pre-determined prior to entering the field and are presented on Figure 3-1. This figure will be loaded into a global positioning system (GPS) unit for locating purposes in the field. This methodology reduces the need for a surveyor to identify the sampling locations in the field. Any of the locations that may need to be field modified will be located utilizing the GPS unit.

### 3.3.5 Health and Safety Procedures

The health and safety procedures previously presented in the found in the RFI Management Plans (Baker, 1995) will be employed during this investigation.

### 3.3.6 Chain-of-Custody

Chain-of-Custody procedures will be followed to ensure a documented, traceable link between measurement results and the sample/parameter that they represent. These procedures are intended to provide a legally acceptable record of sample preparation, storage, and analysis.

To track sample custody transfers before ultimate disposition, sample custody will be documented using a similar chain-of-custody form as presented in the RFI Management Plans (Baker, 1995). A chain-of-custody form will be completed for each shipment in which the samples are shipped. After the samples are properly packaged, the shipping container will be sealed and prepared for shipment to the analytical laboratory.

## 4.0 REPORTING

The drainage ditch soil analytical data will be used to revise the SERA contained within the Final RFI Report (Baker, 2007). Existing surface and subsurface soil analytical data, as well as the drainage ditch analytical data also will be used to conduct Step 3a of the BERA. If the drainage ditch analytical data indicate that site-related chemicals are present along the length of the ditch at ecologically important concentrations (i.e., concentrations that are greater than soil screening values and statistically elevated above background concentrations), the revised ERA will include a recommendation for additional sampling activities within the PEM1 wetland unit to allow for an evaluation of potential risks associated with the surface water and sediment exposure pathways. Additionally, these data will be incorporated into the HHRA contained within the Final RFI Report. A brief overview of the methodology that will be used to revise the SERA and to conduct Step 3a of the BERA is presented within the Sections that follow. It is noted that detailed methodology for the SERA is not presented herein as the technical approach to revise the SERA will follow the methodology presented within the Final RFI Report (Baker, 2007).

### 4.1 Screening-Level Ecological Risk Assessment

As indicated above, the SERA will be revised to include a quantitative evaluation of drainage ditch soil and groundwater. For drainage ditch soil, this evaluation will involve a comparison of the surface and subsurface soil analytical data to the soil screening values listed in Table 4-1. USEPA ecological soil screening levels (Eco-SSLs) (documentation is available at http://www.epa.gov/ecotox/ecossl/) for terrestrial plants and invertebrates will be preferentially used as soil screening values. For a given chemical, if an Eco-SSL is available for both receptor groups, the lowest value will be selected as the soil screening value. For those chemicals lacking terrestrial plant and invertebrate Eco-SSLs, the literature-based toxicological benchmarks listed below will be used as soil screening values.

- Toxicological thresholds for earthworms and microorganisms (Efroymson et al., 1997a)
- Toxicological thresholds for plants (Efroymson et al., 1997b)

If more than one toxicological benchmark is available for a given chemical from Efroymson et al. (1997a and 1997b), the lowest value will be selected as the soil screening value. For those chemicals lacking an Eco-SSL or a toxicological threshold from Efroymson et al. (1997a and 1997b), the following literature-based values, listed in their order of decreasing preference, will be used as soil screening values:

- Toxicity reference values for plants and invertebrates listed in USEPA (1999).
- Soil standards developed by the Ministry of Housing, Spatial Planning and Environment (MHSPE, 2000), assuming a minimum default soil organic carbon content of 2.0 percent.
- Canadian soil quality guidelines (agricultural land use) developed by the Canadian Council of Ministers of the Environment (CCME, 2006).

CCME soil quality guidelines will be given the lowest preference since many are background-based interim guidelines that do not represent effect-based concentrations.

The drainage ditch soil analytical data also will be evaluated for terrestrial food web exposures using the methodology presented in the Final RFI Report (Baker, 2007). The ingestion-based screening values that will be used in the derivation of upper trophic level risk estimates are summarized in Table 4-2.

As discussed in Section 2.4.2, available ground water data were not quantitatively evaluated in the SERA. However, as part of the SERA revisions, a quantitative evaluation will be conducted. Based on the proximity of SWMU 14 to various freshwater wetland units (including the PEM1 wetland unit historically connected to the original fire training pit), the groundwater analytical data will be compared to freshwater toxicological benchmarks identified from the literature sources presented and discussed below.

Chronic freshwater National Ambient Water Quality Criteria (NAWQC) (USEPA, 2006; available at http://www.epa.gov/waterscience/criteria/wqcriteria.html) will be used as groundwater screening values. USEPA NAWQC for arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc are expressed as dissolved concentrations. As a measure of conservatism, they will be converted to total recoverable concentrations using the appropriate conversion factors (USEPA, 2006). For those chemicals lacking a freshwater NAWQC, groundwater screening values will be identified from the following information listed in their order of decreasing preference:

- Final Chronic Values (FCVs) for freshwater contained in Ecotox Thresholds (USEPA, 1996a)
- Secondary Chronic Values (SCVs) developed by the USEPA (1996a) and Suter II (1996)
- Chronic screening values for freshwater contained in Ecological Risk Assessment Bulletins – Supplement to Risk Assessment Guidelines (RAGS) (USEPA, 2001)
- Minimum chronic toxicity test endpoints (No Observed Effect Concentration [NOEC], No Observed Effect Level [NOEL], and Maximum Acceptable Toxicant Concentration [MATC] values) for freshwater species reported in the ECOTOX Database System (Aquatic Toxicity Information Retrieval [AQUIRE] database) (USEPA, 2003)
- Chronic Lowest Observable Effect Levels (LOELs) for freshwater contained in National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQUIRTs) (Buchman, 1999)

The order of preference was selected based on their level of protection. For example, FCVs would be expected to offer a greater degree of protection than a single species NOEC, MATC, or LOEL since their derivation considers a larger toxicological database. In the absence of the above-mentioned FCVs, USEPA Region IV chronic screening values, chronic test endpoints, and chronic LOELs, screening values will be derived from the acute literature values listed below:

- Acute LOELs for freshwater contained in NOAA SQUIRTs (Buchman, 1999)
- 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 freshwater species contained in the ECOTOX Database System (AQUIRE database) (USEPA, 2003)
- $LC_{50}$ values for freshwater species contained in Superfund Chemical Matrix (USEPA, 1996b)

Chronic-based screening values will be extrapolated from acute NOEC, NOEL, LOEC, LOEL, $LC_{50}$, and $EC_{50}$ values as follows:

- An uncertainty factor of 10 will be used to convert an acute NOEC, NOEL, LOEC, or LOEL to a chronic-based screening value

- An uncertainty factor of 100 will be used to convert an $EC_{50}$ or $LC_{50}$ to a chronic-based screening value

When acute toxicity data are used to extrapolate a chronic screening value, NOECs/NOELs will be given preference over LOECs/LOELs, LOECs/LOELs will be given preference over $LC_{50}$ and $EC_{50}$ values, and $EC_{50}$ values will be given preference over $LC_{50}$ values. When more than one value is available from the literature for a given test endpoint (e.g., NOEC), the minimum value will be conservatively used to extrapolate a chronic screening value. In some cases, chronic and acute LOELs for chemical classes (e.g., PAHs) are available from Buchman (1999). A LOEL based on a chemical class will be used to derive a chronic screening value only if that chemical lacked literature-based benchmarks and/or toxicity test endpoints.

## 4.2 Step 3a of the Baseline Ecological Risk Assessment

In Step 3a, the conservative assumptions employed in the SERA (Tier 1 of the Navy ERA process) will be refined and risk estimates will be recalculated using the same conceptual model. Step 3a will include consideration of background data and chemical bioavailability.

The specific assumptions, parameters, and methods that will be modified for the recalculation of media-specific and food web risk estimates are identified below, along with justification for each modification. These refinements and methods will be used in Step 3a of the BERA to weigh the evidence of potential risk for each ecological chemical of potential concern (COPC) identified for each media and receptor to determine whether additional evaluation (i.e., Step 3b of the Navy ERA process; see Figure 2-1) is warranted.

- Refined risk estimates will be derived using average (arithmetic mean) chemical concentrations. For individual receptor species, average chemical 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. Average 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, evaluation of the average exposure case is more indicative of the level of impact that might be expected at the *population* level.

- Literature-based bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) based on, or modeled from, central tendency estimates (e.g., mean, median, midpoint) will be used in place of maximum or high-end (e.g., 90th percentile) estimates. An assumed BCF/BAF of 1.0 will still used for those chemicals lacking a literature-based BAF/BCF. The refined BCFs and BAFs for those chemicals carried into Step 3a of the baseline ERA will be summarized in tables.

- Central tendency estimates (e.g., mean, median, midpoint) for body weight and food ingestion rate will be used to develop exposure estimates for upper trophic level receptors rather than the minimum body weights and maximum food ingestion rates used in the screening-level ERA. 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 will still assume an area use factor (AUF) of 1.0.

- In addition to the no observed adverse effect level (NOAEL)-based risk estimates used in the screening-level ERA, consideration also will given to food web exposure risk estimates based on lowest observed adverse effect levels (LOAELs) and MATCs.

- Consideration will be given to available background data by statistically comparing site concentrations to background concentrations in accordance with Navy guidance ( NFESC, 2002 and 2004). The process that will be used to statistically evaluate data is depicted on Figure 4-1. As evidenced by the figure, statistical comparisons will include descriptive summaries of each data set (maximum, minimum, and mean concentrations), statistical tests on the mean/median of the distributions (i.e., student's t-test, Wilcoxin rank sum test, Gehan test, and Satterthwaite's t-test), and statistical tests on the right tail of the distributions (i.e., quantile test and/or slippage test). The significance level (the probability criteria for rejecting the null hypotheses that data sets were sampled from the same population) will be set at 0.05 for all statistical tests (NFESC, 2002 and 2004). For a given medium, the background data to be used in the statistical evaluation will be the background data set presented and discussed within the *Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds* (Baker, 2006).

- As exposure does not necessarily equate to risk, consideration will be given to site-specific factors that can affect the bioavailability of chemicals.

- 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 evaluated in Step 3a of the baseline ERA since a conclusion of no unacceptable risk can be made with high confidence.

## 5.0 SCHEDULE

A schedule for the implementation of this work plan and revision of the Final RFI Report is provided as Figure 5-1.

## 6.0 SITE MANAGEMENT

An organization chart presenting the proposed staffing for this project is provided on Figure 6-1. This section also outlines the responsibilities and reporting requirements of field personnel and staff.

### 6.1 Project Team Responsibilities

Mr. Mark Kimes, P.E, Activity Coordinator for all work in Puerto Rico, will manage the Baker Project Team. His responsibilities will be to direct the technical performance of the project staff, costs and schedule, ensuring that QA/QC procedures are followed during the course of the project. He will maintain communication with the BRAC PMO SE Navy Technical Representative (NTR), Mr. Mark Davidson. Mr. John Mentz will administer overall QA/QC for this project.

The field portion of this project will consist of one field team managed by the Geologist, Mr. Joe Burawa. Mr. Burawa's responsibilities will include direction of the Baker field team and subcontractors. Mr. John Malinowski will direct the reporting effort associated with the field investigation, ensuring that all necessary staffing is utilized to assist in the revisions to the Final RFI Report.

### 6.2 Field Reporting Requirements

The Geologist will maintain a daily summary of each day's field activities. The following information will be included in this summary:

- Baker and subcontractor personnel on site
- Major activities of the day
- Samples collected
- Problems encountered
- Other pertinent site information

The Geologist will receive direction from the Project Manager regarding any changes in the scope of the investigation.

## 7.0 REFERENCES

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# TABLES

## TABLE 2-1

## SUMMARY OF SCREENING-LEVEL RISK CALCULATION
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## ADDITIONAL DATA COLLECTION WORK PLAN
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| Ecological Chemical of Potential Concern | Lower Trophic Level Receptors | | Upper Trophic Level Receptors (1) | |
|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil |
| **Volatiles** | | | | |
| 1,1,1,2-Tetrachloroethane | | HQ = 2.20 | No SV | No SV |
| 1,1,1-Trichloroethane (TCA) | | HQ = 2.20 | | |
| 1,1,2,2-Tetrachloroethane | | HQ = 2.20 | | |
| 1,1,2-Trichloroethane | | HQ = 2.20 | | |
| 1,1-Dichloroethane | | HQ = 2.20 | | |
| 1,1-Dichloroethene | | HQ = 2.20 | | |
| 1,2,3-Trichloropropane | No SSV | No SSV | | |
| 1,2-Dibromo-3-chloropropane (DBCP) | No SSV | No SSV | | |
| 1,2-Dibromoethane (EDB) | | HQ = 2.20 | | |
| 1,2-Dichloroethane | | | | |
| 1,2-Dichloroethene (trans) | | HQ = 2.20 | | |
| 1,2-Dichloropropane | | | | |
| 1,3-Dichloropropene (cis) | | HQ = 2.20 | | |
| 1,3-Dichloropropene (trans) | | HQ = 2.20 | | |
| 1,4-Dichloro-2-butene (trans) | | | | |
| 2-Butanone (MEK) | No SSV | No SSV | | |
| 2-Chloro-1,3-butadiene (Chloroprene) | No SSV | No SSV | | |
| 2-Hexanone (MBK) | No SSV | No SSV | | |
| 3-Chloropropene (Allyl Chloride) | No SSV | No SSV | | |
| 4-Methyl-2-pentanone (MIBK) | No SSV | No SSV | | |
| Acetone | No SSV | No SSV | | |
| Acetonitrile | No SSV | No SSV | | |
| Acrolein | No SSV | No SSV | | |
| Acrylonitrile | | | | |
| Benzene | | HQ = 2.10 | | |
| Bromodichloromethane | No SSV | No SSV | | |
| Bromoform | No SSV | No SSV | | |
| Bromomethane | No SSV | No SSV | | |
| Carbon Disulfide | No SSV | No SSV | | |
| Carbon Tetrachloride | | | No SV | No SV |
| Chlorobenzene | | | No SV | No SV |
| Chloroethane | No SSV | No SSV | | |
| Chloroform | | | No SV | No SV |
| Chloromethane | No SSV | No SSV | | |
| Dibromochloromethane | No SSV | No SSV | | |
| Dibromomethane | No SSV | No SSV | | |
| Dichlorodifluoromethane (Freon-12) | No SSV | No SSV | | |
| Ethyl Methacrylate | No SSV | No SSV | | |
| Ethylbenzene | | | No SV | No SV |
| Iodomethane | No SSV | No SSV | | |
| Isobutyl Alcohol | No SSV | No SSV | | |
| Methyl Acrylonitrile | No SSV | No SSV | | |

**TABLE 2-1**

**SUMMARY OF SCREENING-LEVEL RISK CALCULATION**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Ecological Chemical of Potential Concern | Lower Trophic Level Receptors | | Upper Trophic Level Receptors (1) | |
|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil |
| **Volatiles (continued)** | | | | |
| Methyl Methacrylate | No SSV | No SSV | | |
| Methylene Chloride | | | | |
| Pentachloroethane | No SSV | No SSV | No SV | No SV |
| Propionitrile (Ethyl Cyanide) | No SSV | No SSV | | |
| Styrene (Ethenylbenzene) | | | No SV | No SV |
| Tetrachloroethene (PCE) | | | | |
| Toluene | | | No SV | No SV |
| Trichloroethene (TCE) | | | No SV | No SV |
| Trichlorofluoromethane | No SSV | No SSV | | |
| Vinyl Acetate | No SSV | No SSV | | |
| Vinyl Chloride | HQ = 1.09 | HQ =20.00 | | |
| Xylenes, total | | | | |
| **Semivolatiles** | | | | |
| 1,2,4,5-Tetrachlorobenzene | HQ = 8.40 | HQ = 8.00 | No SV | No SV |
| 1,2,4-Trichlorobenzene | | | No SV | No SV |
| 1,2-Dichlorobenzene (o-) | | | | |
| 1,3,5-Trinitrobenzene | HQ = 82.00 | HQ = 8.00 | | |
| 1,3-Dichlorobenzene (m-) | | | | |
| 1,3-Dinitrobenzene (m-) | No SSV | No SSV | | |
| 1,4-Dichlorobenzene (p-) | | | | |
| 1,4-Dioxane (p-) | No SSV | No SSV | | |
| 1,4-Naphthoquinone | No SSV | No SSV | | |
| 1,4-Phenylenediamine | No SSV | No SSV | | |
| 1-Naphthylamine | No SSV | No SSV | | |
| 2,3,4,6-Tetrachlorophenol | | | No SV | No SV |
| 2,4,5-Trichlorophenol | | | No SV | No SV |
| 2,4,6-Trichlorophenol | | | No SV | No SV |
| 2,4-Dichlorophenol | | | No SV | No SV |
| 2,4-Dimethylphenol | HQ = 4.20 | HQ = 4.00 | | |
| 2,4-Dinitrophenol | | | | |
| 2,4-Dinitrotoluene | No SSV | No SSV | | |
| 2,6-Dichlorophenol | | | | |
| 2,6-Dinitrotoluene | No SSV | No SSV | | |
| 2-Acetylaminofluorene | No SSV | No SSV | No SV | No SV |
| 2-Chloronaphthalene | No SSV | No SSV | No SV | No SV |
| 2-Chlorophenol | | | | |
| 2-Methylphenol (o-Cresol) | HQ = 4.20 | HQ = 4.00 | | |
| 2-Naphthylamine | No SSV | No SSV | | |
| 2-Nitroaniline | No SSV | No SSV | | |
| 2-Nitrophenol | | | | |
| 2-Picoline | No SSV | No SSV | | |
| 3,3'-Dichlorobenzidine | No SSV | No SSV | No SV | No SV |
| 3,3'-Dimethylbenzidine | No SSV | No SSV | No SV | No SV |

**TABLE 2-1**

**SUMMARY OF SCREENING-LEVEL RISK CALCULATION**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Ecological Chemical of Potential Concern | Lower Trophic Level Receptors | | Upper Trophic Level Receptors (1) | |
|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil |
| **Semivolatiles (continued)** | | | | |
| 3-Methylcholanthrene | No SSV | No SSV | No SV | No SV |
| 3-Methylphenol (m-Cresol) | No SSV | No SSV | | |
| 3-Nitroaniline | No SSV | No SSV | | |
| 4,6-Dinitro-2-methylphenol | No SSV | No SSV | | |
| 4-Aminobiphenyl | No SSV | No SSV | | |
| 4-Bromophenyl-phenylether | No SSV | No SSV | No SV | No SV |
| 4-Chloro-3-methylphenol | No SSV | No SSV | No SV | No SV |
| 4-Chloroaniline | No SSV | No SSV | | |
| 4-Chlorophenyl-phenylether | No SSV | No SSV | No SV | No SV |
| 4-Dimethylaminoazobenzene (p-) | No SSV | No SSV | | |
| 4-Methylphenol (p-Cresol) | No SSV | No SSV | | |
| 4-Nitroaniline | No SSV | No SSV | | |
| 4-Nitrophenol | | | | |
| 4-Nitroquinoline-1-Oxide | No SSV | No SSV | | |
| 5-Nitro-o-toluidine | No SSV | No SSV | | |
| 7,12-Dimethylbenz(a)anthracene | No SSV | No SSV | No SV | No SV |
| a,a-Dimethylphenethylamine | No SSV | No SSV | | |
| Acetophenone | No SSV | No SSV | | |
| Aniline | No SSV | No SSV | | |
| Aramite | No SSV | No SSV | No SV | No SV |
| Benzyl Alcohol | No SSV | No SSV | | |
| Bis(2-chloroethoxy)methane | No SSV | No SSV | | |
| Bis(2-chloroisopropyl)ether | No SSV | No SSV | | |
| Bis(2-chloroethyl)ether | No SSV | No SSV | | |
| Bis(2-ethylhexyl) Phthalate (BEHP) | | | | |
| Butyl Benzyl Phthalate | | | No SV | No SV |
| Diallate (cis) | No SSV | No SSV | No SV | No SV |
| Diallate (trans) | No SSV | No SSV | | |
| Dibenzofuran | No SSV | No SSV | No SV | No SV |
| Diethyl Phthalate (DEP) | | | No SV | No SV |
| Dimethyl Phthalate | | | | |
| Di-n-butyl Phthalate (DBP) | | | | |
| Di-n-octyl Phthalate | | | | |
| Dinoseb | No SSV | No SSV | No SV | No SV |
| Ethyl Methanesulfonate (EMS) | No SSV | No SSV | | |
| Hexachlorobenzene | | | | |
| Hexachlorobutadiene | No SSV | No SSV | | |
| Hexachlorocyclopentadiene | | | No SV | No SV |
| Hexachloroethane | No SSV | No SSV | No SV | No SV |
| Hexachlorophene | No SSV | No SSV | No SV | No SV |
| Hexachloropropene | No SSV | No SSV | | |
| Isophorone | No SSV | No SSV | | |
| Isosafrole | No SSV | No SSV | No SV | No SV |

**TABLE 2-1**

**SUMMARY OF SCREENING-LEVEL RISK CALCULATION**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Ecological Chemical of Potential Concern | Lower Trophic Level Receptors | | Upper Trophic Level Receptors (1) | |
|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil |
| **Semivolatiles (continued)** | | | | |
| Methapyrilene | No SSV | No SSV | | |
| Methyl Methane Sulfonate | No SSV | No SSV | | |
| Nitrobenzene | No SSV | No SSV | | |
| n-Nitrosodiethylamine | | | | |
| n-Nitrosodimethylamine | | | | |
| n-Nitroso-di-n-butylamine | | | | |
| n-Nitrosodi-n-propylamine | | | | |
| n-Nitrosodiphenylamine | | | No SV | No SV |
| n-Nitrosomethylethylamine | | | | |
| n-Nitrosomorpholine | No SSV | No SSV | | |
| n-Nitrosopiperidine | No SSV | No SSV | | |
| n-Nitrosopyrrolidine | No SSV | No SSV | | |
| o-Toluidine | No SSV | No SSV | | |
| Pentachlorobenzene | | | No SV | No SV |
| Pentachloronitrobenzene | No SSV | No SSV | | |
| Pentachlorophenol | HQ = 1.21 | | | |
| Phenacetin | No SSV | No SSV | | |
| Phenol | | | | |
| Pronamide | No SSV | No SSV | No SV | No SV |
| Pyridine | No SSV | No SSV | | |
| Safrole | No SSV | No SSV | | |
| **PAHs** | | | | |
| 1-Methylnaphthalene | | | | |
| 2-Methylnaphthalene | | HQ = 1.42 | | |
| Acenaphthene | | | | |
| Acenaphthylene | | | | |
| Anthracene | | | | |
| Benzo(a)anthracene | HQ = 2.83 | | | |
| Benzo(a)pyrene (BaP) | HQ = 4.17 | | | |
| Benzo(b)fluoranthene | HQ = 6.33 | | | |
| Benzo(g,h,i)perylene | HQ = 3.00 | | | |
| Benzo(k)fluoranthene | HQ = 2.00 | | | |
| Chrysene | HQ = 3.17 | | | |
| Dibenz(a,h)anthracene | | | | |
| Fluoranthene | | | | |
| Fluorene | | | | |
| Indeno(1,2,3-cd)pyrene | HQ = 3.17 | | | |
| Naphthalene | | | | |
| Phenanthrene | | | | |
| Pyrene | | | | |

**TABLE 2-1**

**SUMMARY OF SCREENING-LEVEL RISK CALCULATION**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Ecological Chemical of Potential Concern | Lower Trophic Level Receptors | | Upper Trophic Level Receptors [1] | |
|---|---|---|---|---|
| | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil |
| **PCBs** | | | | |
| Aroclor-1016 | | | | |
| Aroclor-1221 | | | | |
| Aroclor-1232 | | | | |
| Aroclor-1242 | | | | |
| Aroclor-1248 | | | | |
| Aroclor-1254 | | | | |
| Aroclor-1260 | | | | |
| **Dioxins/Furans** | | | | |
| Total dioxin/furan (TEQ) | --- | | --- | HQ = 58.15 |
| **Inorganics** | | | | |
| Antimony | | | | |
| Arsenic | | | | |
| Barium | | | | |
| Beryllium | | | No SV | No SV |
| Cadmium | | | HQ = 3.21 | HQ = 2.01 |
| Chromium | HQ = 187.75 | HQ = 79.75 | HQ = 17.35 | HQ = 7.37 |
| Cobalt | HQ = 3.61 | HQ = 1.88 | HQ = 2.51 | HQ = 1.31 |
| Lead | HQ = 1.71 | | HQ = 9.09 | HQ = .4.24 |
| Mercury | | | HQ = 18.23 | HQ = 4.50 |
| Nickel | | | | |
| Selenium | HQ = 4.70 | HQ = 1.10 | HQ = 5.82 | HQ = 1.36 |
| Silver | | | | |
| Thallium | | | | |
| Vanadium | HQ = 161.50 | HQ = 89.00 | | |
| Zinc | HQ = 1.76 | HQ = 1.52 | HQ = 5.67 | HQ = 4.90 |

**Notes:**

Shaded cell indicates that the chemical was detected; Blank cells indicate acceptable risk (maximum HQ < 1.0)
--- = Chemical was not analyzed for
HQ = Hazard Quotient
SSV = Soil Screening Value
SV = Ingestion-Based Screening Value
(1) For a given chemical, the hazard quotient value shown is for the most sensitive upper trophic level receptor.

# TABLE 3-1

## SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## ADDITIONAL DATA COLLECTION WORK PLAN
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | | Fixed Based Analytical Lab Analysis | | | | |
|---|---|---|---|---|---|---|
| **Media** | **Sample Depth (ft bgs)** | App IX Low Level PAHs | Appendix IX Dioxins/Furans | App IX Metals | TOC and pH | **Comment** |
| **Surface Soil Samples** | | | | | | |
| 14D-SB01-00 | 0.0 - 1.0 | X | X | X | X | |
| 14D-SB02-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB02-00D | 0.0 - 1.0 | X | | X | | Duplicate |
| 14D-SB02-00MS/MSD | 0.0 - 1.0 | X | | X | | Matrix Spike/Matrix Spike Duplicate |
| 14D-SB03-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB04-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB05-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB06-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB07-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB08-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB09-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB10-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB11-00 | 0.0 - 1.0 | X | | X | X | |
| 14D-SB11-00D | 0.0 - 1.0 | X | | X | | Duplicate |
| **Subsurface Soil Samples** | | | | | | |
| 14D-SB01-01 | 1.0-2.0 | X | | X | | |
| 14D-SB02-01 | 1.0-2.0 | X | | X | | |
| 14D-SB03-01 | 1.0-2.0 | X | | X | | |
| 14D-SB04-01 | 1.0-2.0 | X | | X | | |
| 14D-SB05-01 | 1.0-2.0 | X | | X | | |
| 14D-SB06-01 | 1.0-2.0 | X | | X | | |
| 14D-SB07-01 | 1.0-2.0 | X | | X | | |
| 14D-SB08-01 | 1.0-2.0 | X | | X | | |
| 14D-SB09-01 | 1.0-2.0 | X | | X | | |
| 14D-SB09-01D | 1.0-2.0 | X | | X | | Duplicate |
| 14D-SB09-01MS/MSD | 1.0-2.0 | X | | X | | Matrix Spike/Matrix Spike Duplicate |
| 14D-SB10-01 | 1.0-2.0 | X | | X | | |
| 14D-SB11-01 | 1.0-2.0 | X | | X | | |

**Notes:**
ft bgs - feet below ground surface.
TOC = Total Organic Carbon

## TABLE 3-2

## METHOD PERFORMANCE LIMITS
## APPENDIX IX COMPOUND LIST AND CONTRACT
## REQUIRED QUANTITATION LIMITS (CRQL)
## ADDITIONAL DATA COLLECTION WORK PLAN - SWMU 14
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| 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 |
| 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 |
| **Dioxins/Furans** | **Quantitation Limits*** | | **Method Number (Description)** |
| | **Water (ng/L)** | **Low Soil (ng/g)** | |
| **Dioxins** | | | |
| 2,3,7,8-TCDD | 5.0 | 0.5 | 8280A |
| 1,2,3,7,8-PeCDD | 12.5 | 1.25 | 8280A |
| 1,2,3,4,7,8-HxCDD | 12.5 | 1.25 | 8280A |
| 1,2,3,6,7,8-HxCDD | 25.0 | 2.5 | 8280A |
| 1,2,3,7,8,9-HxCDD | 12.5 | 1.25 | 8280A |
| 1,2,3,4,6,7,8-HpCDD | 12.5 | 1.25 | 8280A |
| OCDD | 25.0 | 2.5 | 8280A |
| **Furans** | | | |
| 2,3,7,8-TCDF | 5.0 | 0.5 | 8280A |
| 1,2,3,7,8-PeCDF | 12.5 | 1.25 | 8280A |
| 2,3,4,7,8-PeCDF | 12.5 | 1.25 | 8280A |
| 1,2,3,4,7,8-HxCDF | 12.5 | 1.25 | 8280A |
| 1,2,3,6,7,8-HxCDF | 12.5 | 1.25 | 8280A |
| 2,3,4,6,7,8-HxCDF | 12.5 | 1.25 | 8280A |
| 1,2,3,7,8,9-HxCDF | 12.5 | 1.25 | 8280A |
| 1,2,3,4,6,7,8-HpCDF | 12.5 | 1.25 | 8280A |
| 1,2,3,4,7,8,9-HpCDF | 12.5 | 1.25 | 8280A |
| OCDF | 25.0 | 2.5 | 8280A |

* 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.
ng/L - nanograms per liter
ng/g - nanograms per gram

**TABLE 3-2**

**METHOD PERFORMANCE LIMITS**
**APPENDIX IX COMPOUND LIST AND CONTRACT**
**REQUIRED QUANTITATION LIMITS (CRQL)**
**ADDITIONAL DATA COLLECTION WORK PLAN - SWMU 14**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Inorganics | Method Number | Quantitation Limits* Water (μg/L) | Low Soil (mg/kg) | Method Description |
|---|---|---|---|---|
| Antimony | 6020 | 2.5 | 0.5 | Inductively Coupled Plasma |
| Arsenic | 6020 | 2.5 | 0.5 | Inductively Coupled Plasma |
| Barium | 6020 | 5 | 1.0 | Inductively Coupled Plasma |
| Beryllium | 6020 | 0.5 | 0.1 | Inductively Coupled Plasma |
| Cadmium | 6020 | 0.5 | 0.1 | Inductively Coupled Plasma |
| Chromium | 6020 | 5 | 1.0 | Inductively Coupled Plasma |
| Cobalt | 6020 | 0.5 | 0.1 | Inductively Coupled Plasma |
| Copper | 6020 | 2.5 | 0.5 | Inductively Coupled Plasma |
| Lead | 6020 | 1.5 | 0.3 | Inductively Coupled Plasma |
| Mercury | 7470A/7471A | 0.5 | 0.10 | Cold Vapor AA |
| Nickel | 6020 | 1 | 0.2 | Inductively Coupled Plasma |
| Selenium | 6020 | 2.5 | 0.5 | Inductively Coupled Plasma |
| Silver | 6020 | 1 | 0.2 | Inductively Coupled Plasma |
| Thallium | 6020 | 1 | 0.2 | Inductively Coupled Plasma |
| Tin | 6020 | 5 | 10.0 | Inductively Coupled Plasma |
| Vanadium | 6020 | 5 | 1.0 | Inductively Coupled Plasma |
| Zinc | 6020 | 20 | 4.0 | Inductively Coupled Plasma |

**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.
mg/kg - milligrams per kilogram.

Revised: November 9, 2007

**TABLE 3-3**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM: QA/QC SAMPLES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | Analysis Requested | | | |
|---|---|---|---|---|
| **Media** | App IX Low Level PAHs | App IX Metals (Total) | Dioxins/Furans | **Comment** |
| **Equipment Rinsate Samples** | | | | |
| 14D-ER01 | X | X | | Stainless Steel Spoon |
| 14D-ER02 | X | X | | Bucket Auger |
| 14D-ER03 | X | X | | Aluminum Pie Pan |
| **Field Blank Samples** | | | | |
| 14D-FB01 | X | X | | Lab Grade Deionized Water |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Soil Screening Value | Reference | Comment |
|---|---|---|---|
| **Volatile Organics (ug/kg):** | | | |
| 1,1,1,2-Tetrachloroethane | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,1,1-Trichloroethane | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,1,2,2-Tetrachloroethane | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,1,2-Trichloroethane | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,1-Dichloroethane | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,1-Dichloroethene | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,2,3-Trichloropropane | NA | --- | --- |
| 1,2-Dibromo-3-chloropropane | NA | --- | --- |
| 1,2-Dibromoethane (EDB) | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 1,2-Dichloroethane | 402 (1) | MHSPE 2000 | --- |
| 1,2-Dichloropropane | 700,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| 2-Butanone (Methyl ethyl ketone) | NA | --- | --- |
| 2-Hexanone | NA | --- | --- |
| 3-Chloropropene (Allyl chloride) | NA | --- | --- |
| 4-Methyl-2-pentanone (MIBK) | NA | --- | --- |
| Acetone | NA | --- | --- |
| Acetonitrile | NA | --- | --- |
| Acrolein (Propenal) | NA | --- | --- |
| Acrylonitrile | 1,000,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Benzene | 101 (1) | MHSPE 2000 | --- |
| Bromodichloromethane | NA | --- | --- |
| Bromoform | NA | --- | --- |
| Bromomethane (Methyl bromide) | NA | --- | --- |
| Carbon disulfide | NA | --- | --- |
| Carbon tetrachloride | 1,000,000 | Efroymson et al. 1997a | Toxicological threshold for microbial processes |
| Chlorobenzene | 40,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Chloroethane | NA | --- | --- |
| Chloroform | 1,002 (1) | MHSPE 2000 | --- |
| Chloromethane (Methyl chloride) | NA | --- | --- |
| Chloroprene | NA | --- | --- |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Soil Screening Value | Reference | Comment |
|---|---|---|---|
| **Volatile Organics (ug/kg):** | | | |
| cis-1,3-Dichloropropene | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| Dibromochloromethane | NA | --- | --- |
| Dibromomethane (Methylene bromide) | NA | --- | --- |
| Dichlorodifluoromethane | NA | --- | --- |
| Ethylbenzene | 5,003 (1) | MHSPE 2000 | --- |
| Ethyl methacrylate | NA | --- | --- |
| Iodomethane (Methyl iodide) | NA | --- | --- |
| Isobutanol (Isobutyl alcohol) | NA | --- | --- |
| Methacrylonitrile | NA | --- | --- |
| Methylene chloride (Dichloromethane) | 1,004 (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 | --- |
| 1,2-Dichloroethene (total) | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| trans-1,2-Dichloroethene | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| trans-1,3-Dichloropropene | 100 | CCME 2006 | 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 microbial processess |
| Trichloroethene | 6,010 (1) | MHSPE 2000 | --- |
| Trichlorofluoromethane | NA | --- | --- |
| Vinyl acetate | NA | --- | --- |
| Vinyl chloride | 11.0 (1) | MHSPE 2000 | --- |
| Xylene | 2,501 (1) | MHSPE 2000 | --- |
| **Semi-Volatile Organics (ug/kg):** | | | |
| 1,2,4,5-Tetrachlorobenzene | 50.0 | CCME 2006 | 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-Dichlorobenzene (m-Dichlorobenzene) | 3,003 (1) | MHSPE 2000 | Value for total chlorobenzenes (2) |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Soil Screening Value | Reference | Comment |
|---|---|---|---|
| **Semi-Volatile Organics (ug/kg):** | | | |
| 1,4-Dichlorobenzene (p-Dichlorobenzene) | 20,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| 1,4-Dioxane | NA | --- | --- |
| 1,4-Naphthoquinone | NA | --- | --- |
| 1,4-Phenylenediamine (p-phenylenediamine) | NA | --- | --- |
| 1-Naphthylamine | 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 |
| 2,2'-Oxybis(1-chloropropane) | NA | --- | --- |
| 2,4-Dichlorophenol | 1,001 (1) | MHSPE 2000 | Value for total chlorophenols (3) |
| 2,4-Dimethylphenol | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| 2,4-Dinitrophenol | 20,000 | Efroymson et al. 1997b | Toxicological threshold for plants |
| 2,6-Dichlorophenol | 1,001 (1) | MHSPE 2000 | Value for total chlorophenols (3) |
| 2-Acetylaminofluorene | NA | --- | --- |
| 2-Chloronaphthalene | NA | --- | --- |
| 2-Chlorophenol | 1,001 (1) | MHSPE 2000 | Value for total chlorophenols (3) |
| 2-Naphthylamine | NA | --- | --- |
| 2-Nitroaniline (o-Nitroaniline) | NA | --- | --- |
| 2-Nitrophenol (o-Nitrophenol) | 7,000 | --- | Value for 4-nitrophenol used as a surrogate |
| 2-Picoline | NA | --- | --- |
| 3,3'-Dichlorobenzidine | NA | --- | --- |
| 3,3'-Dimethylbenzidine | NA | --- | --- |
| 3-Methylcholanthrene | NA | --- | --- |
| 3-Nitroaniline (m-Nitroaniline) | NA | --- | --- |
| 4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol) | NA | --- | --- |
| 4-Aminobiphenyl | NA | --- | --- |
| 4-Bromophenylphenyl ether | NA | --- | --- |
| 4-Chloro-3-methylphenol | NA | --- | --- |
| 4-Chloroaniline | NA | --- | --- |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Soil Screening Value | Reference | Comment |
|---|---|---|---|
| **Semi-Volatile Organics (ug/kg):** | | | |
| 4-Chlorophenylphenyl ether | NA | --- | --- |
| 4-Nitroaniline (p-Nitroaniline) | NA | --- | --- |
| 4-Nitrophenol (p-nitrophenol) | 7,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| 4-Nitroquinoline-1-oxide | NA | --- | --- |
| 5-Nitro-o-toluidine | NA | --- | --- |
| 7,12-Dimethylbenz(a)anthracene | NA | --- | --- |
| Acetophenone | NA | --- | --- |
| A,A-Dimethylphenethylamine | NA | --- | --- |
| Aniline | NA | --- | --- |
| Aramite | NA | --- | --- |
| 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) |
| Butylbenzylphthalate | 6,010 (1) | MHSPE 2000 | Value for total phthalates (4) |
| Diallate | NA | --- | --- |
| Dibenzofuran | NA | --- | --- |
| Diethylphthalate | 100,000 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Dimethylphthalate | 200,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Di-n-butylphthalate | 200,000 | Efroymson et al 1997b | Toxicological threshold for plants |
| Di-n-octylphthalate | 6,010 (1) | MHSPE 2000 | Value for total phthalates (4) |
| Dinoseb (2-sec-butyl-4,6-Dinitrophenol) | NA | --- | --- |
| Ethyl methanesulfonate | NA | --- | --- |
| Hexachlorobenzene | 1,000,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Hexachlorobutadiene | NA | --- | --- |
| Hexachlorocyclopentadiene | 10,000 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Hexachloroethane | NA | --- | --- |
| Hexachlorophene | NA | --- | --- |
| Hexachloropropene | NA | --- | --- |
| Isophorone | NA | --- | --- |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Soil Screening Value | Reference | Comment |
|---|---|---|---|
| **Semi-Volatile Organics (ug/kg):** | | | |
| Isosafrole | NA | --- | --- |
| m-Dinitrobenzene (1,3-Dinitrobenzene) | NA | --- | --- |
| m-Cresol (3-Methylphenol) | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| Methapyrilene | NA | --- | --- |
| Methyl methanesulfonate | 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 | --- | --- |
| o-Cresol (2-Methylpheneol) | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| o-Toluidine | NA | --- | --- |
| p-Cresol (4-Methylphenol) | 100 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| p-(Dimethylamino)azobenzene | NA | --- | --- |
| Pentachlorobenzene | 1,150 | USEPA 1999 | Toxicological threshold for earthworms |
| Pentachloronitrobenzene | NA | --- | --- |
| Pentachlorophenol | 1,730 | USEPA 1999 | Toxicological threshold for plants |
| Phenacetin | NA | --- | --- |
| Phenol | 30,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Pronamide | NA | --- | --- |
| Pryridine | NA | --- | --- |
| Safrole | NA | --- | --- |
| **PAHs (ug/kg):** | | | |
| 1-Methylnaphthalene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| 2-Methylnaphthalene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Acenaphthene | 20,000 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Acenaphthylene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Soil Screening Value | Reference | Comment |
|---|---|---|---|
| **PAHs (ug/kg):** | | | |
| Anthracene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Benzo(a)anthracene | 1,200 | USEPA 1999 | Value for benzo(a)pyrene used as a surrogate |
| Benzo(a)pyrene | 1,200 | USEPA 1999 | Toxicological threshold for plants |
| Benzo(b)fluoranthene | 1,200 | USEPA 1999 | Toxicological threshold for plants |
| Benzo(g,h,i)perylene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Benzo(k)fluoranthene | 1,200 | USEPA 1999 | Value for benzo(a)pyrene used as a surrogate |
| Chrysene | 1,200 | USEPA 1999 | Value for benzo(a)pyrene used as a surrogate |
| Dibenzo(a,h)anthracene | 1,200 | USEPA 1999 | Value for benzo(a)pyrene used as a surrogate |
| Fluoranthene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Fluorene | 30,000 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Indeno(1,2,3-cd)pyrene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Naphthalene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Phenanthrene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| Pyrene | 1,200 | --- | Value for benzo(a)pyrene used as a surrogate |
| **Inorganics (mg/kg):** | | | |
| Antimony | 78 | USEPA 2005a | Ecological soil screening level for invertebrates |
| Arsenic | 18 | USEPA 2005b | Ecological soil screening level for plants |
| Barium | 330 | USEPA 2005c | Ecological soil screening level for invertebrates |
| Beryllium | 40 | USEPA 2005d | Ecological soil screening level for invertebrates |
| Cadmium | 32 | USEPA 2005e | Ecological soil screening level for plants |
| Chromium (total) | 0.4 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Cyanide | 0.9 | CCME 2006 | Canadian soil quality guideline based on agricultural land uses |
| Cobalt | 13 | USEPA 2005f | Ecological soil screening level for plants |
| Copper | 70 | USEPA 2006a | Ecological soil screening level for plants |
| Lead | 120 | USEPA 2005g | Ecological soil screening level for plants |
| Mercury | 0.1 | Efroymson et al. 1997a | Toxicological threshold for earthworms |
| Nickel | 30 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Selenium | 1 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Silver | 560 | USEPA 2006b | Ecoloigcal soil screening level for plants |
| Thallium | 1 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Vanadium | 2 | Efroymson et al. 1997b | Toxicological threshold for plants |
| Zinc | 50 | Efroymson et al. 1997b | Toxicological threshold for plants |

**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**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

(1) The screening value shown is an average of the target and intervention soil standards. 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) The value represents a sum of the DDT, DDD, and DDE concentrations.
(6) The value represents the sum of the aldrin, dieldrin, and endrin concentrations.
(7) Value represents the sum of alpha-BHC, beta-BHC, delta-BHC, and gamma-BHC concentrations.

**Table References:**

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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

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**TABLE 4-1**
**SOIL SCREENING VALUES**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

**Table References (continued):**

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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 9285.7-63.

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

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**TABLE 4-2**
**INGESTION-BASED SCREENING VALUES FOR BIRDS**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Test Organism | Body Weight (kg) | Duration | Exposure Route | Effect/Endpoint | Test Material | LOAEL (mg/kg/d) | NOAEL (mg/kg/d) | Reference |
|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organics:** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Carbon tetrachloride | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Chlorobenzene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Chloroform | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Ethylbenzene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Pentachloroethane | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Styrene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Toluene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Trichloroethene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Xylene | Quail | 0.191 | Subacute | ? | "Toxicity" | --- | 405 | 40.5 | Hill and Camardese 1986 |
| **Semi-Volatile Organics:** | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 1,2,4-Trichlorobenzene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 1,2-Dichlorobenzene (o-Dichlorobenzene) | Northern bobwhite | 0.157 | 14 days | Oral (gavage) | Growth/mortality | ? | 2,500 | 250 | Grimes and Jaber 1989 |
| 1,3-Dichlorobenzene (m-Dichlorobenzne) | Northern bobwhite | 0.157 | 14 days | Oral (gavage) | Growth/mortality | ? | 2,500 | 250 | Grimes and Jaber 1989 |
| 1,4-Dichlorobenzene (p-Dichlorobenzne) | Northern bobwhite | 0.157 | 14 days | Oral (gavage) | Growth/mortality | ? | 2,500 | 250 | Grimes and Jaber 1989 |
| 2,3,4,6-Tetrachlorophenol | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 2,4,5-Trichlorophenol | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 2,4,6-Trichlorophenol | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 2,4-Dichlorophenol | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 2-Acetylaminofluorene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 2-Chloronaphthalene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 3,3'-Dichlorobenzidine | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 3,3-Dimethylbenzidine | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 3-Methylcholanthrene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 4-Bromophenylphenyl ether | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 4-Chloro-3-methylphenol | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 4-Chlorophenylphenyl ether | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| 7-12-Dimethyl benz(a)anthracene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Aramite | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| bis(2-Ethylhexyl)phthalate | Ringed dove | 0.155 | 4 weeks | Oral in diet | Reproduction | Not Applicable | 11.0 | 1.10 | Sample et al. 1996 |
| Butylbenzylphthalate | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Diallate | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Dibenzofuran | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Diethylphthalate | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Di-n-butylphthalate | Ringed dove | 0.155 | 4 weeks | Oral in diet | Reproduction | Not Applicable | 1.10 | 0.11 | Sample et al. 1996 |
| Di-n-octylphthalate | Ring-necked pheasant | 1.00 | ? | ? | Mortality | Not Applicable | 500 | 50.0 | TERRTOX 1998 |
| Dinoseb (2-sec-butyl-4,6-Dintrophenol) | Ring-necked pheasant | ? | 14 days | Oral (gavage) | Mortality | Not Applicable | 2.64 | 0.264 | USEPA 2004 |
| Hexachlorobenzene | Japanese quail | 0.19 | 90 days | Oral | Reproduction | Not Applicable | 0.80 | 0.08 | Coulston and Kolbye 1994 |
| Hexachlorobutadiene | Japanese quail | 0.19 | ? | Oral | Reproduction | Not Applicable | 8.00 | 2.50 | Coulston and Kolbye 1994 |
| Hexachlorocyclopentadiene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Hexachloroethane | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Hexachlorophene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Hexachloropropene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Isosafrole | --- | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 4-2**
**INGESTION-BASED SCREENING VALUES FOR BIRDS**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| Chemical | Test Organism | Body Weight (kg) | Duration | Exposure Route | Effect/Endpoint | Test Material | LOAEL (mg/kg/d) | NOAEL (mg/kg/d) | Reference |
|---|---|---|---|---|---|---|---|---|---|
| **Semi-Volatile Organics:** | | | | | | | | | |
| N-Nitrosodiphenylamine | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| p-Dimethylaminoazobenzene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Pentachlorobenzene | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Pentachloronitrobenzene | Chicken | 1.50 | 35 weeks | Oral in diet | Reproduction | Not Applicable | 70.7 | 7.07 | Sample et al. 1996 |
| Pentachlorophenol | Chicken | 1.50 | 8 weeks | Oral | Growth | Not Applicable | 200 | 100 | Eisler 1989 |
| Pronamide | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| **PAHs:** | | | | | | | | | |
| 1-Methylnaphthalene | Mallard duck | 1.04 | 7 months | Oral in diet | Hepatic | Not Applicable | 228 | 22.8 | Patton and Dieter 1980 |
| 2-Methylnaphthalene | Mallard duck | 1.04 | 7 months | Oral in diet | Hepatic | Not Applicable | 228 | 22.8 | Patton and Dieter 1980 |
| Acenaphthene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Acenaphthylene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Anthracene | Mallard duck | 1.043 | 7 months | Oral in diet | Hepatic | Not Applicable | 228 | 22.8 | Patton and Dieter 1980 |
| Benzo(a)anthracene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Benzo(a)pyrene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Benzo(b)fluoranthene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Benzo(g,h,i)perylene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Benzo(k)fluoranthene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Chrysene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Dibenz(a,h)anthracene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Fluoranthene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Fluorene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Indeno(1,2,3-cd)pyrene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Naphthalene | Mallard duck | 1.04 | 7 months | Oral in diet | Hepatic | Not Applicable | 228 | 22.8 | Patton and Dieter 1980 |
| Phenanthrene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| Pyrene | Chicken | 1.50 | 34 days | Oral in diet | Reproduction | Not Applicable | 395 | 39.5 | Rigdon and Neal 1963 |
| **Inorganics:** | | | | | | | | | |
| Antimony | Northern bobwhite | 0.19 | 6 weeks | Oral | ? | Unknown | 47,400 | 4,740 | Opresko et al. 1993 |
| Arsenic | Chicken | Unknown | 19 days | Oral in diet | Mortality | Unknown | 22.4 | 2.24 | USEPA 2005a |
| Barium | One-day old chicks | 0.121 | 4 weeks | Oral in diet | Mortality | Barium hydroxide | 41.7 | 20.8 | Sample et al. 1996 |
| Beryllium | --- | --- | --- | --- | --- | --- | NA | NA | --- |
| Cadmium | Multiple species | Unknown | Various | Oral in diet | Reproduction/growth | Unknown | 11.47 | 1.47 (1) | USEPA 2005b |
| Chromium | Multiple species | Unknown | Various | Oral in diet | Reproduction/growth | Trivalent chromium | 26.6 | 2.66 (1)(2) | USEPA 2005c |
| Cobalt | Multiple species | Unknown | Various | Oral in diet | Growth | Unknown | 76.1 | 7.61 (1) | USEPA 2005d |
| Copper | Chicken | Unknown | 84 days | Oral in diet | Reproduction | Unknown | 12.1 | 4.05 | USEPA 2006a |
| Lead | Chicken | Unknown | 4 weeks | Oral in diet | Reproduction | Unknown | 3.26 | 1.63 | USEPA 2005e |
| Mercury | Mallard duck | 1.00 | 3 generations | Oral in diet | Reproduction | Methyl mercury dicyandiamide | 0.078 | 0.026 | USEPA 1997 |
| Nickel | Mallard duckling | 0.782 | 90 days | Oral in diet | Growth/mortality | Nickel sulfate | 107 | 77.4 | Sample et al. 1996 |
| Selenium | Mallard duck | 1.00 | 100 days | Oral in diet | Reproduction | Selanomethionine | 0.80 | 0.40 | Sample et al. 1996 |
| Silver | Turkey | Unknown | 5 weeks | Oral in diet | Growth | Unknown | 20 | 2.02 | USEPA 2006b |
| Thallium | European starling | Unknown | acute | Oral | Unknown | Unknown | 3.50 | 0.35 | USEPA 1999 |
| Tin | Japanese quail | 0.15 | 6 weeks | Oral in diet | Reproduction | bis(Tributyltin)-oxide | 16.9 | 6.80 | Sample et al. 1996 |
| Vanadium | Chicken | Unknown | 5 weeks | Oral in diet | Growth | Unknown | 0.688 | 0.344 | USEPA 2005f |
| Zinc | White leghorn hen | 1.935 | 44 weeks | Oral in diet | Reproduction | Zinc sulfate | 131 | 14.5 | Sample et al. 1996 |

**TABLE 4-2**
**INGESTION-BASED SCREENING VALUES FOR BIRDS**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

**Notes:**
NA = Not Available
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
USEPA = United States Environmental Protection Agency
(1) The NOAEL value represents a geometric mean of NOAEL values for growth and/or reproduction. The NOAEL value was used in the derivation of the avian ecological soil screening level.
(2) The NOAEL value shown is for trivalent chromium.

**Table References:**


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USEPA. 2006b. 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 Chromium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-66.

**TABLE 4-2**
**INGESTION-BASED SCREENING VALUES FOR BIRDS**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

**Table References (continued):**


USEPA. 2005d. Ecological Soil Screening Levels for Cobalt (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-67

USEPA. 2005e. Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

USEPA. 2005f. 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.

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# FIGURES

K:_SOUTHNAVFAC\111626 DO2\Task 12 – SWMU 14\CAD\ 111626_14_01.dwg


4 0 2 4 8

1 inch = 4 miles

Baker

# FIGURE 1-1
## REGIONAL LOCATION MAP
## SWMU 14-FIRE TRAINING PIT AT CRASH CREW AREA
## ADDITIONAL DATA COLLECTION WORK PLAN

SOURCE: METRODATA, INC., 1999.

NAVAL ACTIVITY PUERTO RICO


LEGEND

– SWMUs

14 – AREA OF WHICH THIS INVESTIGATION PERTAINS TO

AOC D – AOCs

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

3000 0 1500 3000

1 inch = 3000 ft.

FIGURE 1-2
NAPR SWMU AND AOC LOCATION MAP
SWMU 14-FIRE TRAINING PIT AT CRASH CREW AREA
ADDITIONAL DATA COLLECTION WORK PLAN
NAVAL ACTIVITY PUERTO RICO


1000 0 500 1000

1 inch = 1000 ft.

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

Baker

LEGEND

FIGURE 1-3
LOCATION MAP
SWMU 14-FIRE TRAINING PIT AT CRASH CREW AREA
ADDITIONAL DATA COLLECTION WORK PLAN

NAVAL ACTIVITY PUERTO RICO

# Figure 2-1: Navy Ecological Risk Assessment Tiered Approach

**RPM Input and Risk Management Consideration**[3]

Step 8: Risk Management

**Tier 1. Screening Risk Assessment (SRA)**: 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 SRA**

**Exit Criteria for the Screening Risk Assessment**: Decision for exiting or continuing the ecological risk assessment.

1) Site passes screening risk assessment: A determination is made that the site poses acceptable risk and shall be closed out for ecological concerns.

2) Site fails screening 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.

**Tier 2. Baseline Ecological Risk Assessment (BERA)**: 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] (SRA)---- **Proceed to Exit Criteria for Step 3a**

Step 3b: Problem Formulation - Toxicity Evaluation; Assessment Endpoints; Conceptual Model; Risk Hypothesis (SMDP)

Step 4: Study Design/DQO - 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 (SRA) support an acceptable risk determination then the site exits the ecological risk assessment process.

2) If re-evaluation of the conservative exposure assumptions (SRA) 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 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.

**Tier 3. Evaluation of Remedial Alternative (RAGs C)**

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, detection frequency, etc.
3) Risk Management is incorporated throughout the tiered approach.

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150 0 75 150

1 inch = 150 ft.

Baker

Baker Environmental, Inc.

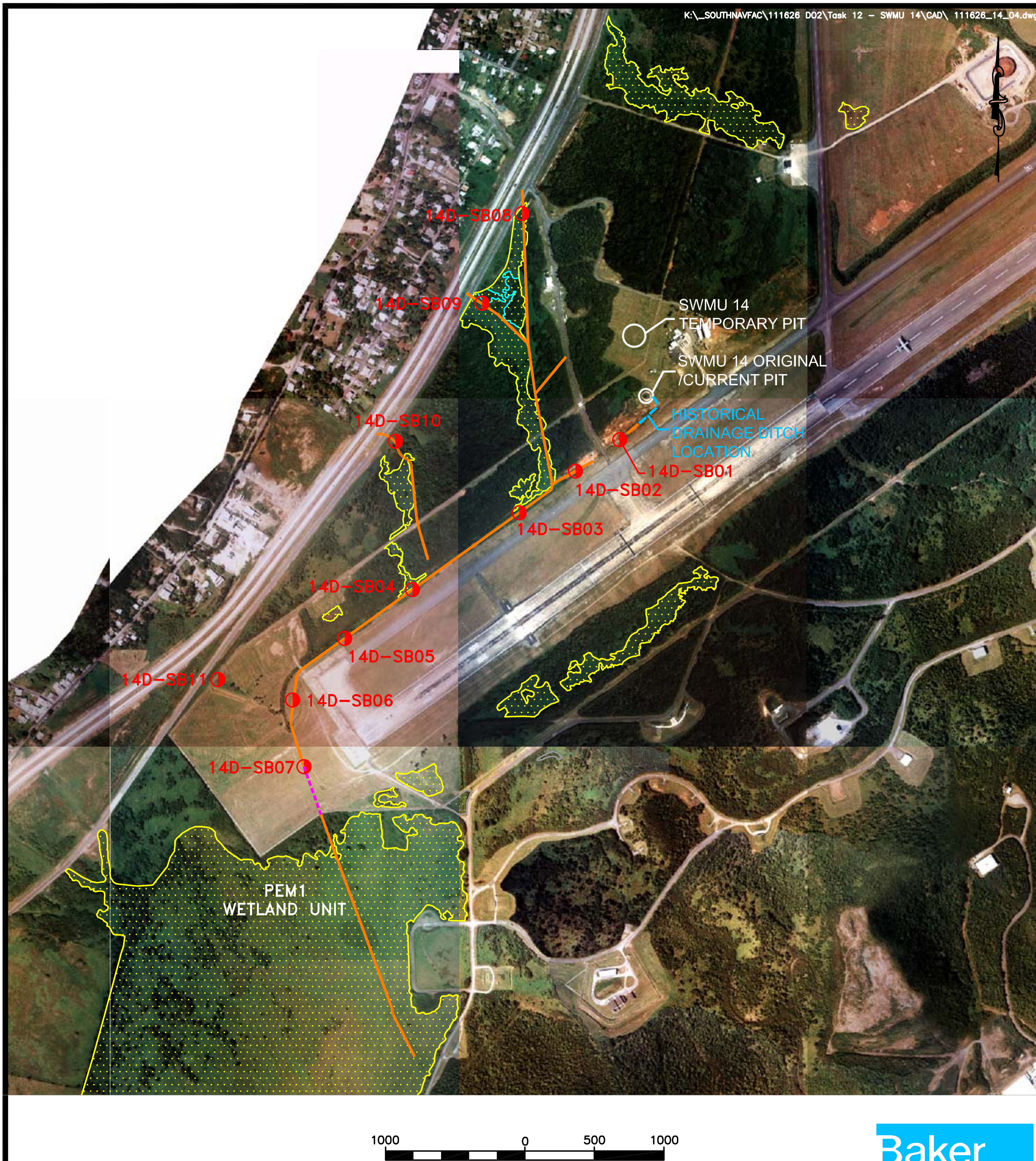
LEGEND

- 1996 SURFACE SOIL SAMPLE
- 2006 SUBSURFACE SOIL SAMPLE
- 2006 SURFACE & SUBSURFACE SOIL SAMPLES
- 2006 SURFACE & SUBSURFACE SOIL AND GROUNDWATER SAMPLES

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

FIGURE 2-2
RFI SOIL AND GROUNDWATER SAMPLING LOCATIONS
SWMU 14-FIRE TRAINING PIT AT CRASH CREW AREA
ADDITIONAL DATA COLLECTION WORK PLAN

NAVAL ACTIVITY PUERTO RICO




Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000.

LEGEND

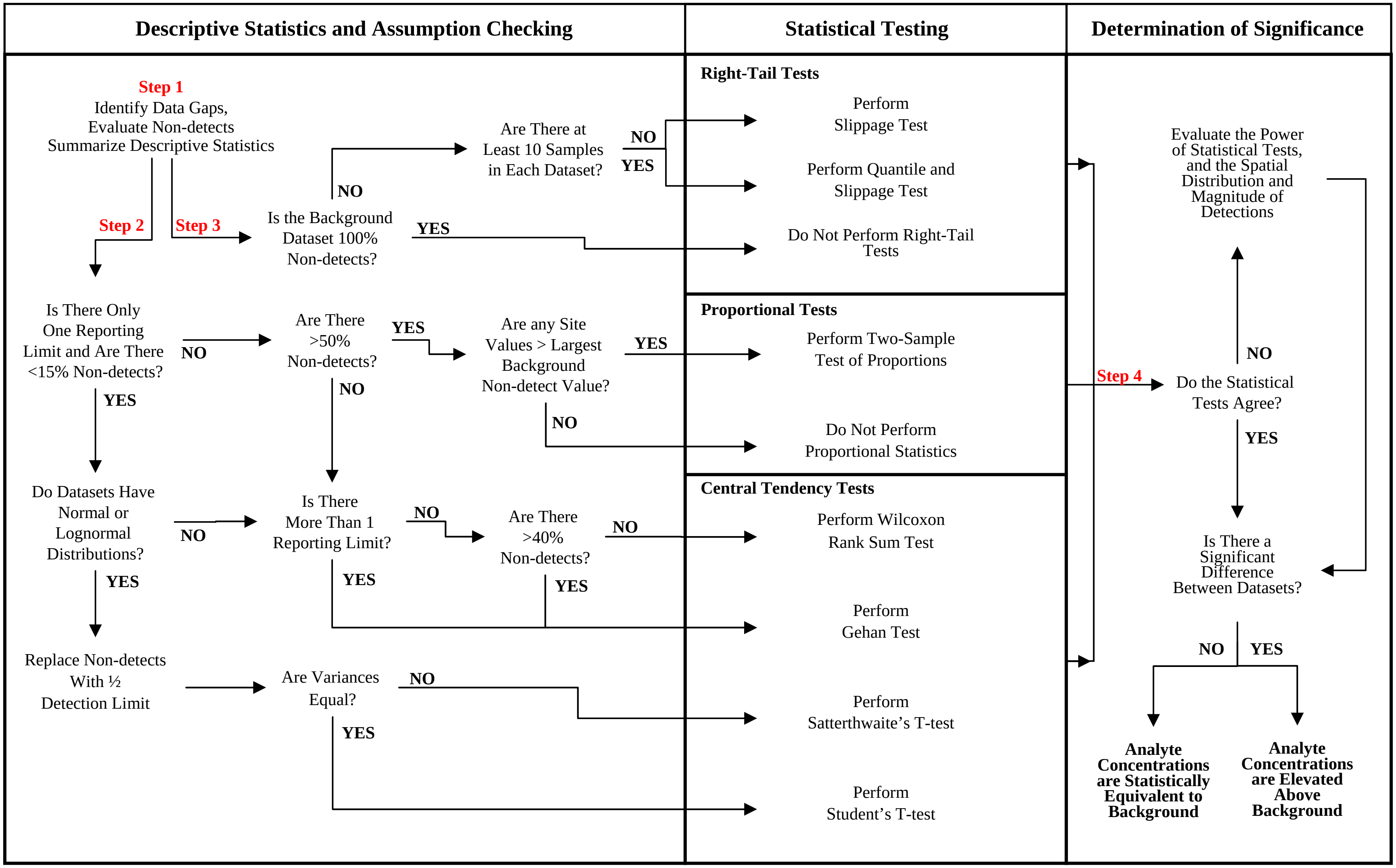
- HISTORIC DRAINAGE DITCH
- DRAINAGE DITCH
- CULVERT
- WETLAND BOUNDARY PEM1 AND UPLAND
- PROPOSED SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

FIGURE 3-1
SAMPLE LOCATION MAP
SWMU 14-FIRE TRAINING PIT AT CRASH CREW AREA
ADDITIONAL DATA COLLECTION WORK PLAN

NAVAL ACTIVITY PUERTO RICO

Revised: November 9, 2007

**FIGURE 4-1**
**STATISTICAL ANALYSIS PROCESS**
**SWMU 14 –FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

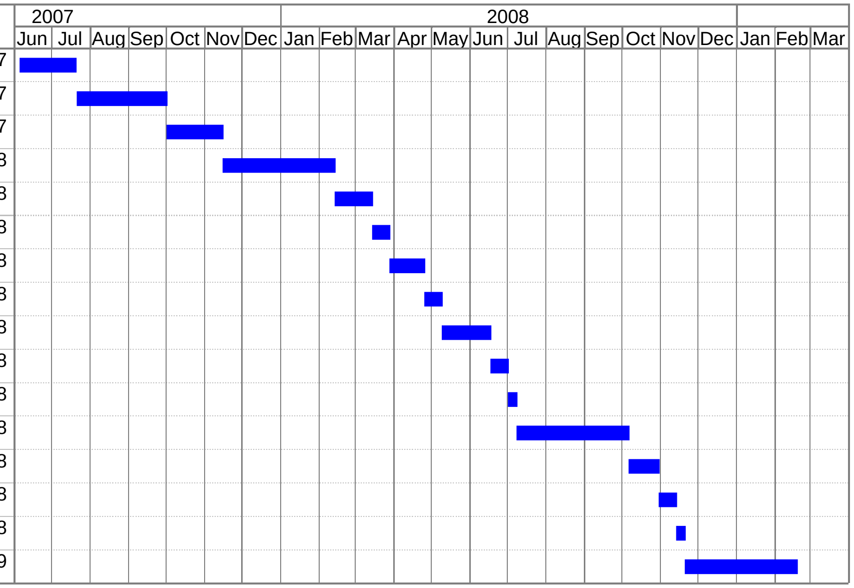



Parametric t-tests performed on log-transformed data if both datasets have lognormal distributions.

Revised: November 9, 2007

**FIGURE 5-1**
**PROPOSED PROJECT SCHEDULE**
**ADDITIONAL DATA COLLECTION WORK PLAN IN SUPPORT OF ERA**
**SWMU 14**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

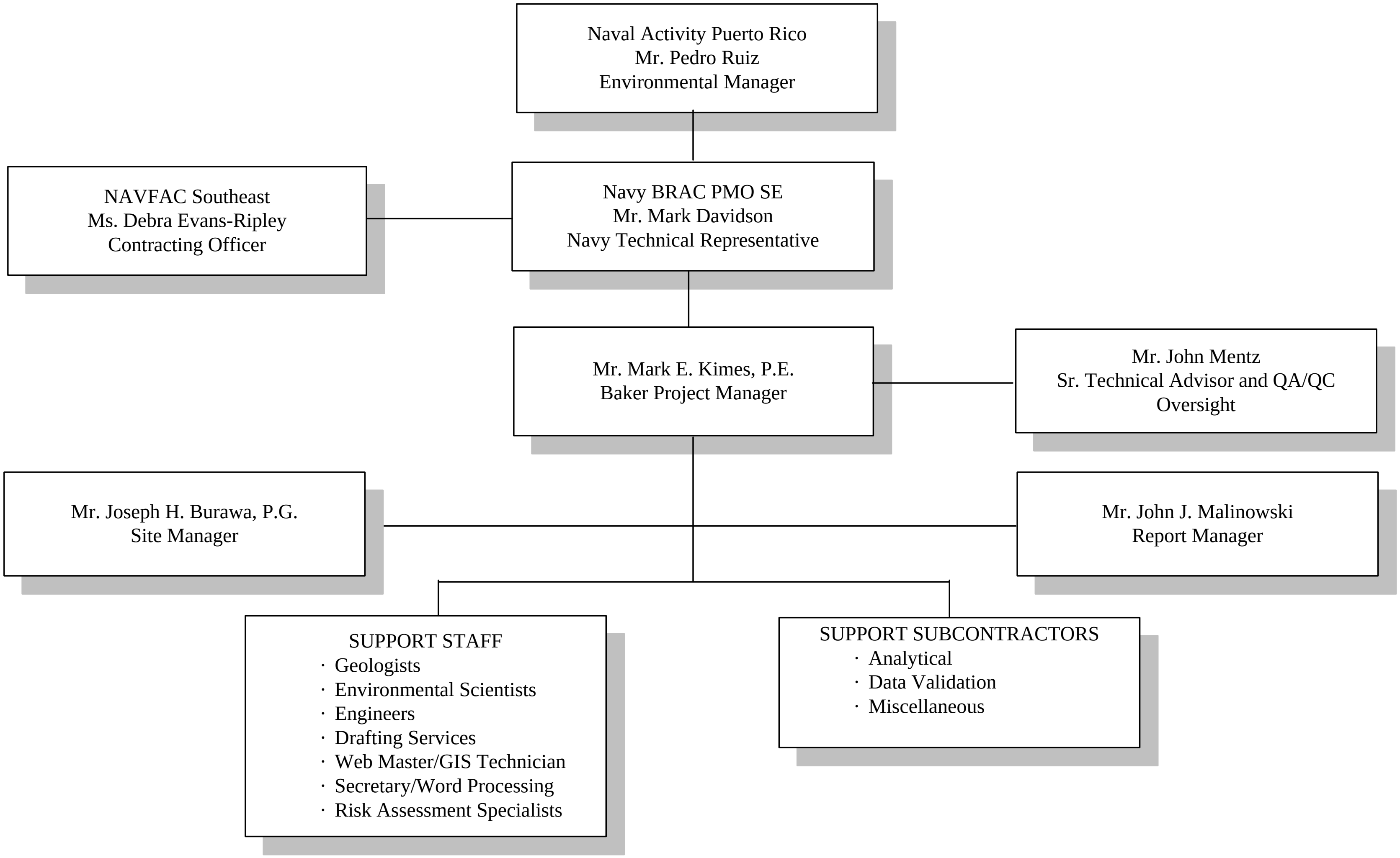
| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | Draft Additional Data Collection Work Plan to the EPA | 45 edays | 6/5/07 | 7/20/07 |
| 2 | EPA Review | 72 edays | 7/21/07 | 10/1/07 |
| 3 | Final Additional Data Collection Work Plan to the EPA | 45 edays | 10/1/07 | 11/15/07 |
| 4 | EPA Review & Approval | 90 edays | 11/15/07 | 2/13/08 |
| 5 | Initiate Field Work | 30 edays | 2/13/08 | 3/14/08 |
| 6 | Field Investigation | 14 edays | 3/14/08 | 3/28/08 |
| 7 | Laboratory Analysis | 28 edays | 3/28/08 | 4/25/08 |
| 8 | Data Validation | 14 edays | 4/25/08 | 5/9/08 |
| 9 | Draft Phase II RFI Report for SWMU 14 to Navy | 39 edays | 5/9/08 | 6/17/08 |
| 10 | Navy Review | 14 edays | 6/17/08 | 7/1/08 |
| 11 | Draft Phase II RFI Report for SWMU 14 to EPA | 7 edays | 7/1/08 | 7/8/08 |
| 12 | EPA Review | 90 edays | 7/8/08 | 10/6/08 |
| 13 | Final Phase II RFI Report for SWMU 14 to Navy | 24 edays | 10/6/08 | 10/30/08 |
| 14 | Navy Review | 14 edays | 10/30/08 | 11/13/08 |
| 15 | Final Phase II RFI Report for SWMU 14 to EPA | 7 edays | 11/13/08 | 11/20/08 |
| 16 | EPA Review & Approval | 90 edays | 11/20/08 | 2/18/09 |




Project:Phase I RFI Work Plan
Date: 11/8/07

Task

**FIGURE 6-1**
**PROJECT ORGANIZATION**
**ADDITIONAL DATA COLLECTION WORK PLAN - SWMU 14**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**



# APPENDIX A
# SWMU 14 Photographs

Photograph 1 – Drainage ditch historically connected to the original fire training pit.

Photograph 2 – Drainage ditch looking southwest from SWMU 14.

# APPENDIX B
# Soil Analytical Data Used in SERA

**APPENDIX B**

**SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04<br>3/22/1996 | 14SS05<br>3/22/1996 | 14SS06<br>3/22/1996 | 14SS07<br>3/22/1996 | 14SS08<br>3/22/1996 | 14SB01-00<br>03-06-2006 | 14SB02-00<br>03-07-2006 | 14SB03-00<br>03-06-2006 | 14SB07-00<br>03-06-2006 |
| **Volatiles (ug/kg)** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,1,1-Trichloroethane (TCA) | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,1,2,2-Tetrachloroethane | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,1,2-Trichloroethane | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,1-Dichloroethane | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,1-Dichloroethene | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,2,3-Trichloropropane | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,2-Dibromo-3-chloropropane (DBCP) | 25 UJ | 25 UJ | 23 UJ | 24 U | 22 U | 4.5 UJ | 5 UJ | 5.4 UJ | 4.3 UJ |
| 1,2-Dibromoethane (EDB) | 25 U | 25 UJ | 23 U | 24 U | 22 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,2-Dichloroethane | 6 UJ | 6 UJ | 6 UJ | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,2-Dichloroethene (trans) | NA | NA | NA | NA | NA | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,2-Dichloropropane | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,3-Dichloropropene (cis) | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,3-Dichloropropene (trans) | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 1,4-Dichloro-2-butene (trans) | 25 U | 25 UJ | 23 U | 24 U | 22 U | 90 U | 100 U | 110 U | 85 U |
| 2-Butanone (MEK) | 12 U | 12 UJ | 12 U | 12 U | 11 U | 36 J | 31 J | 23 J | 11 UJ |
| 2-Chloro-1,3-butadiene (Chloroprene) | 120 U | 120 UJ | 120 U | 120 U | 110 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 2-Hexanone (MBK) | 12 UJ | 12 UJ | 12 UJ | 12 U | 11 U | 2.3 J | 3 J | 13 UJ | 11 UJ |
| 3-Chloropropene (Allyl Chloride) | 25 U | 25 UJ | 23 U | 24 U | 22 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 4-Methyl-2-pentanone (MIBK) | 12 U | 12 UJ | 12 U | 12 U | 11 U | 11 U | 12 U | 13 U | 11 U |
| Acetone | 12 UJ | 12 UJ | 12 UJ | 12 UJ | 11 UJ | 240 U | 95 U | 200 U | 18 U |
| Acetonitrile | 120 U | 120 UJ | 120 U | 120 U | 110 U | 4.5 R | 5 R | 5.4 R | 4.3 R |
| Acrolein | 620 U | 630 UJ | 590 U | 590 U | 540 U | 45 U | 50 U | 54 U | 43 U |
| Acrylonitrile | 120 U | 120 UJ | 120 U | 120 U | 110 U | 45 U | 50 U | 54 U | 43 U |
| Benzene | 6 U | 6 UJ | 6 U | 6 U | 5 U | 9.5 | 5.3 U | 5.4 U | 4.3 U |
| Bromodichloromethane | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Bromoform | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Bromomethane | 12 U | 12 UJ | 12 U | 12 U | 11 U | 0.7 J | 5 U | 5.4 U | 4.3 U |
| Carbon Disulfide | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Carbon Tetrachloride | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |

## APPENDIX B

**SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04<br>3/22/1996 | 14SS05<br>3/22/1996 | 14SS06<br>3/22/1996 | 14SS07<br>3/22/1996 | 14SS08<br>3/22/1996 | 14SB01-00<br>03-06-2006 | 14SB02-00<br>03-07-2006 | 14SB03-00<br>03-06-2006 | 14SB07-00<br>03-06-2006 |
| **Volatiles (ug/kg) (Cont)** | | | | | | | | | |
| Chlorobenzene | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Chloroethane | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| 0 | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Chloromethane | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Dibromochloromethane | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Dibromomethane | 12 U | 12 UJ | 12 U | 12 UJ | 11 UJ | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Dichlorodifluoromethane (Freon-12) | 25 U | 25 UJ | 23 U | 24 UJ | 22 UJ | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Ethyl Methacrylate | 25 U | 25 UJ | 23 U | 24 U | 22 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Ethylbenzene | 6 U | 6 UJ | 6 U | 6 UJ | 5 UJ | 1.5 J | 1.6 J | 5.4 U | 4.3 U |
| Iodomethane | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Isobutyl Alcohol | 2500 R | 2500 R | 2300 R | 2400 R | 2200 R | 230 R | 250 R | 270 R | 210 R |
| Methyl Acrylonitrile | 25 U | 25 UJ | 23 U | 24 U | 22 U | 4.5 UJ | 5 UJ | 5.4 UJ | 4.3 UJ |
| Methyl Methacrylate | 25 U | 25 UJ | 23 U | 24 U | 22 U | 45 U | 50 U | 54 U | 43 U |
| Methylene Chloride | 6 UJ | 6 UJ | 6 UJ | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Pentachloroethane | 25 U | 25 UJ | 23 U | 24 U | 22 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Propionitrile (Ethyl Cyanide) | 62 R | 63 R | 59 R | 59 R | 54 R | 230 U | 250 U | 270 U | 210 U |
| Styrene (Ethenylbenzene) | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Tetrachloroethene (PCE) | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Toluene | 6 U | 6 UJ | 6 U | 6 U | 5 U | 9.1 U | 7.2 U | 5.4 U | 4.3 U |
| Trichloroethene (TCE) | 6 U | 6 UJ | 6 U | 6 U | 5 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Trichlorofluoromethane | 12 UJ | 12 UJ | 12 UJ | 12 UJ | 11 UJ | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Vinyl Acetate | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Vinyl Chloride | 12 U | 12 UJ | 12 U | 12 U | 11 U | 4.5 U | 5 U | 5.4 U | 4.3 U |
| Xylenes, total | 6 U | 6 UJ | 6 U | 6 U | 5 U | 2.3 J | 2.7 J | 16 U | 13 U |
| **Semivolatiles (ug/kg)** | | | | | | | | | |
| 1,2,4,5-Tetrachlorobenzene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 1,2,4-Trichlorobenzene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 1,2-Dichlorobenzene (o-) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 1,3,5-Trinitrobenzene | 4000 U | 4100 U | 3900 U | 3900 U | 3600 U | 380 U | 410 U | 380 U | 420 U |
| 1,3-Dichlorobenzene (m-) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |

**APPENDIX B**

**SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04 | 14SS05 | 14SS06 | 14SS07 | 14SS08 | 14SB01-00 | 14SB02-00 | 14SB03-00 | 14SB07-00 |
| | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 03-06-2006 | 03-07-2006 | 03-06-2006 | 03-06-2006 |
| **Semivolatiles (ug/kg) (Cont)** | | | | | | | | | |
| 1,3-Dinitrobenzene (m-) | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 1,4-Dichlorobenzene (p-) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 1,4-Dioxane (p-) | 800 R | 820 R | 770 R | 770 R | 710 R | 230 R | 250 R | 270 R | 210 R |
| 1,4-Naphthoquinone | 2000 UJ | 2100 UJ | 1900 UJ | 1900 UJ | 1800 UJ | 380 U | 410 U | 380 U | 420 U |
| 1,4-Phenylenediamine | 800 UJ | 820 UJ | 770 UJ | 770 UJ | 710 UJ | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| 1-Naphthylamine | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 2,3,4,6-Tetrachlorophenol | 400 UJ | 410 UJ | 390 UJ | 390 UJ | 360 UJ | 380 U | 410 U | 380 U | 420 U |
| 2,4,5-Trichlorophenol | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 380 U | 410 U | 380 U | 420 U |
| 2,4,6-Trichlorophenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2,4-Dichlorophenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2,4-Dimethylphenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2,4-Dinitrophenol | 2000 UJ | 2100 UJ | 1900 UJ | 1900 UJ | 1800 UJ | 750 U | 810 U | 770 U | 840 UJ |
| 2,4-Dinitrotoluene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2,6-Dichlorophenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2,6-Dinitrotoluene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2-Acetylaminofluorene | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 2-Chloronaphthalene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2-Chlorophenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2-Methylnaphthalene | 400 UJ | 410 UJ | 390 UJ | 390 UJ | 360 UJ | 380 U | 410 U | 380 U | 420 U |
| 2-Methylphenol (o-Cresol) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2-Naphthylamine | 1000 U | 1000 U | 970 U | 970 U | 890 U | 380 U | 410 U | 380 U | 420 U |
| 2-Nitroaniline | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 750 U | 810 U | 770 U | 840 U |
| 2-Nitrophenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 2-Picoline | 400 R | 410 R | 390 R | 390 R | 360 R | 380 U | 410 U | 380 U | 420 U |
| 3,3'-Dichlorobenzidine | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 3,3'-Dimethylbenzidine | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 380 U | 410 U | 380 U | 420 U |
| 3-Methylcholanthrene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 3-Methylphenol (m-Cresol) | NA | NA | NA | NA | NA | 380 U | 410 U | 380 U | 420 U |
| 3-Nitroaniline | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 750 U | 810 U | 770 U | 840 U |
| 4,6-Dinitro-2-methylphenol | 2000 UJ | 2100 UJ | 1900 UJ | 1900 UJ | 1800 UJ | 750 U | 810 U | 770 U | 840 U |

**APPENDIX B**

**SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04 | 14SS05 | 14SS06 | 14SS07 | 14SS08 | 14SB01-00 | 14SB02-00 | 14SB03-00 | 14SB07-00 |
| | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 03-06-2006 | 03-07-2006 | 03-06-2006 | 03-06-2006 |
| **Semivolatiles (ug/kg) (Cont)** | | | | | | | | | |
| 4-Aminobiphenyl | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | 380 U | 410 U | 380 U | 420 U |
| 4-Chloro-3-methylphenol | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 4-Chloroaniline | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 4-Chlorophenyl-phenylether | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| 4-Dimethylaminoazobenzene (p-) | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 4-Methylphenol (p-Cresol) | NA | NA | NA | NA | NA | 380 U | 410 U | 380 U | 420 U |
| 4-Nitroaniline | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 750 U | 810 U | 770 U | 840 U |
| 4-Nitrophenol | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 750 UJ | 810 UJ | 770 UJ | 840 UJ |
| 4-Nitroquinoline-1-Oxide | 2000 UJ | 2100 UJ | 1900 UJ | 1900 UJ | 1800 UJ | 380 U | 410 U | 380 U | 420 UJ |
| 5-Nitro-o-toluidine | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| 7,12-Dimethylbenz(a)anthracene | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| a,a-Dimethylphenethylamine | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 76000 UJ | 83000 UJ | 78000 UJ | 85000 UJ |
| Acetophenone | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Aniline | 2000 UJ | 2100 UJ | 1900 UJ | 1900 UJ | 1800 UJ | 380 U | 410 U | 380 U | 420 U |
| Aramite | 800 UJ | 820 UJ | 770 UJ | 770 UJ | 710 UJ | 380 U | 410 U | 380 U | 420 U |
| Benzyl Alcohol | 400 UJ | 410 UJ | 390 UJ | 390 UJ | 360 UJ | 380 U | 410 U | 380 U | 420 U |
| Bis(2-chloroethoxy)methane | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Bis(2-chloroisopropyl)ether | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Bis(2-chloroethyl)ether | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Bis(2-ethylhexyl) Phthalate (BEHP) | 400 U | 410 U | 97 J | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Butyl Benzyl Phthalate | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Diallate (cis) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Diallate (trans) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Dibenzofuran | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Diethyl Phthalate (DEP) | 400 U | 410 U | 54 J | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Dimethyl Phthalate | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Di-n-butyl Phthalate (DBP) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Di-n-octyl Phthalate | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Dinoseb | 800 UJ | 820 UJ | 770 UJ | 770 UJ | 710 UJ | 380 U | 410 U | 380 U | 420 U |

APPENDIX B

SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL
SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
ADDITIONAL DATA COLLECTION WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04 | 14SS05 | 14SS06 | 14SS07 | 14SS08 | 14SB01-00 | 14SB02-00 | 14SB03-00 | 14SB07-00 |
| | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 03-06-2006 | 03-07-2006 | 03-06-2006 | 03-06-2006 |
| **Semivolatiles (ug/kg) (Cont)** | | | | | | | | | |
| Ethyl Methanesulfonate (EMS) | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Hexachlorobenzene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Hexachlorobutadiene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Hexachlorocyclopentadiene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Hexachloroethane | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Hexachlorophene | 4000 R | 4100 R | 3900 R | 3900 R | 3600 R | NA | NA | NA | NA |
| Hexachloropropene | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 380 U | 410 U | 380 U | 420 U |
| Isophorone | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Isosafrole | 400 UJ | 410 UJ | 390 UJ | 390 UJ | 360 UJ | 380 U | 410 U | 380 U | 420 U |
| Methapyrilene | 1000 UJ | 1000 UJ | 970 UJ | 970 UJ | 890 UJ | 380 U | 410 U | 380 U | 420 UJ |
| Methyl Methane Sulfonate | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Nitrobenzene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| n-Nitrosodiethylamine | 400 UJ | 410 U | 390 U | 390 U | 360 U | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| n-Nitrosodimethylamine | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| n-Nitroso-di-n-butylamine | 400 UJ | 410 UJ | 390 UJ | 390 UJ | 360 UJ | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| n-Nitrosodi-n-propylamine | 400 U | 410 U | 390 U | 390 U | 360 U | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| n-Nitrosodiphenylamine | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| n-Nitrosomethylethylamine | 400 U | 410 UJ | 390 UJ | 390 UJ | 360 UJ | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| n-Nitrosomorpholine | 800 UJ | 820 UJ | 770 UJ | 770 UJ | 710 UJ | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| n-Nitrosopiperidine | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| n-Nitrosopyrrolidine | 2000 UJ | 2100 UJ | 1900 UJ | 1900 UJ | 1800 UJ | 380 UJ | 410 UJ | 380 UJ | 420 UJ |
| o-Toluidine | 400 R | 410 R | 390 R | 390 R | 360 R | 380 U | 410 U | 380 U | 420 U |
| Pentachlorobenzene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Pentachloronitrobenzene | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Pentachlorophenol | 2000 U | 2100 U | 1900 U | 1900 U | 1800 U | 750 U | 810 U | 770 U | 840 U |
| Phenacetin | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Phenol | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Pronamide | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |
| Pyridine | 800 U | 820 U | 770 U | 770 U | 710 U | 380 U | 410 U | 380 U | 420 U |
| Safrole | 400 U | 410 U | 390 U | 390 U | 360 U | 380 U | 410 U | 380 U | 420 U |

**APPENDIX B**

**SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04 | 14SS05 | 14SS06 | 14SS07 | 14SS08 | 14SB01-00 | 14SB02-00 | 14SB03-00 | 14SB07-00 |
| | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 03-06-2006 | 03-07-2006 | 03-06-2006 | 03-06-2006 |
| **PAHs (ug/kg)** | | | | | | | | | |
| 1-Methylnaphthalene | NA | NA | NA | NA | NA | 7.6 U | 6 J | 7.8 UJ | 8.5 UJ |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | 7.6 U | 7.4 J | 7.8 UJ | 8.5 U |
| Acenaphthene | 400 U | 410 U | 390 U | 390 U | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Acenaphthylene | 400 U | 410 U | 390 U | 390 U | 360 U | 7.6 U | 8.3 U | 7.8 UJ | 8.5 U |
| Anthracene | 400 U | 410 U | 390 U | 110 J | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Benzo(a)anthracene | 400 U | 45 J | 300 J | 3400 | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Benzo(a)pyrene (BaP) | 400 U | 45 J | 1800 | 5000 | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Benzo(b)fluoranthene | 400 U | 410 U | 2800 | 7600 | 360 U | 5.8 J | 8.3 U | 7.8 U | 8.5 U |
| Benzo(g,h,i)perylene | 66 J | 91 J | 1200 | 3600 | 360 U | 11 | 5.5 J | 7.8 U | 8.5 U |
| Benzo(k)fluoranthene | 400 U | 410 U | 640 | 2400 | 360 U | 5.7 J | 8.3 U | 7.8 U | 8.5 U |
| Chrysene | 400 U | 50 J | 690 | 3800 | 360 U | 5 J | 8.3 U | 7.8 U | 8.5 U |
| Dibenz(a,h)anthracene | 400 U | 410 U | 210 J | 920 | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Fluoranthene | 88 J | 110 J | 230 J | 67 J | 360 U | 6.5 J | 8.3 U | 7.8 U | 8.5 U |
| Fluorene | 400 U | 410 U | 390 U | 390 U | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Indeno(1,2,3-cd)pyrene | 400 U | 58 J | 1300 | 3800 | 360 U | 9.6 | 4.8 J | 7.8 U | 8.5 U |
| Naphthalene | 400 U | 410 U | 390 U | 390 U | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Phenanthrene | 400 U | 410 U | 39 J | 58 J | 360 U | 7.6 U | 8.3 U | 7.8 U | 8.5 U |
| Pyrene | 170 J | 270 J | 650 | 100 J | 360 U | 6.6 J | 8.3 U | 7.8 U | 8.5 U |
| **PCBs (ug/kg)** | | | | | | | | | |
| Aroclor-1016 | 48 U | 49 U | 46 U | 46 U | 42 U | 35 U | 38 U | 36 U | 39 U |
| Aroclor-1221 | 48 U | 49 U | 46 U | 46 U | 42 U | 48 U | 52 U | 49 U | 53 U |
| Aroclor-1232 | 48 U | 49 U | 46 U | 46 U | 42 U | 35 U | 38 U | 36 U | 39 U |
| Aroclor-1242 | 48 U | 49 U | 46 U | 46 U | 42 U | 24 U | 26 U | 24 U | 27 U |
| Aroclor-1248 | 48 U | 49 U | 46 U | 46 U | 42 U | 24 U | 26 U | 24 U | 27 U |
| Aroclor-1254 | 96 U | 98 U | 93 U | 93 U | 85 U | 24 U | 26 U | 24 U | 27 U |
| Aroclor-1260 | 28 | 17 | 12 | 19 | 6 NJ | 23 J | 27 J | 36 U | 39 U |
| **TPH (mg/kg)** | | | | | | | | | |
| Diesel Range Organics (DRO) | 560 | 360 | 120 | 490 | 4.5 U | 11 U | 12 U | 12 U | 15 U |
| Gasoline Range Organics (GRO) | 3.7 | 3.8 | 1.8 | 1.8 | 0.032 | 0.57 U | 0.62 U | 0.58 U | 0.63 U |

**APPENDIX B**

**SUMMARY OF ANALYTICAL RESULTS, SURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**ADDITIONAL DATA COLLECTION WORK PLAN**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 1996 Phase I RFI | | | | | 2006 RFI | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 14SS04 | 14SS05 | 14SS06 | 14SS07 | 14SS08 | 14SB01-00 | 14SB02-00 | 14SB03-00 | 14SB07-00 |
| | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 3/22/1996 | 03-06-2006 | 03-07-2006 | 03-06-2006 | 03-06-2006 |
| **Inorganics (mg/kg)** | | | | | | | | | |
| Antimony | NA | NA | NA | NA | NA | 1.6 J | 1.5 J | 1.9 J | 1.4 J |
| Arsenic | NA | NA | NA | NA | NA | 2.5 J | 1.4 J | 2.9 J | 2.6 J |
| Barium | NA | NA | NA | NA | NA | 110 J | 106 J | 155 J | 26.5 J |
| Beryllium | NA | NA | NA | NA | NA | 0.05 U | 0.03 U | 0.02 U | 0.01 U |
| Cadmium | NA | NA | NA | NA | NA | 1.3 | 1.1 | 1.6 | 0.58 U |
| Chromium | NA | NA | NA | NA | NA | 38.7 J | 43.3 J | 75.1 J | 33.8 J |
| Cobalt | NA | NA | NA | NA | NA | 31.2 J | 24.1 J | 46.9 J | 5.8 J |
| Copper | NA | NA | NA | NA | NA | 88.5 R | 124 R | 107 R | 71.1 R |
| Lead | NA | NA | NA | NA | NA | 85.3 J | 79.9 J | 40 J | 4.9 J |
| Mercury | NA | NA | NA | NA | NA | 0.031 J | 0.077 | 0.042 | 0.049 |
| Nickel | NA | NA | NA | NA | NA | 9.7 J | 14.4 J | 11.5 J | 4.1 J |
| Selenium | NA | NA | NA | NA | NA | 3 J | 2.1 J | 4.3 J | 4.7 J |
| Silver | NA | NA | NA | NA | NA | 0.09 U | 0.06 U | 0.06 U | 0.06 U |
| Tin | NA | NA | NA | NA | NA | | | | |
| Thallium | NA | NA | NA | NA | NA | 0.43 UJ | 0.46 UJ | 0.65 J | 0.47 UJ |
| Vanadium | NA | NA | NA | NA | NA | 187 J | 187 J | 323 J | 287 J |
| Zinc | NA | NA | NA | NA | NA | 87.8 J | 85 J | 64.6 J | 17.9 J |

**Notes:**
U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
NJ - Presumptive evidence for the presence of the material at an estimated value
R - Result is rejected and unusable
NA - Not Analyzed

## APPENDIX B

## DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## RCRA FACILITY INVESTIGATION
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | 2006 RFI | | | |
|---|---|---|---|---|
| | 14SB04-01 | | 14SB06-01 | |
| | 03-06-2006 | | 03-07-2006 | |
| | 1.5 - 3.0 | | 1.5 - 3.0 | |
| **Volatiles (ug/kg)** | | | | |
| 1,1,1,2-Tetrachloroethane | 220 | U | 4 | U |
| 1,1,1-Trichloroethane (TCA) | 220 | U | 4 | U |
| 1,1,2,2-Tetrachloroethane | 220 | U | 4 | U |
| 1,1,2-Trichloroethane | 220 | U | 4 | U |
| 1,1-Dichloroethane | 220 | U | 4 | U |
| 1,1-Dichloroethene | 220 | U | 4 | U |
| 1,2,3-Trichloropropane | 220 | U | 4 | U |
| 1,2-Dibromo-3-chloropropane (DBCP) | 220 | U | 4 | UJ |
| 1,2-Dibromoethane (EDB) | 220 | U | 4 | U |
| 1,2-Dichloroethane | 220 | U | 4 | U |
| 1,2-Dichloroethene (trans) | 220 | U | 4 | U |
| 1,2-Dichloropropane | 220 | U | 4 | U |
| 1,3-Dichloropropene (cis) | 220 | U | 4 | U |
| 1,3-Dichloropropene (trans) | 220 | U | 4 | U |
| 1,4-Dichloro-2-butene (trans) | 870 | U | 80 | U |
| 2-Butanone (MEK) | 540 | UJ | 8.7 | J |
| 2-Chloro-1,3-butadiene (Chloroprene) | 220 | U | 4 | U |
| 2-Hexanone (MBK) | 540 | U | 10 | UJ |
| 3-Chloropropene (Allyl Chloride) | 220 | U | 4 | U |
| 4-Methyl-2-pentanone (MIBK) | 540 | U | 10 | U |
| Acetone | 540 | UJ | 30 | U |
| Acetonitrile | 220 | U | 4 | R |
| Acrolein | 2200 | R | 40 | U |
| Acrylonitrile | 2200 | UJ | 40 | U |
| Benzene | 220 | U | 4 | U |
| Bromodichloromethane | 220 | U | 4 | U |
| Bromoform | 220 | U | 4 | U |
| Bromomethane | 220 | U | 4 | U |
| Carbon Disulfide | 220 | U | 0.9 | J |
| Carbon Tetrachloride | 220 | U | 4 | U |

**APPENDIX B**

**DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | |
|---|---|---|
| | 14SB04-01 | 14SB06-01 |
| | 03-06-2006 | 03-07-2006 |
| | 1.5 - 3.0 | 1.5 - 3.0 |
| **Volatiles (ug/kg) (Cont)** | | |
| Chlorobenzene | 220 U | 4 U |
| Chloroethane | 220 U | 4 U |
| Chloroform | 220 U | 4 U |
| Chloromethane | 220 U | 4 U |
| Dibromochloromethane | 220 U | 4 U |
| Dibromomethane | 220 UJ | 4 U |
| Dichlorodifluoromethane (Freon-12) | 220 U | 4 U |
| Ethyl Methacrylate | 2200 U | 4 U |
| Ethylbenzene | 740 | 4 U |
| Iodomethane | 220 UJ | 4 U |
| Isobutyl Alcohol | 1100 R | 200 R |
| Methyl Acrylonitrile | 2200 UJ | 4 UJ |
| Methyl Methacrylate | 2200 UJ | 40 U |
| Methylene Chloride | 220 U | 4 U |
| Pentachloroethane | 220 UJ | 4 U |
| Propionitrile (Ethyl Cyanide) | 11000 R | 200 U |
| Styrene (Ethenylbenzene) | 220 U | 4 U |
| Tetrachloroethene (PCE) | 220 UJ | 4 U |
| Toluene | 220 U | 4 U |
| Trichloroethene (TCE) | 220 U | 4 U |
| Trichlorofluoromethane | 220 U | 4 U |
| Vinyl Acetate | 220 U | 4 U |
| Vinyl Chloride | 220 U | 4 U |
| Xylenes, total | 130 J | 12 U |
| **Semivolatiles (ug/kg)** | | |
| 1,2,4,5-Tetrachlorobenzene | 380 U | 400 U |
| 1,2,4-Trichlorobenzene | 380 U | 400 U |
| 1,2-Dichlorobenzene (o-) | 380 U | 400 U |
| 1,3,5-Trinitrobenzene | 380 U | 400 U |
| 1,3-Dichlorobenzene (m-) | 380 U | 400 U |

## APPENDIX B

## DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## RCRA FACILITY INVESTIGATION
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | 2006 RFI | | | |
|---|---|---|---|---|
| | 14SB04-01 | | 14SB06-01 | |
| | 03-06-2006 | | 03-07-2006 | |
| | 1.5 - 3.0 | | 1.5 - 3.0 | |
| **Semivolatiles (ug/kg) (Cont)** | | | | |
| 1,3-Dinitrobenzene (m-) | 380 | U | 400 | U |
| 1,4-Dichlorobenzene (p-) | 380 | U | 400 | U |
| 1,4-Dioxane (p-) | 11000 | R | 200 | R |
| 1,4-Naphthoquinone | 380 | U | 400 | U |
| 1,4-Phenylenediamine | 380 | UJ | 400 | UJ |
| 1-Naphthylamine | 380 | U | 400 | U |
| 2,3,4,6-Tetrachlorophenol | 380 | U | 400 | U |
| 2,4,5-Trichlorophenol | 380 | U | 400 | U |
| 2,4,6-Trichlorophenol | 380 | U | 400 | U |
| 2,4-Dichlorophenol | 380 | U | 400 | U |
| 2,4-Dimethylphenol | 380 | U | 400 | U |
| 2,4-Dinitrophenol | 760 | UJ | 800 | UJ |
| 2,4-Dinitrotoluene | 380 | U | 400 | U |
| 2,6-Dichlorophenol | 380 | U | 400 | U |
| 2,6-Dinitrotoluene | 380 | U | 400 | U |
| 2-Acetylaminofluorene | 380 | U | 400 | U |
| 2-Chloronaphthalene | 380 | U | 400 | U |
| 2-Chlorophenol | 380 | U | 400 | U |
| 2-Methylphenol (o-Cresol) | 380 | U | 400 | U |
| 2-Naphthylamine | 380 | U | 400 | U |
| 2-Nitroaniline | 760 | U | 800 | U |
| 2-Nitrophenol | 380 | U | 400 | U |
| 2-Picoline | 380 | U | 400 | U |
| 3,3'-Dichlorobenzidine | 380 | U | 400 | U |
| 3,3'-Dimethylbenzidine | 380 | U | 400 | U |
| 3-Methylcholanthrene | 380 | U | 400 | U |
| 3-Methylphenol (m-Cresol) | 380 | U | 400 | U |
| 3-Nitroaniline | 760 | U | 800 | U |
| 4,6-Dinitro-2-methylphenol | 760 | U | 800 | U |

**APPENDIX B**

**DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | |
|---|---|---|
| | 14SB04-01 | 14SB06-01 |
| | 03-06-2006 | 03-07-2006 |
| | 1.5 - 3.0 | 1.5 - 3.0 |
| **Semivolatiles (ug/kg) (Cont)** | | |
| 4-Aminobiphenyl | 380 U | 400 U |
| 4-Bromophenyl-phenylether | 380 U | 400 U |
| 4-Chloro-3-methylphenol | 380 U | 400 U |
| 4-Chloroaniline | 380 U | 400 U |
| 4-Chlorophenyl-phenylether | 380 U | 400 U |
| 4-Dimethylaminoazobenzene (p-) | 380 U | 400 U |
| 4-Methylphenol (p-Cresol) | 380 U | 400 U |
| 4-Nitroaniline | 760 U | 800 U |
| 4-Nitrophenol | 760 UJ | 800 UJ |
| 4-Nitroquinoline-1-Oxide | 380 UJ | 400 UJ |
| 5-Nitro-o-toluidine | 380 U | 400 U |
| 7,12-Dimethylbenz(a)anthracene | 380 U | 400 U |
| a,a-Dimethylphenethylamine | 77000 UJ | 82000 UJ |
| Acetophenone | 380 U | 400 U |
| Aniline | 380 U | 400 U |
| Aramite | 380 U | 400 U |
| Benzyl Alcohol | 380 U | 400 U |
| Bis(2-chloroethoxy)methane | 380 U | 400 U |
| Bis(2-chloroisopropyl)ether | 380 U | 400 U |
| Bis(2-chloroethyl)ether | 380 U | 400 U |
| Bis(2-ethylhexyl) Phthalate (BEHP) | 380 U | 400 U |
| Butyl Benzyl Phthalate | 380 U | 400 U |
| Diallate (cis) | 380 U | 400 U |
| Diallate (trans) | 380 U | 400 U |
| Dibenzofuran | 380 U | 400 U |
| Diethyl Phthalate (DEP) | 380 U | 400 U |
| Dimethyl Phthalate | 380 U | 400 U |
| Di-n-butyl Phthalate (DBP) | 380 U | 400 U |
| Di-n-octyl Phthalate | 380 U | 400 U |
| Dinoseb | 380 U | 400 U |

## APPENDIX B

## DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## RCRA FACILITY INVESTIGATION
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | 2006 RFI | |
|---|---|---|
| | 14SB04-01 | 14SB06-01 |
| | 03-06-2006 | 03-07-2006 |
| | 1.5 - 3.0 | 1.5 - 3.0 |
| **Semivolatiles (ug/kg) (Cont)** | | |
| Ethyl Methanesulfonate (EMS) | 380 U | 400 U |
| Hexachlorobenzene | 380 U | 400 U |
| Hexachlorobutadiene | 380 U | 400 U |
| Hexachlorocyclopentadiene | 380 U | 400 U |
| Hexachloroethane | 380 U | 400 U |
| Hexachlorophene | NA | NA |
| Hexachloropropene | 380 U | 400 U |
| Isophorone | 380 U | 400 U |
| Isosafrole | 380 U | 400 U |
| Methapyrilene | 380 UJ | 400 UJ |
| Methyl Methane Sulfonate | 380 U | 400 U |
| Nitrobenzene | 380 U | 400 U |
| n-Nitrosodiethylamine | 380 UJ | 400 UJ |
| n-Nitrosodimethylamine | 380 U | 400 U |
| n-Nitroso-di-n-butylamine | 380 UJ | 400 UJ |
| n-Nitrosodi-n-propylamine | 380 UJ | 400 UJ |
| n-Nitrosodiphenylamine | 380 U | 400 U |
| n-Nitrosomethylethylamine | 380 UJ | 400 UJ |
| n-Nitrosomorpholine | 380 UJ | 400 UJ |
| n-Nitrosopiperidine | 380 U | 400 U |
| n-Nitrosopyrrolidine | 380 UJ | 400 UJ |
| o-Toluidine | 380 U | 400 U |
| Pentachlorobenzene | 380 U | 400 U |
| Pentachloronitrobenzene | 380 U | 400 U |
| Pentachlorophenol | 760 U | 800 U |
| Phenacetin | 380 U | 400 U |
| Phenol | 380 U | 400 U |
| Pronamide | 380 U | 400 U |
| Pyridine | 380 U | 400 U |
| Safrole | 380 U | 400 U |

## APPENDIX B

## DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## RCRA FACILITY INVESTIGATION
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | 2006 RFI | |
|---|---|---|
| | 14SB04-01 | 14SB06-01 |
| | 03-06-2006 | 03-07-2006 |
| | 1.5 - 3.0 | 1.5 - 3.0 |
| **PAHs (ug/kg)** | | |
| 1-Methylnaphthalene | NA | 8.2 UJ |
| 2-Methylnaphthalene | 1700 | 8.2 UJ |
| Acenaphthene | 380 U | 8.2 U |
| Acenaphthylene | 380 U | 8.2 UJ |
| Anthracene | 380 U | 8.2 U |
| Benzo(a)anthracene | 380 U | 8.2 U |
| Benzo(a)pyrene (BaP) | 380 U | 8.2 U |
| Benzo(b)fluoranthene | 380 U | 8.2 U |
| Benzo(g,h,i)perylene | 16 J | 7.7 J |
| Benzo(k)fluoranthene | 380 U | 8.2 U |
| Chrysene | 380 U | 8.2 U |
| Dibenz(a,h)anthracene | 380 U | 8.2 U |
| Fluoranthene | 380 U | 8.2 U |
| Fluorene | 380 U | 8.2 U |
| Indeno(1,2,3-cd)pyrene | 380 U | 5.6 J |
| Naphthalene | 480 | 8.2 U |
| Phenanthrene | 45 J | 8.2 U |
| Pyrene | 62 J | 8.2 U |
| **PCBs (ug/kg)** | | |
| Aroclor-1016 | 36 UJ | 38 U |
| Aroclor-1221 | 48 UJ | 51 U |
| Aroclor-1232 | 36 UJ | 38 U |
| Aroclor-1242 | 24 UJ | 26 U |
| Aroclor-1248 | 24 UJ | 26 U |
| Aroclor-1254 | 24 UJ | 26 U |
| Aroclor-1260 | 36 UJ | 38 U |

## APPENDIX B

## DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL
## SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA
## RCRA FACILITY INVESTIGATION
## NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

| | 2006 RFI | |
|---|---|---|
| | 14SB04-01 | 14SB06-01 |
| | 03-06-2006 | 03-07-2006 |
| | 1.5 - 3.0 | 1.5 - 3.0 |
| **Dioxins / Furans (ug/kg)** | | |
| TCDD, 2,3,7,8- | 0.113 U | NA |
| PeCDD, 1,2,3,7,8- | 0.113 U | NA |
| HxCDD, 1,2,3,4,7,8- | 0.283 U | NA |
| HxCDD, 1,2,3,6,7,8- | 0.283 U | NA |
| HxCDD, 1,2,3,7,8,9- | 0.283 U | NA |
| HpCDD, 1,2,3,4,6,7,8- | 1.27 J | NA |
| OCDD | 11.6 | NA |
| TCDF, 2,3,7,8- | 0.113 U | NA |
| PeCDF, 1,2,3,7,8- | 0.113 U | NA |
| PeCDF, 2,3,4,7,8- | 0.113 U | NA |
| HxCDF, 1,2,3,4,7,8- | 0.283 U | NA |
| HxCDF, 1,2,3,6,7,8- | 0.283 U | NA |
| HxCDF, 2,3,4,6,7,8- | 0.283 U | NA |
| HxCDF, 1,2,3,7,8,9- | 0.283 U | NA |
| HpCDF, 1,2,3,4,6,7,8- | 0.283 U | NA |
| HpCDF, 1,2,3,4,7,8,9- | 0.283 U | NA |
| OCDF | 0.566 U | NA |
| **TPH (mg/kg)** | | |
| Diesel Range Organics (DRO) | 2400 | 29 |
| Gasoline Range Organics (GRO) | 5.4 | 0.61 U |

**APPENDIX B**

**DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT, SUBSURFACE SOIL**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | | |
|---|---|---|---|---|
| | 14SB04-01 | | 14SB06-01 | |
| | 03-06-2006 | | 03-07-2006 | |
| | 1.5 - 3.0 | | 1.5 - 3.0 | |
| **Inorganics (mg/kg)** | | | | |
| Antimony | 1 | UJ | 1.4 | J |
| Arsenic | 0.79 | J | 1.2 | J |
| Barium | 64.4 | J | 63.8 | J |
| Beryllium | 0.01 | U | 0.01 | U |
| Cadmium | 0.84 | | 1 | |
| Chromium | 20.8 | J | 31.9 | J |
| Cobalt | 12.8 | J | 24.5 | J |
| Copper | 84 | R | 143 | R |
| Lead | 39.8 | J | 14.8 | J |
| Mercury | 0.017 | U | 0.019 | U |
| Nickel | 7.7 | J | 13.5 | J |
| Selenium | 0.54 | J | 1.1 | J |
| Silver | 0.05 | U | 0.06 | U |
| Thallium | 0.42 | UJ | 0.46 | UJ |
| Tin | | | | |
| Vanadium | 98.8 | J | 178 | J |
| Zinc | 68 | J | 75.9 | J |

**Notes:**
U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
NA - Not Analyzed
R - Result is rejected and unusable

# APPENDIX C
# Groundwater Analytical Data

**APPENDIX C**

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01 | 14TW02 | 14TW07 |
| | 03-08-2006 | 03-08-2006 | 03-08-2006 |
| **Volatiles (ug/L)** | | | |
| 1,1,1,2-Tetrachloroethane | 0.5 U | 0.5 U | 0.5 U |
| 1,1,1-Trichloroethane (TCA) | 0.5 U | 0.5 U | 0.5 U |
| 1,1,2,2-Tetrachloroethane | 0.5 U | 0.5 U | 0.5 U |
| 1,1,2-Trichloroethane | 0.5 U | 0.5 U | 0.5 U |
| 1,1-Dichloroethane | 0.5 U | 0.5 U | 0.5 U |
| 1,1-Dichloroethene | 0.5 U | 0.5 U | 0.5 U |
| 1,2,3-Trichloropropane | 0.5 U | 0.5 U | 0.5 U |
| 1,2-Dibromo-3-chloropropane (DBCP) | 0.5 UJ | 0.5 UJ | 0.5 U |
| 1,2-Dibromoethane (EDB) | 0.5 U | 0.5 U | 0.5 U |
| 1,2-Dichloroethane | 4.1 | 0.5 U | 0.5 U |
| 1,2-Dichloroethene (trans) | 0.5 U | 0.5 U | 0.5 U |
| 1,2-Dichloropropane | 0.5 U | 0.5 U | 0.5 U |
| 1,4-Dichloro-2-butene (trans) | 20 U | 20 U | 20 R |
| 2-Butanone (MEK) | 16 | 7.2 | 2.5 R |
| 2-Chloro-1,3-butadiene (Chloroprene) | 0.5 U | 0.5 U | 0.5 UJ |
| 2-Hexanone (MBK) | 2.5 U | 2.5 U | 2.5 U |
| 3-Chloropropene (Allyl Chloride) | 0.5 U | 0.5 U | 0.5 UJ |
| 4-Methyl-2-pentanone (MIBK) | 2.5 U | 2.5 U | 2.5 U |
| Acetone | 72 | 58 | 2.5 U |
| Acetonitrile | 0.5 R | 0.5 R | 0.5 R |
| Acrolein | 5 R | 5 R | 5 R |
| Acrylonitrile | 5 R | 5 R | 5 R |
| Benzene | 220 | 0.41 J | 0.5 U |
| Bromodichloromethane | 0.5 U | 0.5 U | 0.5 U |
| Bromoform | 0.5 U | 0.5 U | 0.5 U |
| Bromomethane | 0.5 U | 0.5 U | 0.5 U |
| Carbon Disulfide | 0.13 J | 0.22 J | 0.5 U |
| Carbon Tetrachloride | 0.5 U | 0.5 U | 0.5 U |
| Chlorobenzene | 0.5 U | 0.5 U | 0.5 U |
| Chloroethane | 0.5 U | 0.5 U | 0.5 UJ |
| Chloroform | 0.5 U | 0.5 U | 0.5 U |

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01 | 14TW02 | 14TW07 |
| | 03-08-2006 | 03-08-2006 | 03-08-2006 |
| **Volatiles (ug/L) (Cont)** | | | |
| Chloromethane | 0.5 U | 0.5 U | 0.5 UJ |
| Dibromochloromethane | 0.5 U | 0.5 U | 0.5 U |
| Dibromomethane | 0.5 U | 0.5 U | 0.5 U |
| Dichlorodifluoromethane (Freon-12) | 0.5 U | 0.5 U | 0.5 U |
| Ethyl Methacrylate | 5 U | 5 U | 5 U |
| Ethylbenzene | 1.3 | 0.56 | 0.5 U |
| Iodomethane | 0.5 U | 0.58 J | 0.5 UJ |
| Isobutyl Alcohol | 25 UJ | 25 UJ | 25 UJ |
| Methyl Acrylonitrile | 5 UJ | 5 UJ | 5 UJ |
| Methyl Methacrylate | 5 U | 5 U | 5 U |
| Methylene Chloride | 0.5 U | 0.5 U | 0.5 U |
| Pentachloroethane | 0.5 UJ | 0.5 UJ | 0.5 UJ |
| Propionitrile (Ethyl Cyanide) | 25 R | 25 R | 25 R |
| Styrene (Ethenylbenzene) | 0.5 U | 0.5 U | 0.5 U |
| Tetrachloroethene (PCE) | 0.5 U | 0.5 U | 0.5 U |
| Toluene | 0.5 U | 0.5 U | 0.5 U |
| Trichloroethene (TCE) | 0.5 U | 0.5 U | 0.5 U |
| Trichlorofluoromethane | 0.5 U | 0.5 U | 0.5 U |
| Vinyl Acetate | 1 U | 1 U | 1 U |
| Vinyl Chloride | 0.5 U | 0.5 U | 0.5 U |
| Xylene, m/p- | 0.28 J | 0.35 J | 1 U |
| Xylene, o- | 1 | 0.53 | 0.5 U |
| Xylenes, total | 1.3 | 0.91 | 0.5 U |
| **Semivolatiles (ug/L)** | | | |
| 1,2,4,5-Tetrachlorobenzene | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | 10 U | 10 U | 10 U |
| 1,2-Dichlorobenzene (o-) | 10 U | 10 U | 10 U |
| 1,3,5-Trinitrobenzene | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene (m-) | 10 U | 10 U | 10 U |
| 1,3-Dinitrobenzene (m-) | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene (p-) | 10 U | 10 U | 10 U |
| **Semivolatiles (ug/L) (Cont)** | | | |
| 1,4-Dioxane (p-) | 25 U | 25 U | 25 UJ |
| 1,4-Naphthoquinone | 10 U | 10 U | 10 U |
| 1,4-Phenylenediamine | 100 UJ | 100 UJ | 100 UJ |

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01 | 14TW02 | 14TW07 |
| | 03-08-2006 | 03-08-2006 | 03-08-2006 |
| 1-Naphthylamine | 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 |
| 2,4,6-Trichlorophenol | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | 20 U | 20 U | 20 U |
| 2,4-Dinitrotoluene | 10 U | 10 U | 10 U |
| 2,6-Dichlorophenol | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | 10 U | 10 U | 10 U |
| 2-Acetylaminofluorene | 10 U | 10 U | 10 U |
| 2-Chloronaphthalene | 10 U | 10 U | 10 U |
| 2-Chlorophenol | 10 U | 10 U | 10 U |
| 2-Methylphenol (o-Cresol) | 10 U | 10 U | 10 U |
| 2-Naphthylamine | 10 U | 10 U | 10 U |
| 2-Nitroaniline | 20 U | 20 U | 20 U |
| 2-Nitrophenol | 10 U | 10 U | 10 U |
| 2-Picoline | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | 10 U | 10 U | 10 U |
| 3,3'-Dimethylbenzidine | 10 U | 10 U | 10 U |
| 3-Methylcholanthrene | 10 U | 10 U | 10 U |
| 3-Methylphenol (m-Cresol) | 10 U | 10 U | 10 U |
| 3-Nitroaniline | 20 U | 20 U | 20 U |
| 4,6-Dinitro-2-methylphenol | 20 U | 20 U | 20 U |
| 4-Aminobiphenyl | 10 U | 10 U | 10 U |
| 4-Bromophenyl-phenylether | 10 U | 10 U | 10 U |
| 4-Chloro-3-methylphenol | 10 U | 10 U | 10 U |
| 4-Chloroaniline | 10 U | 10 U | 10 U |
| **Semivolatiles (ug/L) (Cont)** | | | |
| 4-Chlorophenyl-phenylether | 10 U | 10 U | 10 U |
| 4-Dimethylaminoazobenzene (p-) | 10 U | 10 U | 10 U |
| 4-Methylphenol (p-Cresol) | 10 U | 10 U | 10 U |
| 4-Nitroaniline | 20 U | 20 U | 20 U |
| 4-Nitrophenol | 20 U | 20 U | 20 U |
| 4-Nitroquinoline-1-Oxide | 10 U | 10 U | 10 U |
| 5-Nitro-o-toluidine | 10 U | 10 U | 10 U |

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01<br>03-08-2006 | 14TW02<br>03-08-2006 | 14TW07<br>03-08-2006 |
| 7,12-Dimethylbenz(a)anthracene | 10 U | 10 U | 10 U |
| a,a-Dimethylphenethylamine | 2000 U | 2000 U | 2000 U |
| Acetophenone | 0.33 J | 10 U | 10 U |
| Aniline | 10 U | 10 U | 10 U |
| Aramite | 10 U | 10 U | 10 U |
| Benzyl Alcohol | 10 U | 10 U | 10 U |
| Bis(2-chloroethoxy)methane | 10 U | 10 U | 10 U |
| Bis(2-chloroisopropyl)ether | 10 U | 10 U | 10 U |
| Bis(2-chloroethyl)ether | 10 U | 10 U | 10 U |
| Bis(2-ethylhexyl) Phthalate (BEHP) | 10 U | 10 U | 10 U |
| Butyl Benzyl Phthalate | 10 U | 10 U | 0.3 J |
| Chrysene | 10 U | 10 U | 10 U |
| Diallate (cis) | 10 U | 10 U | 10 U |
| Diallate (trans) | 10 U | 10 U | 10 U |
| Dibenzofuran | 0.43 J | 10 U | 10 U |
| Diethyl Phthalate (DEP) | 0.89 J | 10 U | 1.3 J |
| Dimethyl Phthalate | 10 U | 10 U | 10 U |
| Di-n-butyl Phthalate (DBP) | 10 U | 10 U | 0.48 J |
| Di-n-octyl Phthalate | 10 U | 10 U | 10 U |
| Dinoseb | 10 U | 10 U | 10 U |
| Ethyl Methanesulfonate (EMS) | 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 |

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01 | 14TW02 | 14TW07 |
| | 03-08-2006 | 03-08-2006 | 03-08-2006 |
| **Semivolatiles (ug/L) (Cont)** | | | |
| Hexachloroethane | 10 U | 10 U | 10 U |
| Hexachloropropene | 10 U | 10 U | 10 U |
| Isophorone | 10 U | 10 U | 10 U |
| Isosafrole | 10 U | 10 U | 10 U |
| Methapyrilene | 10 U | 10 U | 10 U |
| Methyl Methane Sulfonate | 10 U | 10 U | 10 U |
| Nitrobenzene | 10 U | 10 U | 10 U |
| n-Nitrosodiethylamine | 10 U | 10 U | 10 U |
| n-Nitrosodimethylamine | 10 UJ | 10 UJ | 10 UJ |
| n-Nitroso-di-n-butylamine | 10 UJ | 10 UJ | 10 UJ |
| n-Nitrosodi-n-propylamine | 10 UJ | 10 UJ | 10 UJ |
| n-Nitrosodiphenylamine | 10 U | 10 U | 10 U |
| n-Nitrosomethylethylamine | 10 U | 10 U | 10 U |
| n-Nitrosomorpholine | 10 UJ | 10 UJ | 10 UJ |
| n-Nitrosopiperidine | 10 U | 10 U | 10 U |
| n-Nitrosopyrrolidine | 10 UJ | 10 UJ | 10 UJ |
| o-Toluidine | 10 U | 10 U | 10 U |
| Pentachlorobenzene | 10 U | 10 U | 10 U |
| Pentachloronitrobenzene | 10 U | 10 U | 10 U |
| Pentachlorophenol | 20 U | 20 U | 20 U |
| Phenacetin | 10 U | 10 U | 10 U |
| Phenol | 10 U | 10 U | 10 U |
| Pronamide | 10 U | 10 U | 10 U |
| Pyridine | 10 U | 10 U | 10 U |
| Safrole | 10 U | 10 U | 10 U |
| **PAHs (ug/L)** | | | |
| 1-Methylnaphthalene | 1.4 J | 1.9 J | 0.2 UJ |
| 2-Methylnaphthalene | 2 J | 1.8 J | 0.2 U |
| Acenaphthene | 0.081 J | 0.079 J | 0.2 U |
| Acenaphthylene | 0.2 U | 0.2 UJ | 0.2 U |
| Anthracene | 0.2 U | 0.2 U | 0.2 U |
| **PAHs (ug/L) (Cont)** | | | |
| Benzo(a)anthracene | 0.095 J | 0.2 U | 0.2 U |
| Benzo(a)pyrene (BaP) | 0.084 J | 0.2 U | 0.2 U |
| Benzo(b)fluoranthene | 0.083 J | 0.2 U | 0.2 U |

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01 | 14TW02 | 14TW07 |
| | 03-08-2006 | 03-08-2006 | 03-08-2006 |
| Benzo(g,h,i)perylene | 0.088 J | 0.2 U | 0.2 U |
| Benzo(k)fluoranthene | 0.093 J | 0.2 U | 0.2 U |
| Chrysene | 0.078 J | 0.2 U | 0.2 U |
| Dibenz(a,h)anthracene | 0.097 J | 0.2 U | 0.2 U |
| Fluoranthene | 0.078 J | 0.2 U | 0.2 U |
| Fluorene | 0.25 | 0.11 J | 0.066 J |
| Indeno(1,2,3-cd)pyrene | 0.11 J | 0.2 U | 0.2 U |
| Naphthalene | 14 | 3 | 0.34 |
| Phenanthrene | 0.2 U | 0.2 U | 0.2 U |
| Pyrene | 0.087 J | 0.2 U | 0.2 U |
| **PCBs (ug/L)** | | | |
| Aroclor-1016 | NA | 0.93 U | NA |
| Aroclor-1221 | NA | 1.3 U | NA |
| Aroclor-1232 | NA | 0.93 U | NA |
| Aroclor-1242 | NA | 0.63 U | NA |
| Aroclor-1248 | NA | 0.63 U | NA |
| Aroclor-1254 | NA | 0.63 U | NA |
| Aroclor-1260 | NA | 0.93 U | NA |
| **TPH (mg/L)** | | | |
| Diesel Range Organics (DRO) | 1.8 | 1.4 | 1.5 |
| Gasoline Range Organics (GRO) | 0.86 | 0.15 J | 0.5 U |
| **Metals (ug/L)** | | | |
| Antimony | NA | 1.4 U | 1.2 U |
| Arsenic | NA | 1.4 U | 1.4 U |
| Barium | NA | 157 U | 110 U |
| Beryllium | NA | 0.1 U | 0.34 U |
| Cadmium | NA | 0.2 U | 0.2 U |
| Chromium | NA | 16.5 J | 27.8 J |
| **Metals (ug/L) (Cont)** | | | |
| Cobalt | NA | 5 | 28.2 |
| Copper | NA | 24.8 R | 74.3 J |
| Lead | NA | 6.1 | 1.9 J |
| Mercury | NA | 0.1 U | 0.1 U |
| Nickel | NA | 4.1 J | 11.1 J |
| Selenium | NA | 3.3 UJ | 3.3 UJ |
| Silver | NA | 0.5 U | 0.5 U |

**APPENDIX C**

**GROUNDWATER ANALYTICAL DATA**
**SWMU 14 - FIRE TRAINING PIT AT CRASH CREW AREA**
**RCRA FACILITY INVESTIGATION**
**NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO**

| | 2006 RFI | | |
|---|---|---|---|
| | 14TW01 | 14TW02 | 14TW07 |
| | 03-08-2006 | 03-08-2006 | 03-08-2006 |
| Thallium | NA | 3.9 U | 3.9 U |
| Tin | | | |
| Vanadium | NA | 59.2 | 74 |
| Zinc | NA | 12.7 U | 50.8 |

**Notes:**
U - Not detected
UJ - Reported quantitation limit is qualified as estimated
J - Analyte present - Reported value is estimated
NA - Not Analyzed
R - Result is rejected and unusable