Final

Corrective Measures Study Final Report
SWMU 6/AOC B

Naval Station Roosevelt Roads

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
Baker	Baker Environmental, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measure Study
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
cPAHs	carcinogenic poly-aromatic hydrocarbons
CSF	Cancer Slope Factors
DoN	Department of the Navy
DRMO	Defense Reutilization and Marketing Office
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
HI	Hazard Index
HQ	Hazard Quotient
HxCDD	hexachlorodibenzodioxin
HxCDF	hexachlorodibenzofuran
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IR	Installation Restoration
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
MCL	Maximum Contaminant Level
Fg/kg	micrograms per kilogram
Fg/L	micrograms per liter
MS	mass spectrometry
NSRR	Naval Station Roosevelt Roads
OU	Operable Unit
PCB	Polychlorinated biphenyl
RA	Risk Assessment
RBCs	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RfDs	Reference Doses
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigations
SWMUs	Solid Waste Management Units
SVOC	Semivolatile Organic Compounds

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

TCDD	tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalency Factor
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
USTs	Underground Storage Tanks
VOCs	Volatile Organic Compounds
VSI	Visual Site Inspection

1.0 INTRODUCTION

This document presents the Corrective Measure Study (CMS) Report for Solid Waste Management Unit (SWMU) 6/Area of Concern (AOC) B at the Naval Station Roosevelt Roads (NSRR), Ceiba, Puerto Rico. The report has been prepared under the Corrective Action provisions of the Station's Resource Conservation and Recovery Act (RCRA) permit (RCRA/HSWA Permit No. PR2170027203). This report has been prepared by Baker Environmental, Inc. (Baker) under contract to the Atlantic Division, Naval Facilities Engineering Command (LANTDIV).

1.1 Regulatory Framework

In 1943, NSRR was commissioned as a Naval Operations Base. NSRR continued in this status until 1957 when it was redesignated a naval station with the mission of providing full support for Atlantic Fleet weapons training and development activities. Until 1993 all environmental operations, with the exception of underground storage tanks (USTs), were conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations as part of the Department of the Navy's (DoN) Installation Restoration (IR) Program. On October 20, 1994, a Final RCRA Part B permit was issued by the United States Environmental Protection Agency (USEPA) Region II to the Defense Reutilization and Marketing Office (DRMO), NSRR. This corrective action provision of the permit required RCRA Facility Investigation (RFI) activities at 25 SWMUs and 4 AOCs.

RCRA regulations provide a procedure to investigate and remediate areas that may have been affected by a release of hazardous wastes. The first steps for investigating a site are the RCRA Facility Assessment (RFA) and the RFI. These assessments and investigations are studies on a property to determine if there has been a release of hazardous waste and to quantify any releases that have occurred. If these studies determine that a release has occurred, a CMS is performed to identify the most appropriate corrective measure for a given site.

A RFA was performed in 1988 and updated in 1993 by A.T. Kearney, Inc. for the USEPA to identify SWMUs and AOCs, and to assess the potential for the release of hazardous constituents from any areas or units. The RFA identified 47 SWMUs and 4 AOCs, and recommended

additional investigation at 25 of the SWMUs and all four AOCs. In 1996, a Draft RFI report was prepared for Operable Units (OUs) 1, 6, and 7. Additional investigations, described in Section 2.0 of this report, were also conducted. Because the RFA and RFI indicated that releases had occurred, a CMS was deemed necessary. This report specifically focuses on the soil at SWMU 6/AOC B which was found to be the only environmental media significantly impacted by past activities.

1.2 Intent of the Focused CMS

The purpose of a CMS is typically:

to identify and evaluate remedial alternatives that may be used to address a release at a facility;

- to justify the recommended corrective action based upon technical, human health, and environmental considerations;
- to determine clean up levels;
- to provide a system for reporting compliance requirements and use this system to document remediation activities; and
- to provide information pertinent to the remedial design.

However, in a situation where the extent of contamination is limited and no remedial action is required, as is the case at SWMU 6 and AOC B, a streamlined approach to this process should be considered, as the screening of clean-up technologies will not be necessary.

1.3 Goals of the Corrective Measure Process

The goal of this CMS is to identify the appropriate technical approach needed to address releases to the soil at SWMU 6/AOC B. The contaminant levels in the soil will be reduced to levels at or below the clean up goals established in this CMS. This CMS establishes the framework for the

remediation of the SWMU/AOC by providing remediation goals, a selected remediation method, and other information that is pertinent for the preparation of the remedial design and ultimately SWMU clean up if determined necessary.

1.4 Organization of the Report

As stated previously, this report is the consolidated CMS for the above mentioned SWMU/AOC. This CMS is organized into six sections. Section 1.0 contains the introduction. Section 2.0 describes the sites, their investigative history, and the current site conditions. Section 3.0 establishes the corrective action objectives based upon the human health risk assessments and the developed risk-based remediation goals. Section 4.0 presents the recommendations and justification of no remedial action at SWMU 6/AOC B. References are contained in Section 5.0.

2.0 DESCRIPTION OF CURRENT CONDITIONS

This section contains general site description of SWMU 6/AOC B. The investigative history and current site descriptions are also discussed in this section. Figure 2-1 shows the location of the SWMU and AOC.

2.1 General Site Descriptions

General site descriptions of SWMU 6/AOC B are included in the subsections that follow. SWMU 6 and AOC B are located adjacent to each other in a limited access area of NSRR. These sites are located in a secure fenced storage yard located in the industrial area of NSRR. The area containing SWMU 6 and AOC B is level and is a wide, open gravel and grass field. This area is currently utilized for the parking of heavy equipment. It should be noted that this area is scheduled to be upgraded. The upgrade will consist of paving the parking area and demolishing the bunker described in the following section.

2.1.1 SWMU 6

SWMU 6 consists of Building 145. Building 145 is a partially subterranean, concrete bunker (Appendix A, Photograph 2-1), with three openings to the surface through the roof (Appendix A, Photographs 2-2 and 2-3). The dimensions of SWMU 6 are approximately 180 feet long, 7 feet high, and 8 feet wide. Figure 2-2 shows a site plan of SWMU 6.

2.1.2 AOC B

AOC B consists of the site of the now demolished Building 25. Remnants of this building include a floor/foundation that is now mostly overgrown with grasses (Appendix A, Photograph 2-4). The building was approximately 110 feet long by 40 feet wide. Figure 2-2 shows a site plan of AOC B.

2.2 Summary of Site Conditions

The sections that follow describe the investigation history and the current conditions of SWMU 6 and AOC B.

2.2.1 Investigation History

Table 2-1 summarizes the investigation history at both SWMU 6 and AOC B. The following is a chronological summary of investigations:

- 1983/84 Initial Assessment Study
- 1986 Confirmation Study
- 1988 RCRA Facility Assessment
- 1993 Draft Supplemental Investigation

These investigations were site-wide and conducted by consultants other than Baker. The results of these investigations are summarized in Table 2-1 and Section 2.2.2.

- 1996 RCRA Facility Investigations
- 1998 Additional Facility Investigations

The 1996 RFI focused on sites in Operable Units 1, 6, and 7, which included SWMU 6 and AOC B. The purpose of the additional investigation at SWMU 6/AOC B was to replace and sample one pre-RFI monitoring well. The well, an old IR program well (from IR Site 10) was found in the approximate location intended for a 1996 RFI well and used for the RFI.

The RFI and the Additional Facility Investigation were performed by Baker. The results of these investigations are summarized in Table 2-1 and detailed in Section 2.2.2.

2.2.2 Site Conditions

The following subsections describe the current conditions at SWMU 6/AOC B and Figures 2-3 through 2-6 show the current extent of contamination.

SWMU 6 (the bunker) was formerly used as a long-term storage area for containers of surplus and discarded paints, polishes, etc. The Navy's 1984 Initial Assessment Study (IAS) indicated this building was used for more than 25 years for this purpose, and at that time, contained a large quantity (sixty 55 gallon drums plus 100 five gallon pails) of containers. Most of these containers were in poor condition, some resting in standing water, with tree roots penetrating through the structure. According to the 1988 Visual Site Inspection (VSI), all contents formerly stored in this SWMU had been removed at that point; the same finding resulted from the 1993 follow-up inspection. The 1993 re-inspection found the building to be empty with only some standing water in the lowest point.

AOC B, the demolished building, formerly contained hazardous waste materials. The 1993 follow-up inspection found seventeen 55-gallon drums of lubricating oils and diesel fuel stored outdoors, unsheltered, and resting directly on a bricked surface that was the former floor of Building 25. A makeshift sandbag dike surrounded the area. Extensive oil stains were observed on both the brick floor and surrounding soils.

Sampling activities in 1996 at SWMU 6 included the collection of six surface soils (three surface soil samples including one duplicate and three surface soil samples associated with the soil borings), six subsurface soils including one duplicate and one surface water sample. Sampling activities in 1996 at AOC B included the collection of eight surface soils (two surface soil samples and six surface soil samples including one duplicate associated with the soil borings), eight subsurface soil samples, and two groundwater samples.

The RFI conducted in 1996 indicated that no volatile organic compounds (VOCs) exceeded EPA Region III risk based concentrations (RBC) values in surface soil samples. Several semivolatile organic compounds (SVOCs) were detected during the 1996 RFI as shown on Figure 2-3. Benzo(a)pyrene was above the residential RBC in five samples and one duplicate and the industrial RBC in one sample and it's corresponding duplicate. Benzo(a)anthracene, benzo(b)fluoranthene and dibenzo(a,h)anthracene were greater than the residential RBC only. The compounds 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were detected in one sample, namely ACBSB01-00 (and the duplicate) in concentrations above the residential RBCs, as presented in Table 2-2. The industrial RBC for 4,4'-DDE was exceeded in both of these samples as well. A total of two dioxins were detected (Total HxCDD and Total HxCDF) in surface soil and were evaluated utilizing the toxicity

equivalency factor (TEF) based on the relationship of the dioxin to 2, 3, 7, 8-TCDD. Total HxCDD was above at least one of the listed criteria in two surface soil samples including 6SB01-00, 6SS01, and it's duplicate 6SS01D. Total HxCDF was above the residential RBC in one surface soil sample including 6SS01 and it's duplicate 6SS01D. Arsenic was detected in all surface soil samples above the residential RBC (Figure 2-3). Arsenic was detected in three surface soil samples and one duplicate sample above the residential RBC and background screening criteria, and above both RBCs and background screening criteria in four samples and one duplicate sample. A total of nine additional constituents exceeded their respective background screening criteria including antimony, beryllium, cadmium, copper, cyanide, lead, mercury, tin, and zinc, as presented in Table 2-3.

The RFI conducted in 1996 indicated that no VOCs or SVOCs exceeded RBCs in any of the subsurface soil samples, as presented in Table 2-4. However, 4,4-DDE, 4,4'-DDD, and 4,4'-DDT were above the residential RBC values in sample ACBSB01-02 (Figure 2-4). Arsenic also was present above the residential RBC in four samples (Figure 2-4). It should be noted that arsenic did not exceed the background screening criteria in any of the four samples. A total of eleven constituents exceeded their respective background screening criteria including antimony, beryllium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, and zinc, as presented in Table 2-5.

Two subsurface soil samples (BMW02-03 and BMW02-04) were collected from SWMU 6/AOC B during 1997 additional investigation. No VOCs, SVOCs, pesticides/polychlorinated biphenyls(PCBs), dioxins, chlorinated herbicides, or total petroleum hydrocarbons (TPH), diesel range organics (DRO) and gasoline range organics (GRO) were detected in the subsurface soil samples, as presented in Table 2-4.

Fourteen different inorganic compounds were detected in the additional investigation subsurface soil samples. Only antimony, chromium, and silver were detected above background screening criteria (Figure 2-4). None of the detected inorganics exceeded residential or industrial RBCs.

A total of three groundwater samples and one duplicate sample were obtained between both phases of the investigation at SWMU 6/AOC B. Two samples (ACBMW01 and ACBMW03) were

collected during the initial phase while the third groundwater sample (BGW02 and its duplicate BGW02D) were obtained during the additional investigation of the RFI investigation.

No VOCs, pesticides/PCBs, op-pesticides, dioxins, chlorinated herbicides, or TPH, DRO and GRO were detected in the groundwater samples. Only one SVOC, benzoic acid was detected in one of the groundwater samples (BGW02) at a concentration of 2 J micrograms per liter (µg/L), as presented in Table 2-6. It should be noted that this concentration is below the tap water RBC and currently there is no federal Maximum Contaminant Level (MCL) for benzoic acid.

A total of twelve different inorganics were detected in the total fraction of the groundwater samples obtained from SWMU 6/AOC B. Eight of which exceeded at least one of the two screening criteria. Arsenic, chromium, copper, and vanadium were detected at concentrations above the tap water RBC. Barium, beryllium, chromium, copper, lead, and nickel concentrations were above the federal primary MCLs as indicated on Figure 2-5 and in Table 2-7.

A total of nine different inorganics were detected in the dissolved (soluble) fraction of the groundwater samples. Only lead exceeded the federal primary MCL in sample ACBMW03 as indicated on Figure 2-5. Currently there is not a tap water RBC for lead. None of the other detected soluble constituents were above the screening criteria as presented in Table 2-8.

In the one surface water sample, the tap water RBCs were exceeded for acetophenone, benzo(b)flouranthene, and 4,4'-DDE as indicated on Figure 2-6 and in Table 2-9. Arsenic was also exceeded in this sample as presented in Table 2-10.

3.0 ESTABLISHMENT OF CORRECTIVE ACTION OBJECTIVES

This section determines the potential need for corrective action to mitigate potential risk to human health at SWMU 6/AOC B. Mitigation requires the determination of chemicals of concern (COCs) from a thorough review of the baseline risk assessment. COCs are those chemicals responsible for the majority (i.e., 90 percent or more) of an unacceptable human health risk for a given medium. Once COCs are identified, current and potential future land use is evaluated to identify receptors and potential exposure routes. COCs, land use and exposure can then be more thoroughly evaluated to identify site-specific corrective action objectives, if necessary.

It is important to note that site specific risk assessments are conducted at NSRR in accordance with the National Contingency Plan (55 Fed. Reg. 8666-8865, March 1990). Station-wide assessments of risk are not conducted at NSRR because of the lack of geographical proximity of the sites/SWMUs across the base. This creates difficulty in segregating exposure frequency (days exposure per year) to account for the amount of time a receptor could spend at each site/SWMU. Site specific risk assessments provide very conservative estimation of potential human health risks.

3.1 Corrective Action Objectives

Corrective action objectives are medium-, site-, and chemical-specific goals for the protection of human health and the environment based on current and likely future property use scenarios. The corrective action objectives are used to focus the development of appropriate response actions that meet or exceed site specific cleanup goals in a cost-effective manner. Corrective action objectives can be specific and numerical (i.e., quantitative) or general and descriptive (i.e., qualitative). They are achieved by reducing exposure (e.g., installing a soil cover or limiting access) or by reducing contaminant levels (e.g., active remediation). Important components in the development of corrective action objectives include: the identification of media of concern/chemicals of concern and identification of potential exposure routes and receptors from the baseline risk assessment (RA) presented in the Draft RCRA Facility Investigation Report for Phase I Investigations at Operable Units 1, 6, and 7 (Baker, 1996) and in the Draft Additional Investigation Report for Operable Units 1, 6, and 7 (Baker, 1998).

SWMU 6 and AOC B (Building 145 and the Building 25 Area) are located in an industrialized area of NSRR where the potential for human exposure and ecological exposure is limited by ongoing activities in support of the Station's mission. The mission for NSRR is unlikely to change in the future. Therefore, corrective action objectives for this CMS include the protection of current and future potential on-site commercial/utility workers from constituents in affected media. A second corrective action objective is the protection of future military residents if the property use changes. These corrective action objectives are evaluated in the following sections.

3.2 Identification of Media of Concern/Chemicals of Concern as Determined by the Human Health Risk Assessment

This section presents the results of the risk assessment prepared for this CMS. A revised risk assessment was submitted to the EPA on November 24, 1998 in a letter Response to EPA Comments (November 24, 1998). Since the resubmission of the risk assessment, additional changes were incorporated to support the development of this CMS. These revisions are in response to changes in toxicity criteria and certain assumed values for residential and occupational exposure parameters that have occurred since the issuance of the 1998 document. Table B-1 summarizing these changes is presented in Appendix B along with the revised risk calculation spreadsheets.

The subsections below present the media of concern and the determination of chemicals of concern for SWMU 6 and AOC B. Analytical results for respective media of concern are first compared to pertinent regulatory criteria. Those chemicals that exceed corresponding criteria are retained for further evaluation as chemicals of potential concern (COPCs). Those chemicals/analytes identified as COPCs are then evaluated in the human health risk calculations. The results from the risk calculations are used to determine COCs.

3.2.1 Pertinent Regulatory Criteria

Pertinent regulatory criteria for SWMU 6 and AOC B are limited to USEPA Region III Risk Based Concentrations (RBCs). The RBCs are the primary criteria used in selecting COPCs for SWMU 6 and AOC B. A description of RBCs, along with alternate comparison criteria should an RBC not be available, is presented below.

USEPA Region III (Risk Based Concentrations) RBCs - RBC values are derived using conservative USEPA promulgated default values assuming standard exposure scenarios and the most recent toxicological criteria available. The RBCs for potentially carcinogenic chemicals are based on a target Incremental Cancer Risk (ICR) of $1x10^{-6}$. The RBCs for noncarcinogens are based on a target hazard quotient of 1.0. For potential carcinogens, the toxicity criteria applicable to the derivation of RBC values are oral and inhalation cancer slope factors (CSFs); for noncarcinogens, they are chronic oral and inhalation reference doses (RfDs). These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. Therefore, the use of toxicity criteria in the derivation of RBC values requires that the screening concentrations be updated periodically to reflect changes in the toxicity criteria. The RBC table is issued on a semi-annual basis and was recently updated in October 2000 (USEPA, 2000a).

Federal Maximum Contaminant Levels (MCLs) – MCLs are enforceable standards for public water supplies promulgated under the Safe Drinking Water Act and are designed for the protection of human health. MCLs are based on laboratory or epidemiological studies and apply to drinking water supplies consumed by a minimum of 25 persons. They are designed for prevention of human health effects associated with a lifetime exposure (70-year lifetime) of an average adult (70 kg) consuming 2 liters of water per day. MCLs also consider the technical feasibility of removing the contaminant from the public water supply.

Action Level for Lead in Drinking Water – The Action Level for lead (15 μg/L) in drinking water is published in the Drinking Water Standards and Health Advisories by the USEPA Office of Water (USEPA, 2000b). An Action Level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow. For lead it is the level which, if exceeded in over ten percent of the homes tested, triggers treatment. The Action Level for lead is used in the selection of COPCs in the absence of risk-based criteria.

3.2.2 Identification of COPCs at SWMU 6

Surface Soil

Table 2-2 presents a summary of the comparison of detected organic compounds in surface soil at SWMU 6 to USEPA Region III RBCs. A total of 5 surface soils and one duplicate sample were collected at SWMU 6. These samples were analyzed for Appendix IX list constituents.

Of these samples, sample 6SS01 and 6SS01D (the duplicate) contained concentrations of potentially carcinogenic polynuclear aromatic hydrocarbons (cPAHs). These cPAHs exceeded USEPA Region III RBCs for residential property use. The cPAH benzo(a)pyrene also exceeded the corresponding industrial soil RBC at this location.

Low-resolution mass spectrometry (MS) results indicate that hexachlorodibenzodioxin (HxCDD) and hexachlorodibenzofuran (HxCDF) were present in surface soil at SWMU 6. Concentrations detected in soil samples 6SB01-00, 6SS01 and its corresponding duplicate, 6SS01D, exceeded corresponding soil RBCs. Other chlorinated dioxin/dibenzofuran congeners were not detected. Total reported dioxin/dibenzofuran concentrations were below 1 microgram per kilogram (µg/kg) in every soil sample obtained from SWMU 6 and the 2,3,7,8 – TCDD congener was not detected.

Table 2-3 presents a summary of the comparison of detected inorganics in surface soil at SWMU 6 to USEPA Region III RBCs. Arsenic concentrations detected in SWMU 6 surface soil also exceeded both residential and industrial USEPA RBC values. No other inorganic contaminant in SWMU 6 surface soil exceeded corresponding soil RBCs.

Subsurface Soil

Table 2-4 presents a summary of the comparison of detected organic compounds in subsurface soil at SWMU 6 to USEPA Region III RBCs. A total of five subsurface soil samples and one duplicate sample were collected at SWMU 6. These samples were also analyzed for Appendix IX constituents. Organic contaminants were not detected in subsurface soil above corresponding residential or industrial RBC values.

Table 2-5 presents a summary of the comparison of detected inorganics in subsurface soil at SWMU 6 to USEPA Region III RBCs. Of the inorganics only arsenic was detected above residential RBC values.

Surface Water

Tables 2-9 and 2-10 present summaries of the comparison of detected organic compounds and inorganics, respectively, in surface water at SWMU 6 to USEPA Region III tap water RBCs. A surface water sample was obtained from the bunker (Building 145) during the Phase I investigation. Detected concentrations of organic compounds and inorganic constituents in the surface water sample were conservatively compared to USEPA tap water RBCs because human health comparison criteria do not exist for surface water. Acetophenone, benzo(b)fluoranthene, 4,4'-DDE, and arsenic were detected at concentrations that exceed corresponding USEPA tap water RBCs.

3.2.3 AOC B

Surface Soil

Table 2-2 presents a summary of the comparison of detected organic compounds in surface soil at AOC B to USEPA Region III RBCs. A total of seven surface soil samples and one duplicate sample were collected at AOC B. Two of these samples (ACBSB01 and ACBSB02) were collected from under a concrete slab. Relatively high concentrations of 4,4'-DDE, 4,4'-DDD and 4,4'-DDT were detected in sample ACBSB01 and the duplicate sample. Only 4,4'-DDE exceeded both residential and industrial soil RBC values. No other organic contaminants were detected that exceeded RBC values.

Table 2-3 presents a summary of the comparison of detected inorganics in surface soil at AOC B to USEPA Region III RBCs. Only arsenic was detected in AOC B surface soil in excess of soil RBC values. Arsenic exceeded both residential and industrial RBCs.

Subsurface Soil

Table 2-4 presents a summary of the comparison of detected organic compounds in subsurface soil at AOC B to USEPA Region III RBCs. The DDT series pesticides were detected in subsurface soils in the vicinity of sample ACBSB01. Concentrations of pesticides exceeded residential RBCs in the 4 to 6 feet depth interval. Concentrations of pesticides were lower in the 2 to 4 feet sample.

Table 2-5 presents a summary of the comparison of detected inorganics in subsurface soil at AOC B to USEPA Region III RBCs. The inorganic arsenic exceeded residential RBCs in subsurface soil. Arsenic did not exceed industrial RBCs in the subsurface soil samples.

Groundwater

Tables 2-6 through 2-8 present summaries of the comparison of detected organic compounds and inorganics, respectively, in groundwater at AOC B to USEPA Region III tap water RBCs and Federal MCLs. Two wells were installed in the shallow underlying groundwater aquifer at AOC B. Groundwater samples were analyzed for Appendix IX constituents. Organic chemicals were not detected in groundwater samples obtained from AOC B except for benzoic acid at a low level. Inorganics including arsenic, barium, beryllium, chromium, copper, lead, nickel, and vanadium exceeded either corresponding Federal MCLs or USEPA tap water RBC values in total (unfiltered) groundwater samples. Arsenic was not detected in filtered samples suggesting that the presence of this inorganic in groundwater may be associated with suspended sediment present in the groundwater sample matrix. Lead was the only inorganic to be detected at a concentration above its comparison criterion (Action Level) in the filtered samples. In addition, barium was identified as a COPC in the revised risk assessment (November 24, 1998). Therefore, it was included for further evaluation.

3.3 Chemicals of Concern (COCs)

COPCs identified in the previous section as exceeding USEPA Region III RBC values were evaluated in human health risk calculations. It should be noted that, these same COPCs were also identified in the revised risk assessment for SWMU 6/AOC B (November 24, 1998). Appendix B presents the risk calculations and summary risk tables for potential current (on-site workers) and

future (military resident and construction worker) receptors. The potential for exposure at SWMU 6 and AOC B was evaluated as if these two areas were one site. In other words, the COPCs identified at SWMU 6 and AOC B were combined by medium and evaluated in the risk calculations presented in Appendix B.

COCs are identified from the COPCs identified in the baseline risk assessment and are those contaminants that warrant evaluation for corrective action based on the results of the risk assessment process. Specifically, COCs are those contaminants that, upon potential exposure to either the current or reasonably anticipated future land use conditions, cause the cumulative excess carcinogenic risk or noncarcinogenic hazard index to exceed acceptable levels. The levels below which response actions at a site are generally not warranted (i.e., acceptable levels) are 10^{-4} for cumulative excess risk and one for noncarcinogenic hazard index (USEPA, 1997; 1991).

3.3.1 Exposure Routes and Receptors

Exposure routes considered in the human health risk calculations include accidental ingestion and dermal contact of COPCs in soil, surface water, and groundwater. The inhalation of fugitive dust was also considered for both surface and subsurface soil in the event that construction activities would bring previously subsurface soil borne COPCs to the surface. On-site workers (i.e., commercial/industrial), future construction workers and future potential military residents could be exposed to contaminants by these pathways at SWMU 6 and AOC B. Tables B-2 and B-3 in Appendix B present summaries of exposure parameters for the aforementioned current and future receptors. Table B-4 presents toxicity criteria for the COPCs.

3.3.2 Results of the Human Health Risk Assessment

Results of the revised risk assessment performed as part of this CMS are presented below. Table 3-1 presents a summary of the risks by receptor. The 95 percent upper confidence limit of the arithmetic mean of the lognormal distribution was calculated for each COPC and used as the exposure point concentration in the risk calculations. No unacceptable human health risks were identified for SWMU 6/AOC B for the current on-site commercial/utility worker, future military adult resident, or future construction worker receptors. The noncarcinogenic health hazard for the

future military child resident exceeded the USEPA acceptable level of 1.0. The risk assessment results are summarized in the following subsections.

Current On-Site Commercial/Utility Workers

The current on-site commercial/utility worker receptor was evaluated for potential exposure to surface soil and the standing pool of water located in an underground bunker. As presented on Table 3-2, there were no unacceptable risks or hazard levels calculated for this receptor from exposure to these media.

Future Military Adult and Young Child Residents

The future residential receptors were evaluated for potential exposure to surface soil and groundwater. It should be noted that groundwater is not currently used for potable purposes at Naval Station Roosevelt Roads because of generally poor quality, relatively low yields, and the availability of public water. Potential exposure to groundwater as a potable source in the future seems very unlikely for the same reasons. However, to maintain a conservative approach for this revised risk assessment, groundwater was evaluated using beneficial-use scenario (e.g., washing cars, watering lawns). As presented on Table 3-3, there were no unacceptable risks or hazard levels calculated for the future adult and young child residential receptors from exposure to groundwater.

Lead was detected in one out of three filtered groundwater samples at a concentration (17.5 μg/L) exceeding its Action Level (15 μg/L). However, it is considered that this concentration would not result in hazardous health effects given that potential exposure to untreated groundwater would be very unlikely. Furthermore, the evaluation of a residential exposure scenario is a very conservative approach to the risk assessment for SWMU 6/AOC B.

As shown in Table 3-3, the total hazard index (HI) for the future residential young child exceeded 1.0. This was due to the sum total of all exposure pathway HIs. Exposure to arsenic and 4,4'-DDT in the surface soil via incidental ingestion and dermal absorption were the primary contributors to the elevated total HI for SWMU 6/AOC B. However, it is important to note that the individual hazard quotient (HQ) values for arsenic and 4,4'-DDT were below 1.0 when summed over all relevant exposure pathways (0.6 and 0.8, respectively).

Furthermore, the noncarcinogenic effects from potential exposure to arsenic and 4,4'-DDT (represented by the HQ) should not be summed due to an evaluation of the critical toxic effect and target organ upon which the reference dose (RfD) of each chemical is based. USEPA risk assessment procedures conservatively include an assumption of additivity of noncarcinogenic effects but allow for segregation of hazard by mechanism of action/target organ when unity is exceeded (USEPA, 1989). The RfDs for both arsenic and 4,4'-DDT are from the Integrated Risk Information System (IRIS; USEPA, 2001). The critical effects listed in IRIS for the arsenic RfD are hyperpigmentation and keratosis—both disorders of the skin. The critical effect from IRIS upon which the 4,4'-DDT RfD is based is liver lesions. The potential effects to the skin and liver are not additive and therefore arsenic and 4,4'-DDT are not COCs because the resulting HI (segregated by target organ) for this receptor is below one.

Future Construction Workers

The future construction worker receptor was evaluated for potential exposure to subsurface soil. As presented on Table 3-4, there were no unacceptable risks or hazard levels calculated for this receptor from exposure to this medium.

It should be noted that the future construction worker was not evaluated for potential exposure to surface soil, standing water, or groundwater. Evaluation of construction worker soil exposure was limited to subsurface soil because potential exposure to subsurface soil is much more significant to the construction worker than surface soil exposure. During excavation activities, it is estimated that 90 percent of the exposure would come from the subsurface soil, while only 10 percent would come from surface soil. Finally, the future construction worker was not evaluated for exposure to groundwater because this is an incomplete exposure pathway for this receptor. The groundwater at the site is approximately nine to ten feet below ground surface. This depth is greater than what would be encountered for normal construction activities at that area of the base. Utilities are normally located in the top few feet below ground surface, and all buildings are constructed on slabs (i.e., no basements).

4.0 CONCLUSIONS AND RECOMMENDATIONS

The revised risk assessment demonstrated that there were no unacceptable carcinogenic risks or noncarcinogenic adverse health effects for current on-site commercial/utility workers, future adult military residents, or future construction workers resulting from potential exposure to the sampled media at SWMU 6/AOC B. The noncarcinogenic health hazard calculated for the future military child resident exceeded the USEPA acceptable level of 1.0. However, an evaluation of the critical toxic effects for the two principal contaminants (arsenic and 4,4'-DDT) demonstrated that the hazard indices should be segregated based on target organs, resulting in neither contaminant exceeding the acceptable level. Hence, COCs were not identified for any of the media at SWMU 6/AOC B, and there were no quantitative corrective action objectives calculated for SWMU 6/AOC B.

No remedial action is required for SWMU 6 and AOC B based on the results of the risk assessment.

5.0 REFERENCES

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TABLES

TABLE 2-1

SUMMARY OF PREVIOUS INVESTIGATIONS
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, CEIBA, PUERTO RICO

Investigation	Date Conducted	Scope	Results
Initial Assessment Study	1983/1984	To provide a records search, site surveys, and interviews with station personnel	Identified 16 sites that required further investigation under the NACIP Program. Identified a large quantity of containers inside Building 145, which were in poor condition, some resting in standing water.
Confirmation Study	1986	To determine if specific toxic or hazardous materials have contaminated the site. Two rounds of surface soil, sediment, and surface water samples were conducted. Three groundwater monitoring wells were installed and sampled.	Very low levels of organic compounds were detected in the groundwater, and the metals concentrations detected were generally representative of background ground water quality. Additional groundwater monitoring is not recommended for Building 25 Storage Area.
RCRA Facility Assessment	1988	To assess the potential for release of hazardous wastes and constituents to the environment.	Suggested further action at 25 of 47 SWMUs and 4 AOCs. It was suggested that the regulatory status of SWMU 6 be determined. AOC B was recommended for Inventory and then a decision to be made at that point for further action pending the results of the inventory. All containers formerly stored in Building 145 had been removed.
Draft Supplemental Investigation	1993	To verify data collected during the Confirmation Study and to provide data for a RCRA Facilities Investigation. Groundwater, soil, surface water, and sediment were sampled.	4,4-DDT, 4,4-DDE, PAHs, lead, zinc, and chromium were found in Building 25 area soils. Further investigation of site conditions is unnecessary, considering the absence of risk calculated from the available information.
Final RCRA Facility Investigation Workplans	1995	To provide workplans for proposed RFI.	
RCRA Facility Investigation Report for Phase I Investigations at OUs 1, 6, and 7	1996	Six surface soil samples, six subsurface soil samples, and one surface water sample were collected at SWMU 6. Eight surface soil samples, eight subsurface soil samples, and two groundwater samples were collected at AOC B.	PAHs, pesticides, and arsenic were found above RBCs in surface and subsurface soil. Several total metals including arsenic were detected in groundwater above RBCs and MCLs. Semivolatiles, pesticides, and arsenic were detected above EPA Region III Tap Water RBC in the one surface water sample.
Additional Investigations Report, OUs 1, 6, and 7	1998	One groundwater monitoring well was installed, two subsurface soil samples, and one groundwater sample were collected. Groundwater elevation measurements were taken.	Antimony, chromium, and silver were detected above base background criteria in subsurface soil samples. Two total metals were detected above RBCs and/or MCLs in groundwater.

TABLE 2-2 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	6SB01-00	6SB02-00	6SB03-00	6SS01	6SS01D	6SS02	ACBMW01-00
Sample Date	Industrial	**Residential**	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96
Depth Range (ft bgs)	RBC	**RBC**	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00
	(ug/kg)	(ug/kg)							
Volatiles (ug/kg)									
1,2-Dichloroethene (Total)	18,396,000	703,929	2 J	5 U	5 U	5 U	5 U	2 J	5 U
Xylene (total)	4,088,000,000	156,428,571	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Semivolatiles (ug/kg)									
2-Methylnaphthalene	81,760,000	3,128,571	78 J	340 UJ	340 UJ	340 UJ	340 UJ	340 UJ	350 U
Acenaphthylene	NE	NE	35 J	340 U	340 U	350	280 J	42 J	350 U
Acetophenone	204,400,000	7,821,429	300 J	340 U	340 U	340 U	340 U	340 U	350 U
Anthracene	613,200,000	23,464,286	61 J	340 U	340 U	370	320 J	77 J	350 U
Benzo(a)anthracene	7,840	870	150 J	340 U	170 J	**2,400**	**1,300**	430	350 U
Benzo(a)pyrene	784	88.0	**290** J	340 U	**160** J	**1,800**	**1,600**	**380**	350 U
Benzo(b)fluoranthene	7,840	875	460	340 U	310 J	**4,300**	**3,500**	840	350 U
Benzo(g,h,i)perylene	NE	NE	120 J	340 U	100 J	630	540	220 J	350 U
Benzo(k)fluoranthene	78,400	8,750	190 J	340 U	160 J	1,300	1,000	380	350 U
Benzoic acid	8,176,000,000	312,857,143	1,700 UJ	1,700 UJ	1,700 U	410 J	1,700 UJ	1,700 UJ	1,700 U
Bis (2-Ethylhexyl) Phthalate	408,800	45,623	1,000	340 U	45 J	170 J	120 J	59 J	350 U
Butylbenzylphthalate	408,800,000	1,564,857	340 U	340 U	340 U	49 J	150 J	100 J	350 U
Carbazole	286,160	31,936	74 J	340 U	340 U	330 J	210 J	61 J	350 U
Chrysene	784,000	87,497	200 J	340 U	340 J	3,300	2,300	880	350 U
Dibenzo(a,h)anthracene	784	87.5	340 U	340 U	340 U	**180** J	**140** J	50 J	350 U
Di-n-butylphthalate	204,400,000	7,821,429	38 J	340 U	340 U	340 U	37 J	340 U	350 U
Fluoranthene	81,760,000	3,128,571	500	340 U	360	3,200	1,100	890	350 U
Indeno(1,2,3-cd)pyrene	7,840	875	150 J	340 U	120 J	790	660	250 J	350 U
Naphthalene	81,760,000	3,128,571	210 J	340 U	340 U	340 U	340 U	340 U	350 U
Phenanthrene	NE	NE	130 J	340 U	60 J	210 J	110 J	240 J	350 U
Pyrene	61,320,000	2,346,429	570	340 U	350	4,200	1,700	840	350 U

TABLE 2-2 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	6SB01-00	6SB02-00	6SB03-00	6SS01	6SS01D	6SS02	ACBMW01-00
Sample Date	Industrial	**Residential**	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96
Depth Range (ft bgs)	RBC	**RBC**	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00
	(ug/kg)	(ug/kg)							
Pesticides/PCBs (ug/kg)									
4,4'-DDT	16,833	1,879	84 U	8.2 U	42 U	82 U	82 U	42 U	8.3 U
4,4'-DDD	23,847	2,661	84 U	8.2 U	42 U	82 U	82 U	42 U	8.3 U
4,4'-DDE	16,833	1,880	11 J	8.2 U	42 U	82 U	82 U	42 U	8.3 U
Heptachlor Epoxide	629	70.2	42 U	4.1 U	21 U	41 U	41 U	0.07 U	4.1 U
Dioxins (ug/kg)									
Total HxCDD	0.38	0.043	**0.25** J	0.3 U	0.07 U	**0.76** J	**0.74** J	0.1 U	110 U
Total HxCDF	0.38	0.043	0.08 U	0.24 U	0.08 U	**0.23** J	**0.17** J	0.07 U	90 U
OP-Pesticides (ug/kg)									
Not detected									
Herbicides (ug/kg)									
Not detected									
TPH (ug/kg)									
Gasoline Range Organics	NE	NE	NA	NA	NA	NA	NA	NA	32 U

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
N - Tentative identification. Consider analyte present. Special methods may be needed to confirm its presence or absence in future sampling efforts.

ug/kg - micrograms per kilogram
BOLD indicates exceedances of EPA Region III Residential RBCs
Shading indicates exceedances of EPA Region III Industrial RBCs

TABLE 2-2 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	ACBMW02-00	ACBMW03-00	ACBSS01	ACBSS02-00	ACBSB01-00	ACBSB01-00D	ACBSB02-00
Sample Date	Industrial	**Residential**	03/19/96	03/19/96	03/19/96	03/19/96	03/26/96	03/26/96	03/26/96
Depth Range (ft bgs)	RBC	**RBC**	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00
	(ug/kg)	(ug/kg)							
Volatiles (ug/kg)									
1,2-Dichloroethene (Total)	18,396,000	703,929	5 U	5 U	6 U	5 U	5 U	5 U	5 U
Xylene (total)	4,088,000,000	156,428,571	5 U	5 U	6 U	5 U	5 U	5 U	8
Semivolatiles (ug/kg)									
2-Methylnaphthalene	81,760,000	3,128,571	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Acenaphthylene	NE	NE	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Acetophenone	204,400,000	7,821,429	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Anthracene	613,200,000	23,464,286	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Benzo(a)anthracene	7,840	870	340 U	67 J	370 U	150 J	38 J	47 J	1,800 U
Benzo(a)pyrene	784	88.0	340 U	69 J	39 J	**140** J	340 U	350 U	1,800 U
Benzo(b)fluoranthene	7,840	875	340 U	91 J	56 J	200 J	340 U	350 U	1,800 U
Benzo(g,h,i)perylene	NE	NE	340 U	46 J	370 U	79 J	340 U	350 U	1,800 U
Benzo(k)fluoranthene	78,400	8,750	340 U	45 J	370 U	100 J	340 U	350 U	1,800 U
Benzoic acid	8,176,000,000	312,857,143	1,700 U	1,700 U	1,900 U	1,700 U	1,700 U	1,800 U	8,800 U
Bis (2-Ethylhexyl) Phthalate	408,800	45,623	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Butylbenzylphthalate	408,800,000	1,564,857	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Carbazole	286,160	31,936	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Chrysene	784,000	87,497	340 U	95 J	51 J	250 J	45 J	70 J	1,800 U
Dibenzo(a,h)anthracene	784	87.5	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Di-n-butylphthalate	204,400,000	7,821,429	340 U	340 U	370 U	340 U	77 J	350 U	350 J
Fluoranthene	81,760,000	3,128,571	340 U	150 J	86 J	390	80 J	100 J	1,800 U
Indeno(1,2,3-cd)pyrene	7,840	875	340 U	46 J	370 U	78 J	340 U	43 J	1,800 U
Naphthalene	81,760,000	3,128,571	340 U	340 U	370 U	340 U	340 U	350 U	1,800 U
Phenanthrene	NE	NE	340 U	71 J	370 U	170 J	340 U	350 U	1,800 U
Pyrene	61,320,000	2,346,429	340 U	140 J	76 J	360	42 J	62 J	1,800 U

TABLE 2-2 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	ACBMW02-00	ACBMW03-00	ACBSS01	ACBSS02-00	ACBSB01-00	ACBSB01-00D	ACBSB02-00
Sample Date	Industrial	**Residential**	03/19/96	03/19/96	03/19/96	03/19/96	03/26/96	03/26/96	03/26/96
Depth Range (ft bgs)	RBC	**RBC**	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00
	(ug/kg)	(ug/kg)							
Pesticides/PCBs (ug/kg)									
4,4'-DDT	16,833	1,879	81 U	NA	19 J	8.1 U	**11,000**	**14,000**	13 J
4,4'-DDD	23,847	2,661	81 U	8.2 U	5.9 NJ	8.1 U	**17,000**	**18,000**	40
4,4'-DDE	16,833	1,880	21 J	8.2 U	40	8.1 U	**19,000**	**22,000**	15 J
Heptachlor Epoxide	629	70.2	40 U	1.7 NJ	2.6	4 U	210 U	210 U	42 U
Dioxins (ug/kg)									
Total HxCDD	0.38	0.043	0.1 U	230 U	0.08 U	0.15 U	0.43 U	0.12 U	0.13 U
Total HxCDF	0.38	0.043	0.07 U	200 U	0.09 U	0.13 U	0.33 U	0.11 U	0.15 U
OP-Pesticides (ug/kg)									
Not detected									
Herbicides (ug/kg)									
Not detected									
TPH (ug/kg)									
Gasoline Range Organics	NE	NE	31 U	31 U	34 U	31 U	32 U	32 U	36

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
N - Tentative identification. Consider analyte present. Special methods may be needed to confirm its presence or absence in future sampling efforts.

ug/kg - micrograms per kilogram
BOLD indicates exceedances of EPA Region III Residential RBCs
Shading indicates exceedances of EPA Region III Industrial RBCs

TABLE 2-2 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	EPA Region III Industrial RBC (ug/kg)	**EPA Region III Residential RBC** (ug/kg)	Number Exceeding EPA Region III Industrial RBC	Range Exceeding EPA Region III Industrial RBC	**Number Exceeding EPA Region III Residential RBC**	**Range Exceeding EPA Region III Residential RBC**	Location Maximum Detection
Volatiles (ug/kg)							
1,2-Dichloroethene (Total)	18,396,000	703,929	0/14		0/14		6SB01-00, 6SS02
Xylene (total)	4,088,000,000	156,428,571	0/14		0/14		ACBSB02-00
Semivolatiles (ug/kg)							
2-Methylnaphthalene	81,760,000	3,128,571	0/14		0/14		6SB01-00
Acenaphthylene	NE	NE	NA		NA		6SS01D
Acetophenone	204,400,000	7,821,429	0/14		0/14		6SB01-00
Anthracene	613,200,000	23,464,286	0/14		0/14		6SS01
Benzo(a)anthracene	7,840	870	1/14	150J	3/14	1.3-150J	ACBSS02-00
Benzo(a)pyrene	784	88.0	2/14	1.6-1.8	7/14	0.14J-1.8	6SS01
Benzo(b)fluoranthene	7,840	875	0/14		2/14	3.5-4.3	6SS01
Benzo(g,h,i)perylene	NE	NE	NA		NA		6SS01
Benzo(k)fluoranthene	78,400	8,750	0/14		0/14		6SS01
Benzoic acid	8,176,000,000	312,857,143	0/14		0/14		6SS01
Bis (2-Ethylhexyl) Phthalate	408,800	45,623	0/14		0/14		6SB01-00
Butylbenzylphthalate	408,800,000	1,564,857	0/14		0/14		6SS01D
Carbazole	286,160	31,936	0/14		0/14		6SS01
Chrysene	784,000	87,497	0/14		0/14		6SS01
Dibenzo(a,h)anthracene	784	87.5	0/14		2/14	0.14J-0.18J	6SS01
Di-n-butylphthalate	204,400,000	7,821,429	0/14		0/14		ACBSB02-00
Fluoranthene	81,760,000	3,128,571	0/14		0/14		6SS01
Indeno(1,2,3-cd)pyrene	7,840	875	0/14		0/14		6SS01
Naphthalene	81,760,000	3,128,571	0/14		0/14		6SB01-00
Phenanthrene	NE	NE	NA		NA		6SS01
Pyrene	61,320,000	2,346,429	0/14		0/14		6SS01

TABLE 2-2 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	EPA Region III Industrial RBC (ug/kg)	**EPA Region III Residential RBC** (ug/kg)	Number Exceeding EPA Region III Industrial RBC	Range Exceeding EPA Region III Industrial RBC	**Number Exceeding EPA Region III Residential RBC**	**Range Exceeding EPA Region III Residential RBC**	Location Maximum Detection
Pesticides/PCBs (ug/kg)							
4,4'-DDT	16,833	1,879	0/13		2/13	11-14	ACBSS01
4,4'-DDD	23,847	2,661	0/14		2/14	17-18	ACBSB01-00D
4,4'-DDE	16,833	1,880	2/14	19-22	2/14	19-22	ACBSS01
Heptachlor Epoxide	629	70.2	0/14		0/14		ACBSS01
Dioxins (ug/kg)							
Total HxCDD	0.38	0.043	2/14	0.74J-0.76J	3/14	0.25J-0.76J	6SS01
Total HxCDF	0.38	0.043	0/14		2/14	0.17J-0.23J	6SS01
OP-Pesticides (ug/kg)							
Not detected							
Herbicides (ug/kg)							
Not detected							
TPH (ug/kg)							
Gasoline Range Organics	NE	NE	NA		NA		ACBSB02-00

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
N - Tentative identification. Consider analyte present. Special methods may be needed to confirm its presence or absence in future sampling efforts.

ug/kg - micrograms per kilogram
BOLD indicates exceedances of EPA Region III Residential RBCs
Shading indicates exceedances of EPA Region III Industrial RBCs

TABLE 2-3 (continued)

SUMMARY OF INORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	2 X Average	**EPA Region III**	EPA Region III	6SB01-00	6SB02-00	6SB03-00	6SS01	6SS01D	6SS02	ACBMW01-00
Sample Date	Detected	**Industrial**	Residential	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96	03/19/96
Depth Range (ft bgs)	Background	**RBC**	RBC	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00
	(mg/kg)	(mg/kg)	(mg/kg)							
Inorganics (mg/kg)										
Antimony, Total	0	818	31.3	4.1 J	3.6 J	3.6 J	5.2 J	3.1 J	4.4 J	1.6 UJ
Arsenic, Total	2	3.82	0.43	**10**	0.6	3.4	**5.3**	3.7	**5.7**	2.9
Barium, Total	181	143,080	5,475	98.8	98.5	53.9	68.2	69.1	74.8	111 J
Beryllium, Total	0.45	4,100	160	0.27	0.3	0.16	0.25	0.27	0.28	0.55
Cadmium, Total	0	2,044	78.2	0.67	0.19 U	1.3	0.51	0.51	0.52	0.65
Chromium, Total	59	6,100[(1)]	230[(1)]	28.6 J	22.8 J	15.7 J	30.8 J	29.7 J	27.7 J	19.3 J
Cobalt, Total	44	122,640	4,693	10.2	18	7.7	11	10.3	17.3	18.4 J
Copper, Total	234	81,760	3,129	1,030	87.3	91.9	203	166	116	137
Cyanide, Total	0.52	41,000	1,600	0.37 U	0.42 U	0.45 U	0.44 U	0.5 U	0.52 U	0.5 U
Lead, Total	15	400[(2)]	400[(2)]	225	9.7	50.4	112	131	49.7	4.2
Mercury, Total	0.11	NE	NE	12.6	0.28	1.3	4.1	5	0.08	0.05 U
Nickel, Total	17	40,880	1,564	9.6	16.5	5.5	14.5	11.7	11.3	12.4
Selenium, Total	1.46	10,220	391	0.13 UJ	0.14 UJ	0.17 UJ	0.34 UJ	0.75 UJ	0.15 UJ	0.38 J
Tin, Total	2.4	1,226,400	46,929	1.2	0.91 U	1.6	2.7	1.5	1.2	1.4
Vanadium, Total	355	14,308	548	71.2	98.5	49.4	69.1	73.8	101	87.9
Zinc, Total	125	613,200	23,464	335	67.7	105	195	208	125	88.2 J

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
(1) - Chromium VI data.
(2) - Action level for lead.

Shading indicates exceedances of 2X average detected background
BOLD indicates exceedances of EPA Region III Industrial RBCs
Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-3 (continued)

SUMMARY OF INORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	2 X Average	**EPA Region III**	EPA Region III	ACBMW02-00	ACBMW03-00	ACBSS01	ACBSS02-00	ACBSB01-00	ACBSB01-00D	ACBSB02-00
Sample Date	Detected	**Industrial**	Residential	03/19/96	03/19/96	03/19/96	03/19/96	03/26/96	03/26/96	03/26/96
Depth Range (ft bgs)	Background	**RBC**	RBC	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00	0.00-1.00
	(mg/kg)	(mg/kg)	(mg/kg)							
Inorganics (mg/kg)										
Antimony, Total	0	818	31.3	2 UJ	2 UJ	2 UJ	1.6 J	1.2 UJ	2 UJ	1.4 UJ
Arsenic, Total	2	3.82	0.43	1.4	2.5	1	0.72	**4.2** J	**4.7** J	1.3 J
Barium, Total	181	143,080	5,475	40 J	13 J	90 J	39 J	76.1	71	49.5
Beryllium, Total	0.45	4,100	160	0.1	0.28	0.44	0.06 U	0.05 U	0.08 U	0.05 U
Cadmium, Total	0	2,044	78.2	0.4	0.43	0.52	0.88	1.4	1.5	0.85
Chromium, Total	59	6,100[(1)]	230[(1)]	35 J	6.7 J	24 J	32 J	16	12.9	13.6
Cobalt, Total	44	122,640	4,693	12 J	1.8 J	30 J	14 J	19.1 J	16.1 J	15.3
Copper, Total	234	81,760	3,129	58	11.4	167	65	123	113	167 J
Cyanide, Total	0.52	41,000	1,600	0.4 U	0.39 U	1.8	0 U	0.36 U	0.46 U	0.48 U
Lead, Total	15	400[(2)]	400[(2)]	10	10.5	17	8	34.2	50.1	23.2
Mercury, Total	0.11	NE	NE	0.04 U	0.07 J	0.04 U	0.09 J	0.05 U	0.06	0.05 U
Nickel, Total	17	40,880	1,564	13	3.2	15	12	12.1	9.8	14.8
Selenium, Total	1.46	10,220	391	0.2 UJ	0.68 UJ	0.5 J	0.14 UJ	0.27 U	0.19 UJ	0.17 UJ
Tin, Total	2.4	1,226,400	46,929	1 U	1.1 U	1.2 U	0.83 U	0.64 U	1.2	1.5
Vanadium, Total	355	14,308	548	89	13.9	172	82	113	98.3	89.5
Zinc, Total	125	613,200	23,464	63 J	25.1 J	108 J	43.5 J	246 J	221 J	291 J

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
(1) - Chromium VI data.
(2) - Action level for lead.

Shading indicates exceedances of 2X average detected background
BOLD indicates exceedances of EPA Region III Industrial RBCs
Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-3 (continued)

SUMMARY OF INORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	2 X Average Detected Background (mg/kg)	**EPA Region III Industrial RBC** (mg/kg)	EPA Region III Residential RBC (mg/kg)	Number Exceeding 2 X Average Detected Background	Range Exceeding 2 X Average Detected Background	**Number Exceeding EPA Region III Industrial RBC**	**Range Exceeding EPA Region III Industrial RBC**	Number Exceeding EPA Region III Residential RBC	Range Exceeding EPA Region III Residential RBC
Inorganics (mg/kg)									
Antimony, Total	0	818	31.3	6/14	3.1J-5.2J	0/14		0/14	
Arsenic, Total	2	3.82	0.43	9/14	2.5-10	5/14	4.2J-10	14/14	0.6-10
Barium, Total	181	143,080	5,475	0/14		0/14		0/14	
Beryllium, Total	0.45	4,100	160	1/14	0.55	0/14		0/14	
Cadmium, Total	0	2,044	78.2	13/14	0.43-1.5	0/14		0/14	
Chromium, Total	59	6,100[(1)]	230[(1)]	0/14		0/14		0/14	
Cobalt, Total	44	122,640	4,693	0/14		0/14		0/14	
Copper, Total	234	81,760	3,129	1/14	1,030	0/14		0/14	
Cyanide, Total	0.52	41,000	1,600	1/14	1.8	0/14		0/14	
Lead, Total	15	400[(2)]	400[(2)]	9/14	17-225	0/14		0/14	
Mercury, Total	0.11	NE	NE	5/14	0.28-12.6	NA		NA	
Nickel, Total	17	40,880	1,564	0/14		0/14		0/14	
Selenium, Total	1.46	10,220	391	0/14		0/14		0/14	
Tin, Total	2.4	1,226,400	46,929	1/14	2.7	0/14		0/14	
Vanadium, Total	355	14,308	548	0/14		0/14		0/14	
Zinc, Total	125	613,200	23,464	6/14	195-335	0/14		0/14	

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
(1) - Chromium VI data.
(2) - Action level for lead.

Shading indicates exceedances of 2X average detected background
BOLD indicates exceedances of EPA Region III Industrial RBCs
Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-3 (continued)

SUMMARY OF INORGANIC DETECTIONS IN SURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	2 X Average Detected Background (mg/kg)	**EPA Region III Industrial RBC** (mg/kg)	EPA Region III Residential RBC (mg/kg)	Location Maximum Detection
Inorganics (mg/kg)				
Antimony, Total	0	818	31.3	6SS01
Arsenic, Total	2	3.82	0.43	6SB01-00
Barium, Total	181	143,080	5,475	ACBMW01-00
Beryllium, Total	0.45	4,100	160	ACBMW01-00
Cadmium, Total	0	2,044	78.2	ACBSB01-00D
Chromium, Total	59	6,100(1)	230(1)	ACBMW02-00
Cobalt, Total	44	122,640	4,693	ACBSS01
Copper, Total	234	81,760	3,129	6SB01-00
Cyanide, Total	0.52	41,000	1,600	ACBSS01
Lead, Total	15	400(2)	400(2)	6SB01-00
Mercury, Total	0.11	NE	NE	6SB01-00
Nickel, Total	17	40,880	1,564	6SB02-00
Selenium, Total	1.46	10,220	391	ACBSS01
Tin, Total	2.4	1,226,400	46,929	6SS01
Vanadium, Total	355	14,308	548	ACBSS01
Zinc, Total	125	613,200	23,464	6SB01-00

Notes:
ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
(1) - Chromium VI data.
(2) - Action level for lead.

TABLE 2-4 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	6SB01-01	6SB01-02	6SB02-01	6SB03-01	6SB03-01D	6SB03-03	ACBMW01-04	ACBMW01-05
Sample Date	Industrial	**Residential**	03/21/96	03/21/96	03/26/96	03/26/96	03/26/96	03/26/96	03/20/96	03/20/96
Depth Range (ft bgs)	RBC	**RBC**	2.00-4.00	6.00-8.00	2.00-6.00	2.00-6.00	2.00-6.00	6.00-8.00	6.00-8.00	8.00-12.00
	(ug/kg)	(ug/kg)								
Volatiles (ug/kg)										
Acetone	204,400,000	7,821,429	32 J	14 J	11 UJ	11 UJ	11 UJ	11 UJ	16	12 U
Xylene (total)	4,088,000,000	156,428,571	6 U	5 U	5 U	6 U	5 U	5 U	6 U	6 U
Semivolatiles (ug/kg)										
Benzo(a)anthracene	7,840	875	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Benzo(a)pyrene	784	87.5	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Benzo(b)fluoranthene	7,840	875	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Bis (2-Ethylhexyl) Phthalate	408,800	45,623	380 U	350 U	360 UJ	360 UJ	360 UJ	360 UJ	390 U	400 U
Chrysene	784,000	87,497	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Di-n-butylphthalate	204,400,000	7,821,429	380 U	54 J	360 U	360 U	360 U	360 U	49 J	400 U
Fluoranthene	81,760,000	3,128,571	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Phenanthrene	NE	NE	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Pyrene	61,320,000	2,346,429	380 U	350 U	360 U	360 U	360 U	360 U	390 U	400 U
Pesticides/PCBs (ug/kg)										
4,4'-DDT	16,833	1,879	9.1 U	8.5 U	8.8 U	8.8 U	8.6 U	8.6 U	9.3 U	9.5 U
4,4'-DDD	23,847	2,661	9.1 U	8.5 U	8.8 U	8.8 U	8.6 U	1.4 J	9.3 U	9.5 U
4,4'-DDE	16,833	1,879	9.1 U	8.5 U	8.8 U	8.8 U	8.6 U	1.4 J	9.3 U	6.7
alpha-Chlordane	NE	NE	45 U	42 U	44 U	44 U	43 U	43 U	46 U	47 U
gamma-Chlordane	NE	NE	45 U	42 U	44 U	44 U	43 U	43 U	46 U	47 U
Heptachlor Epoxide	NE	NE	4.5 U	4.2 U	4.4 U	4.4 U	4.3 U	4.3 U	4.6 U	1.6 J

TABLE 2-4 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	6SB01-01	6SB01-02	6SB02-01	6SB03-01	6SB03-01D	6SB03-03	ACBMW01-04	ACBMW01-05
Sample Date	Industrial	**Residential**	03/21/96	03/21/96	03/26/96	03/26/96	03/26/96	03/26/96	03/20/96	03/20/96
Depth Range (ft bgs)	RBC	**RBC**	2.00-4.00	6.00-8.00	2.00-6.00	2.00-6.00	2.00-6.00	6.00-8.00	6.00-8.00	8.00-12.00
	(ug/kg)	(ug/kg)								
Dioxins (ug/kg)										
Not detected										
OP-Pesticides (ug/kg)										
Not detected										
Herbicides (ug/kg)										
Not detected										
TPH (ug/kg)										
Not detected										

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
ug/kg - micrograms per kilogram.

BOLD indicates exceedances of EPA Region III Residential RBCs
Shading indicates exceedances of EPA Region III Industrial RBCs

TABLE 2-4 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	ACBMW03-01	ACBMW03-02	ACBSB01-01	ACBSB01-02	ACBSB02-01	ACBSB02-02	BMW02-03	BMW02-
Sample Date	Industrial	**Residential**	03/25/96	03/25/96	03/26/96	03/26/96	03/26/96	03/26/96	09/20/97	09/20/9
Depth Range (ft bgs)	RBC	**RBC**	2.00-4.00	4.00-6.00	2.00-4.00	4.00-6.00	2.00-6.00	6.00-10.00	4.00-6.00	6.00-8.0
	(ug/kg)	(ug/kg)								
Volatiles (ug/kg)										
Acetone	204,400,000	7,821,429	11 UJ	12 UJ	12 U	11 U	10 U	12 U	11 U	11
Xylene (total)	4,088,000,000	156,428,571	5 U	6 U	6 U	6 U	6	6 U	6 U	5
Semivolatiles (ug/kg)										
Benzo(a)anthracene	7,840	875	360 U	380 U	380 U	360 U	350 U	57 J	370 U	360
Benzo(a)pyrene	784	87.5	360 U	380 U	380 U	360 U	350 U	48 J	370 U	360
Benzo(b)fluoranthene	7,840	875	360 U	380 U	380 U	360 U	350 U	70 J	370 U	360
Bis (2-Ethylhexyl) Phthalate	408,800	45,623	36 J	380 U	380 U	360 U	350 U	380 U	370 U	360
Chrysene	784,000	87,497	360 U	380 U	380 U	360 U	350 U	60 J	370 U	360
Di-n-butylphthalate	204,400,000	7,821,429	360 U	380 U	380 U	360 U	140 J	380 U	370 U	360
Fluoranthene	81,760,000	3,128,571	360 U	380 U	380 U	360 U	350 U	140 J	370 U	360
Phenanthrene	NE	NE	360 U	380 U	380 U	360 U	350 U	42 J	370 U	360
Pyrene	61,320,000	2,346,429	360 U	380 U	380 U	360 U	350 U	59 J	370 U	360
Pesticides/PCBs (ug/kg)										
4,4'-DDT	16,833	1,879	8.6 U	9.2 U	180	**2,800**	42 U	9.3 U	8.9 U	8.7
4,4'-DDD	23,847	2,661	8.6 U	9.2 U	180	**9,800**	42 U	1.2 J	8.9 U	8.7
4,4'-DDE	16,833	1,879	8.6 U	9.2 U	300	**2,600**	42 U	1.9	8.9 U	8.7
alpha-Chlordane	NE	NE	43 U	46 U	45 U	2,200 U	210 U	21	44 U	43
gamma-Chlordane	NE	NE	43 U	46 U	45 U	2,200 U	210 U	17	44 U	43
Heptachlor Epoxide	NE	NE	4.3 U	4.6 U	4.5 U	220 U	21 U	4.7 U	4.4 U	4.3

TABLE 2-4 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	EPA Region III	**EPA Region III**	ACBMW03-01	ACBMW03-02	ACBSB01-01	ACBSB01-02	ACBSB02-01	ACBSB02-02	BMW02-03	BMW02-
Sample Date	Industrial	**Residential**	03/25/96	03/25/96	03/26/96	03/26/96	03/26/96	03/26/96	09/20/97	09/20/9
Depth Range (ft bgs)	RBC	**RBC**	2.00-4.00	4.00-6.00	2.00-4.00	4.00-6.00	2.00-6.00	6.00-10.00	4.00-6.00	6.00-8.0
	(ug/kg)	(ug/kg)								
Dioxins (ug/kg)										
Not detected										
OP-Pesticides (ug/kg)										
Not detected										
Herbicides (ug/kg)										
Not detected										
TPH (ug/kg)										
Not detected										

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
ug/kg - micrograms per kilogram.

BOLD indicates exceedances of EPA Region III Residential RBCs
Shading indicates exceedances of EPA Region III Industrial RBCs

TABLE 2-4 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	EPA Region III Industrial RBC (ug/kg)	**EPA Region III Residential RBC** (ug/kg)	)4 ')	Number Exceeding EPA Region III Industrial RBC	Range Exceeding EPA Region III Industrial RBC	**Number Exceeding EPA Region III Residential RBC**	**Range Exceeding EPA Region III Residential RBC**	Location Maximum Detection
Volatiles (ug/kg)								
Acetone	204,400,000	7,821,429	U	0/16		0/16		6SB01-01
Xylene (total)	4,088,000,000	156,428,571	U	0/16		0/16		ACBSB02-01
Semivolatiles (ug/kg)								
Benzo(a)anthracene	7,840	875	U	0/16		0/16		ACBSB02-02
Benzo(a)pyrene	784	87.5	U	0/16		0/16		ACBSB02-02
Benzo(b)fluoranthene	7,840	875	U	0/16		0/16		ACBSB02-02
Bis (2-Ethylhexyl) Phthalate	408,800	45,623	U	0/16		0/16		ACBMW03-01
Chrysene	784,000	87,497	U	0/16		0/16		ACBSB02-02
Di-n-butylphthalate	204,400,000	7,821,429	U	0/16		0/16		ACBSB02-01
Fluoranthene	81,760,000	3,128,571	U	0/16		0/16		ACBSB02-02
Phenanthrene	NE	NE	U	NA		NA		ACBSB02-02
Pyrene	61,320,000	2,346,429	U	0/16		0/16		ACBSB02-02
Pesticides/PCBs (ug/kg)								
4,4'-DDT	16,833	1,879	U	0/16		1/16	2,800	ACBSB01-02
4,4'-DDD	23,847	2,661	U	0/16		1/16	9,800	ACBSB01-02
4,4'-DDE	16,833	1,879	U	0/16		1/16	2,600	ACBSB01-02
alpha-Chlordane	NE	NE	U	NA		NA		ACBSB02-02
gamma-Chlordane	NE	NE	U	NA		NA		ACBSB02-02
Heptachlor Epoxide	NE	NE	U	NA		NA		ACBMW01-05

TABLE 2-4 (continued)

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	EPA Region III Industrial RBC (ug/kg)	**EPA Region III Residential RBC** (ug/kg)	Number Exceeding EPA Region III Industrial RBC	Range Exceeding EPA Region III Industrial RBC	**Number Exceeding EPA Region III Residential RBC**	**Range Exceeding EPA Region III Residential RBC**	Location Maximum Detection
Dioxins (ug/kg)							
Not detected							
OP-Pesticides (ug/kg)							
Not detected							
Herbicides (ug/kg)							
Not detected							
TPH (ug/kg)							
Not detected							

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
ug/kg - micrograms per kilogram.

BOLD indicates exceedances of EPA Region III Residential RBCs
Shading indicates exceedances of EPA Region III Industrial RBCs

TABLE 2-5

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	2 X Average	**EPA Region III**	EPA Region III	6SB01-01	6SB01-02	6SB02-01	6SB03-01	6SB03-01D	6SB03-03	ACBMW01-04
Sample Date	Detected	**Industrial**	Residential	03/21/96	03/21/96	03/26/96	03/26/96	03/26/96	03/26/96	03/20/96
Depth Range (ft bgs)	Background	**RBC**	RBC	2.00-4.00	6.00-8.00	2.00-6.00	2.00-6.00	2.00-6.00	6.00-8.00	6.00-8.00
	(mg/kg)	(mg/kg)	(mg/kg)							
Inorganics (mg/kg)										
Antimony, Total	0	817.6	31.3	3.8 J	2.3 J	2.2 UJ	2.1 UJ	2.1 UJ	2 UJ	3.6 J
Arsenic, Total	2.05	3.82	0.43	0.93	0.6 U	1.2 J	0.09 UJ	0.17 J	0.34 J	1.4
Barium, Total	222	143,080	5,475	90	84.6	68.7	37.4	92.8	66.4	53.3 J
Beryllium, Total	0.74	4,100	160	0.24	0.23	0.1 U	0.09 U	0.09 U	0.09 U	0.69
Cadmium, Total	0.74	2,044	78.2	0.22 U	0.17 U	0.26 U	0.24 U	0.31	0.32	0.18 U
Chromium, Total	133	6100[(1)]	230[(1)]	18.5 J	17.6 J	13.8 J	6.3 J	23.5 J	13 J	41.4 J
Cobalt, Total	30	122,640	4,693	15.3	10.7	17	18.8	16.9	10.7	31.8 J
Copper, Total	193	81,760	3,129	70.5	56.1	118	107	122	60	78.4
Cyanide	0.63	40,880	1,564	0.5 U	0.43 U	0.49 U	0.52 U	0.46 U	0.4 U	0.53 U
Lead, Total	8.68	400[(2)]	400[(2)]	5.9	0.94	9.6	2.1	2.5	1.8	5.7
Mercury, Total	0.09	NE	NE	0.04 U	0.04 U	0.2	0.05 U	0.04 U	0.04 U	0.06 U
Nickel, Total	31.9	40,880	1,564	9.3	4.8	10.9	6.9	12.6	8.8	35.8
Selenium, Total	0.57	10,220	391	0.19 UJ	0.83 UJ	0.15 UJ	0.15 UJ	0.14 UJ	0.13 UJ	0.21 U
Silver, Total	0	10,220	391	0.31 U	0.24 U	0.36 U	0.33 U	0.57	0.54	0.25 U
Thallium, Total	0.17	143.1	5.48	0.18 UJ	0.16 UJ	0.09 U	0.09 U	0.09 U	0.09 U	0.2 UJ
Tin, Total	2.96	1,226,400	46,929	1.1 U	0.83 U	1.7	1.5	2.3	1.8	0.86 U
Vanadium, Total	462	14,308	547.5	79.4	62.3	108 J	48.4 J	88.2 J	59.1 J	14.6
Zinc, Total	89	613,200	23,464	48.8	56.3	60.9	43	71.4	52.2	65.4 J

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.

[(1)] - Chromium VI data.
[(2)] - Action level for lead.

Shading indicates exceedances of 2X average detected background
BOLD indicates exceedances of EPA Region III Industrial RBCs
Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-5

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID	2 X Average	**EPA Region III**	EPA Region III	ACBMW01-05	ACBMW03-01	ACBMW03-02	ACBSB01-01	ACBSB01-02
Sample Date	Detected	**Industrial**	Residential	03/20/96	03/25/96	03/25/96	03/26/96	03/26/96
Depth Range (ft bgs)	Background	**RBC**	RBC	8.00-12.00	2.00-4.00	4.00-6.00	2.00-4.00	4.00-6.00
	(mg/kg)	(mg/kg)	(mg/kg)					
Inorganics (mg/kg)								
Antimony, Total	0	817.6	31.3	1.8 J	1.4 UJ	2.3 UJ	2.1 UJ	3.1 J
Arsenic, Total	2.05	3.82	0.43	0.45 U	0.49 UJ	0.29 UJ	0.96 J	0.13 UJ
Barium, Total	222	143,080	5,475	86.2 J	110	87.1	50	89
Beryllium, Total	0.74	4,100	160	0.05 U	1.1	0.14	0.32	0.07 U
Cadmium, Total	0.74	2,044	78.2	0.22	0.18	0.54	0.42	0.67
Chromium, Total	133	6100[(1)]	230[(1)]	6.8 J	9.8	45.3	25.6	29.2
Cobalt, Total	30	122,640	4,693	12.9 J	51.3 J	19.7 J	11 J	25.9 J
Copper, Total	193	81,760	3,129	92.7	336	126	124	163
Cyanide	0.63	40,880	1,564	0.59 U	0.44	0.41 U	0.48 U	0.47 U
Lead, Total	8.68	400[(2)]	400[(2)]	1.5	3.3 J	22 J	3.9	12.1
Mercury, Total	0.09	NE	NE	0.04 U	0.04 UJ	0.04 UJ	0.05 U	0.05 U
Nickel, Total	31.9	40,880	1,564	6.1	13.4	12.5	9.3	22.7
Selenium, Total	0.57	10,220	391	0.12 UJ	0.66 J	0.39 U	1.2 J	0.48 UJ
Silver, Total	0	10,220	391	0.2 U	0.23 U	0.41	0.33 U	0.49
Thallium, Total	0.17	143.1	5.48	0.12 U	0.07 U	0.1 U	0.08 U	0.14
Tin, Total	2.96	1,226,400	46,929	1.4	0.77 U	2.2	1.1 U	0.95 U
Vanadium, Total	462	14,308	547.5	111	168	104	204	134
Zinc, Total	89	613,200	23,464	70.6 J	93.5 J	123 J	46.9 J	132 J

Notes:

ft bgs - feet below ground surface.

NA - Not Applicable.

NE - Not Established.

J - Analyte present. Reported value may not be accurate or precise.

U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.

UJ - Not detected, quantitation limit may be inaccurate or imprecise.

(1) - Chromium VI data.

(2) - Action level for lead.

Shading indicates exceedances of 2X average detected background

BOLD indicates exceedances of EPA Region III Industrial RBCs

Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-5

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	2 X Average Detected Background (mg/kg)	**EPA Region III Industrial RBC** (mg/kg)	EPA Region III Residential RBC (mg/kg)	ACBSB02-01 03/26/96 2.00-6.00	ACBSB02-02 03/26/96 6.00-10.00	BMW02-03 09/20/97 4.00-6.00	BMW02-04 09/20/97 6.00-8.00
Inorganics (mg/kg)							
Antimony, Total	0	817.6	31.3	1.5 UJ	2.2 UJ	0.18 J	0.16 U
Arsenic, Total	2.05	3.82	0.43	0.14 UJ	0.15 UJ	0.56 U	0.54 U
Barium, Total	222	143,080	5,475	94.2	91.4	79.4	73.7
Beryllium, Total	0.74	4,100	160	0.06 U	0.09 U	0.14 J	0.13 J
Cadmium, Total	0.74	2,044	78.2	0.42	0.24 U	0.53	0.63
Chromium, Total	133	6100[(1)]	230[(1)]	81.2	15.5	9.2	270
Cobalt, Total	30	122,640	4,693	23.3 J	30.2 J	18.9	14.8
Copper, Total	193	81,760	3,129	151	157	96.9	110
Cyanide	0.63	40,880	1,564	0.47 U	0.53 U	NA	NA
Lead, Total	8.68	400[(2)]	400[(2)]	2.3	5.7	1.3	1.6
Mercury, Total	0.09	NE	NE	0.05 U	0.05 U	0.02 U	0.02 U
Nickel, Total	31.9	40,880	1,564	15.6	15.2	9.5	14
Selenium, Total	0.57	10,220	391	0.49 UJ	0.22 UJ	0.47	0.19 U
Silver, Total	0	10,220	391	0.39	0.34 U	0.2 J	0.19 J
Thallium, Total	0.17	143.1	5.48	0.09	0.08 U	0.19 U	0.9 U
Tin, Total	2.96	1,226,400	46,929	0.8 U	1.2 U	2.2 J	2.3 J
Vanadium, Total	462	14,308	547.5	120	101	145	114
Zinc, Total	89	613,200	23,464	70.9 J	58.2 J	84.8	52.6

Notes:

ft bgs - feet below ground surface.

NA - Not Applicable.

NE - Not Established.

J - Analyte present. Reported value may not be accurate or precise.

U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.

UJ - Not detected, quantitation limit may be inaccurate or imprecise.

(1) - Chromium VI data.

(2) - Action level for lead.

Shading indicates exceedances of 2X average detected background

BOLD indicates exceedances of EPA Region III Industrial RBCs

Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-5

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	2 X Average Detected Background (mg/kg)	**EPA Region III Industrial RBC** (mg/kg)	EPA Region III Residential RBC (mg/kg)	Number Exceeding 2 X Average Detected Background	Range Exceeding 2 X Average Detected Background	**Number Exceeding EPA Region III Industrial RBC**	**Range Exceeding EPA Region III Industrial RBC**	Number Exceeding EPA Region III Residential RBC	Range Exceeding EPA Region III Residential RBC
Inorganics (mg/kg)									
Antimony, Total	0	817.6	31.3	4/16	0.18J-3.8J	0/16		0/16	
Arsenic, Total	2.05	3.82	0.43	0/16		0/16		4/16	0.93-1.4
Barium, Total	222	143,080	5,475	0/16		0/16		0/16	
Beryllium, Total	0.74	4,100	160	1/16	1.1	0/16		0/16	
Cadmium, Total	0.74	2,044	78.2	0/16		0/16		0/16	
Chromium, Total	133	6100[(1)]	230[(1)]	1/16	270	0/16		1/16	
Cobalt, Total	30	122,640	4,693	2/16	30.2J-51.3J	0/16		0/16	
Copper, Total	193	81,760	3,129	1/16	336	0/16		0/16	
Cyanide	0.63	40,880	1,564	0/14		0/14		0/14	
Lead, Total	8.68	400[(2)]	400[(2)]	3/16	9.6-22J	NA		NA	
Mercury, Total	0.09	NE	NE	1/16	0.2	0/16		0/16	
Nickel, Total	31.9	40,880	1,564	1/16	35.8	0/16		0/16	
Selenium, Total	0.57	10,220	391	2/16	0.66J-1.2J	0/16		0/16	
Silver, Total	0	10,220	391	7/16	0.19J-0.57	0/16		0/16	
Thallium, Total	0.17	143.1	5.48	0/16		0/16		0/16	
Tin, Total	2.96	1,226,400	46,929	0/16		0/16		0/16	
Vanadium, Total	462	14,308	547.5	0/16		0/16		0/16	
Zinc, Total	89	613,200	23,464	3/16	93.5J-132J	0/16		0/16	

Notes:

ft bgs - feet below ground surface.
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.

(1) - Chromium VI data.
(2) - Action level for lead.

Shading indicates exceedances of 2X average detected background
BOLD indicates exceedances of EPA Region III Industrial RBCs
Underlining indicates exceedances of EPA Region III Residential RBCs

TABLE 2-5

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date Depth Range (ft bgs)	2 X Average Detected Background (mg/kg)	**EPA Region III Industrial RBC** (mg/kg)	EPA Region III Residential RBC (mg/kg)	Location Maximum Detection
Inorganics (mg/kg)				
Antimony, Total	0	817.6	31.3	6SB01-01
Arsenic, Total	2.05	3.82	0.43	ACBMW01-04
Barium, Total	222	143,080	5,475	ACBMW03-01
Beryllium, Total	0.74	4,100	160	ACBMW03-01
Cadmium, Total	0.74	2,044	78.2	ACBSB01-02
Chromium, Total	133	6100(1)	230(1)	BMW02-04
Cobalt, Total	30	122,640	4,693	ACBMW03-01
Copper, Total	193	81,760	3,129	ACBMW03-01
Cyanide	0.63	40,880	1,564	ACBMW03-01
Lead, Total	8.68	400(2)	400(2)	ACBMW03-02
Mercury, Total	0.09	NE	NE	6SB02-01
Nickel, Total	31.9	40,880	1,564	ACBMW01-04
Selenium, Total	0.57	10,220	391	ACBSB01-01
Silver, Total	0	10,220	391	6SB03-01D
Thallium, Total	0.17	143.1	5.48	ACBSB01-02
Tin, Total	2.96	1,226,400	46,929	6SB03-01D BMW02-04
Vanadium, Total	462	14,308	547.5	ACBSB01-01
Zinc, Total	89	613,200	23,464	ACBSB01-02

Notes:

ft bgs - feet below ground surface.

NA - Not Applicable.

NE - Not Established.

(1) - Chromium VI data.

(2) - Action level for lead.

J - Analyte present. Reported value may not be accurate or precise.

U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.

UJ - Not detected, quantitation limit may be inaccurate or imprecise.

TABLE 2-6

SUMMARY OF ORGANIC DETECTIONS IN GROUNDWATER
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date	Federal MCL (ug/L)	**EPA Region III Tap Water** RBC (ug/L)	ACBMW01 03/30/96	ACBMW03 03/30/96	BGW02 09/30/97	BGW02D 09/30/97	Number Exceeding Federal MCL	Range Exceeding Federal MCL	**Number Exceeding EPA Region III Tap Water RBC**	**Range Exceeding EPA Region III Tap Water RBC**	Location Maximum Detection
Volatiles (ug/L)											
Not detected											
Semivolatiles (ug/L)											
Benzoic acid	NE	146,000	50 U	50 U	2 J	50 U	0/4		0/4		BGW02
Pesticides/PCBs (ug/L)											
Not detected											
OP-Pesticides (ug/L)											
Not detected											
Dioxins (ug/L)											
Not detected											
Herbicides (ug/L)											
Not detected											
TPH (ug/L)											
Not detected											

Notes:

NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.

TABLE 2-7

SUMMARY OF INORGANIC (TOTAL) DETECTIONS IN GROUNDWATER
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date	Federal MCL (ug/L)	**EPA Region III Tap Water RBC** (ug/L)	ACBMW01 03/30/96	ACBMW03 03/30/96	BGW02 09/30/97	Number Exceeding Federal MCL	Range Exceeding Federal MCL	**Number Exceeding EPA Region III Tap Water RBC**	**Range Exceeding EPA Region III Tap Water RBC**	Location Maximum Detection
Inorganics, Total (ug/L)										
Arsenic, Total	50	0.045	**5.8** J	**3.6**	2.5 U	0/3		2/3	3.6-5.8J	ACBMW01
Barium, Total	2,000	2,555	2,210	342	921	1/3	2,210	0/3		ACBMW01
Beryllium, Total	4	73	5.9	1.1 U	1.1 J	1/3	5.9	0/3		ACBMW01
Chromium, Total	100	110[1]	**168**	34.4	25.9	1/3	168	1/3	168	ACBMW01
Cobalt, Total	NE	2,190	162	73.9	60.9	NA		0/3		ACBMW01
Copper, Total	1,300[2]	1,460	**2,480**	429	414 J	1/3	2,480	1/3	2,480	ACBMW01
Lead, Total	15[3]	NE	6.5 J	19.1 J	5.6	1/3	19.1J	NA		ACBMW03
Mercury, Total	2	NE	0.19	0.23	0.1 U	0/3		NA		ACBMW03
Nickel, Total	0.1	730	199	25.4	32.7 J	3/3	25.4-199	0/3		ACBMW01
Tin, Total	NE	21,900	13.5 U	13.5 U	6.5 J	NA		0/3		BGW02
Vanadium, Total	NE	255.5	**790**	**326**	**269**	NA		3/3	269-790	ACBMW01
Zinc, Total	NE	10,950	2,020	275	239	NA		0/3		ACBMW01

Notes:

NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
(1) - Chromium VI data.
(2) - Action level for copper.
(3) - Action level for lead.
Bold indicates exceedance of EPA Region III Tap Water RBC
Shading indicates exceedance of Federal MCL

TABLE 2-8

SUMMARY OF INORGANIC (DISSOLVED) DETECTIONS IN GROUNDWATER
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date	Federal MCL (ug/L)	**EPA Region III Tap Water RBC (ug/L)**	ACBMW01 03/30/96	ACBMW03 03/30/96	BGW02 09/30/97	Number Exceeding Federal MCL	Range Exceeding Federal MCL	**Number Exceeding EPA Region III Tap Water RBC**	**Range Exceeding EPA Region III Tap Water RBC**	Location Maximum Detection
Inorganics, Soluble (ug/L)										
Barium, Soluble	2,000	2,555	333	61.8	454	0/3		0/3		BGW02
Beryllium, Soluble	4	73	1.9	1.1 U	0.3 U	0/3		0/3		ACBMW01
Chromium, Soluble	100	110[(1)]	2.6 U	2.6 U	1.9 J	0/3		0/3		BGW02
Cobalt, Soluble	NE	2,190	3.9 U	3.9 U	3.6 J	NA		0/3		BGW02
Copper, Soluble	1,300[(2)]	1,460	10.6	3.6	1.3 U	0/3		0/3		ACBMW01
Lead, Soluble	15[(3)]	NE	1.2 UJ	17.5 J	1.5 U	1/3	17.5J	NA		ACBMW03
Tin, Soluble	NE	21,900	13.5 U	13.5 U	4 J	NA		0/3		BGW02
Vanadium, Soluble	NE	255.5	7	11.2	2.4 J	NA		0/3		ACBMW03
Zinc, Soluble	NE	10,950	8.9	4.7	4.5 J	NA		0/3		ACBMW01

Notes:

NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
U - Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ - Not detected, quantitation limit may be inaccurate or imprecise.
(1) - Chromium VI data.
(2) - Action level for copper.
(3) - Action level for lead.
Bold indicates exceedance of EPA Region III Tap Water RBC
Shading indicates exceedance of Federal MCL

TABLE 2-9

SUMMARY OF ORGANIC DETECTIONS IN SURFACE WATER
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date	**EPA Region III Tap Water RBC** (ug/L)	6-SW01 3/21/96	**Number Exceeding EPA Region III Tap Water RBC**	**Range Exceeding EPA Region III Tap Water RBC**	Location Maximum Detection
Volatiles (ug/L)					
Not detected					
Semivolatiles (ug/L)					
Acetophenone	0.42	**2** J	1/1	2J	6-SW01
Benzo(b)flouranthene	0.92	**1** J	1/1	1J	6-SW01
Benzoic Acid	150,000	4 J	0/1		6-SW01
Chrysene	9.2	1 J	0/1		6-SW01
Flouranthene	1,500	1 J	0/1		6-SW01
Phenols	22,000	1 J	0/1		6-SW01
Pyrene	180	1 J	0/1		6-SW01
Pesticides/PCBs (ug/L)					
4,4'-DDE	0.2	**0.52**	1/1	0.52	6-SW01
OP-Pesticides (ug/L)					
Not detected					
Dioxins (ug/L)					
Total HXCDF	NE	0.001 J	NA		6-SW01
Herbicides (ug/L)					
Not detected					

Notes:
NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
Bold indicates exceedance of EPA Region III Tap Water RBC

TABLE 2-10

SUMMARY OF INORGANIC (TOTAL) DETECTIONS IN SURFACE WATER
SWMU 6/AOC B (FORMER BUILDING 25 SITE)
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

Sample ID Sample Date	**EPA Region III Tap Water RBC** (ug/L)	6-SW01 3/21/96	**Number Exceeding EPA Region III Tap Water RBC**	**Range Exceeding EPA Region III Tap Water RBC**	Location Maximum Detection
Inorganics, Total (ug/L)					
Arsenic, Total	0.045	**5**	1/1	5	6-SW01
Barium, Total	2,555	116	0/1		6-SW01
Cadmium, Total	37	3.6	0/1		6-SW01
Chromium, Total	110[(1)]	6.7	0/1		6-SW01
Copper, Total	1,460	1,170	0/1		6-SW01
Cyanide, Total	730	67 J	0/1		6-SW01
Lead, Total	NE	735	NA		6-SW01
Mercury, Total	NE	22	NA		6-SW01
Vanadium, Total	255.5	7.1	0/1		6-SW01
Zinc, Total	10,950	572	0/1		6-SW01

Notes:

NA - Not Applicable.
NE - Not Established.
J - Analyte present. Reported value may not be accurate or precise.
(1) - Chromium VI data.
Bold indicates exceedance of EPA Region III Tap Water RBC

TABLE 3-1

TOTAL SITE INCREMENTAL LIFETIME CANCER RISKs (ILCRs) AND HAZARD INDICES (HIs) FOR CURRENT AND FUTURE POTENTIAL HUMAN RECEPTORS
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

		Current On-site Commercial/ Utility Workers[1]	Future Adult Military Residents[2]	Future Young Child Military Residents[2]	Future Construction Workers[3]
SWMU 6/AOC B	Total ILCR	6.8×10^{-5}	1.5×10^{-5}	6.0×10^{-5}	4.0×10^{-7}
	Total HI	0.2	0.4	1.4[4]	0.04

-- Not applicable because no toxicological criteria was available

Shading indicates exceedence of USEPA acceptable target hazard level by total hazard level.

Notes:

(1) Current on-site workers were evaluated for exposures to surface soil and surface water COPCs.

(2) Future adult and young child military residents were evaluated for exposures to surface soil and groundwater (beneficial-use scenario) COPCs.

(3) Future construction workers were evaluated for exposures to subsurface soil COPCs.

(4) Total HI for the future residential young child exceeded 1.0, due to the sum of all exposure pathway HIs. However, the individual HQ values for arsenic and 4,4'-DDT were below 1.0 when summed over all relevant exposure pathways and arsenic and 4,4'-DDT act on different target organs/systems (skin and liver, respectively)

TABLE 3-2

**INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ON-SITE COMMERCIAL/UTILITY WORKERS
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

Medium/Pathway	Current On-site Commercial/Utility Worker	
	ILCR	HI
Surface Soil		
Ingestion	9.7×10^{-6}	0.03
Dermal Contact	5.0×10^{-5}	0.2
Inhalation[(1)]	2.9×10^{-9}	--
Subtotal	6.0×10^{-5}	0.2
Surface Water		
Ingestion	3.0×10^{-6}	0.02
Dermal Contact	4.6×10^{-6}	<0.01
Subtotal	7.6×10^{-6}	0.02
TOTAL	6.8×10^{-5}	0.2

Notes:

(1) Inhalation of fugitive dusts

-- Not applicable because no toxicological criteria was available

TABLE 3-3

**INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

Pathway	Future Residents			
	Adult		Young Child	
	ILCR	HI	ILCR	HI
Surface Soil				
Ingestion	4.3×10^{-6}	0.1	4.0×10^{-5}	0.8
Dermal Contact	1.1×10^{-5}	0.3	2.0×10^{-5}	0.6
Inhalation [1]	1.9×10^{-9}	--	8.9×10^{-9}	--
Subtotal	1.5×10^{-5}	0.4	6.0×10^{-5}	1.4[3]
Groundwater[2]				
Ingestion	--	<0.01	--	0.02
Dermal Contact	--	<0.01	--	<0.01
Subtotal	--	<0.01	--	0.02
TOTAL	1.5×10^{-5}	0.4	6.0×10^{-5}	1.4[3]

Notes:

[1] Inhalation of fugitive dusts.
[2] Evaluation of potential groundwater exposure using beneficial-use scenario (i.e., washing cars, watering lawns).
[3] Total HI for the future residential young child exceeded 1.0, due to the sum of all exposure pathway HIs. However, the individual HQ values for arsenic and 4,4'-DDT were below 1.0 when summed over all relevant exposure pathways and arsenic and 4,4'-DDT act on different target organs/systems (skin and liver, respectively).

-- Not applicable because no toxicological criteria was available

Shading indicates exceedence of USEPA acceptable target hazard level by total hazard level.

TABLE 3-4

**INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE CONSTRUCTION WORKERS
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

Medium/Pathway	Future Construction Worker	
	ILCR	HI
Subsurface Soil		
Ingestion	3.0×10^{-7}	0.01
Dermal Contact	1.0×10^{-7}	0.03
Inhalation[(1)]	--	--
TOTAL	4.0×10^{-7}	0.04

Notes:

[(1)] Inhalation of fugitive dusts.

-- Not applicable because no toxicological criteria was available

FIGURES

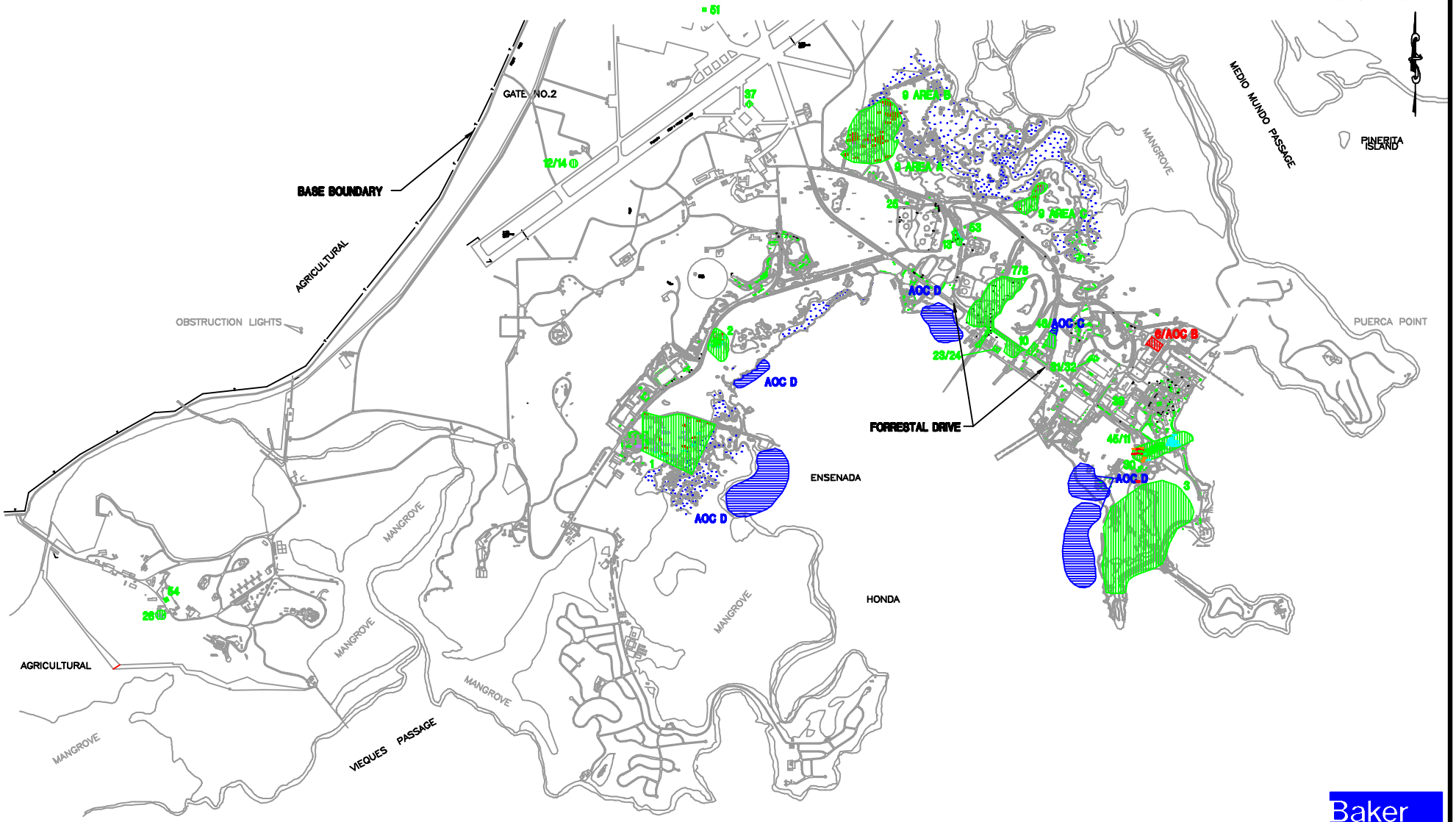
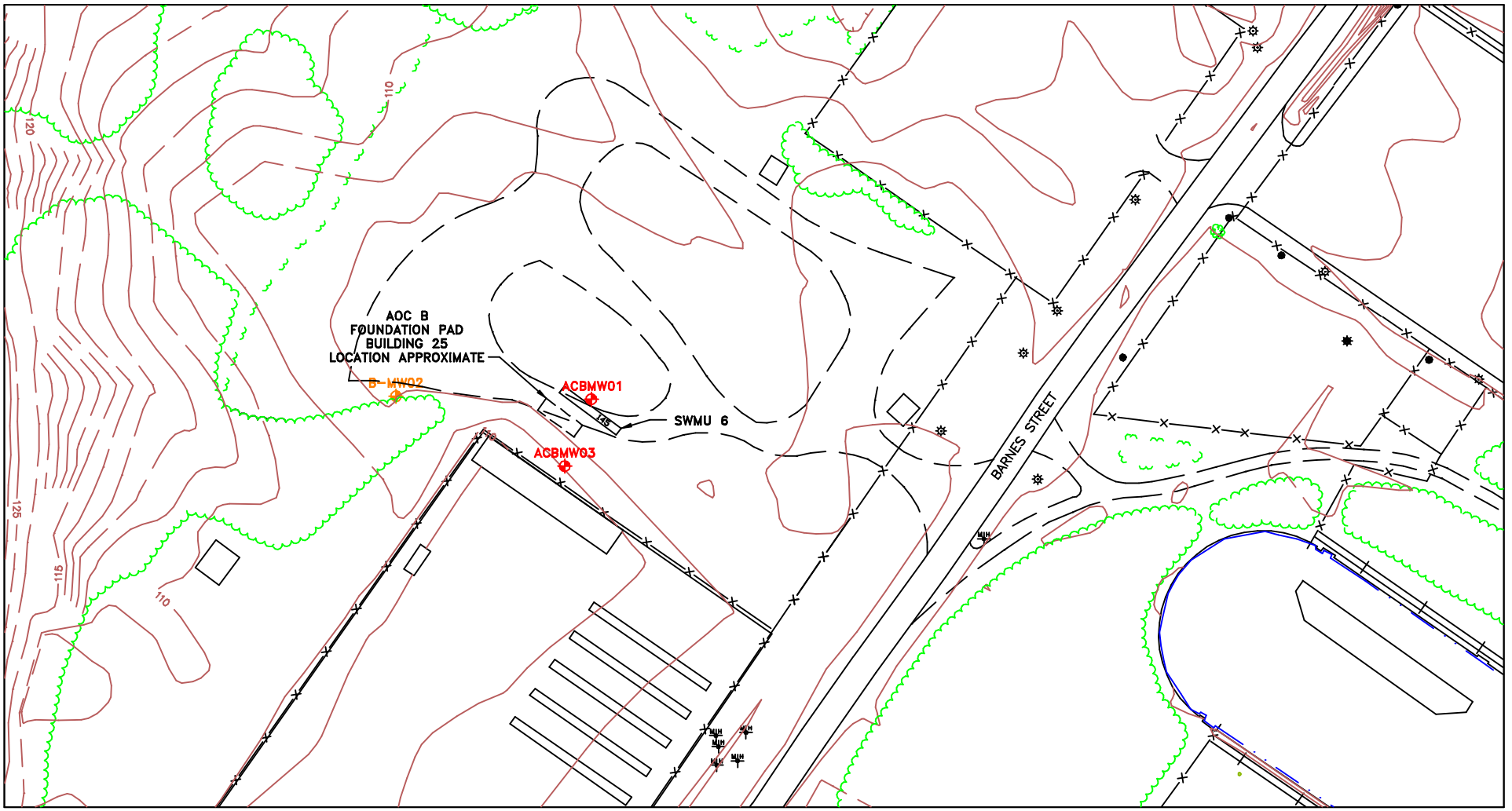


FIGURE 2-1
SWMU/AOC LOCATION MAP

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



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LEGEND

- – MONITORING WELL LOCATION (03/96)
- – MONITORING WELL LOCATION (1998)
- – PROPERTY BOUNDARY
- – TREELINE

SOURCE: LANTDIV, FEB. 1992/1997

80 0 40 80
1 inch = 80 ft.

FIGURE 2-2
SWMU 6 AND AOC B
SITE CONDITIONS
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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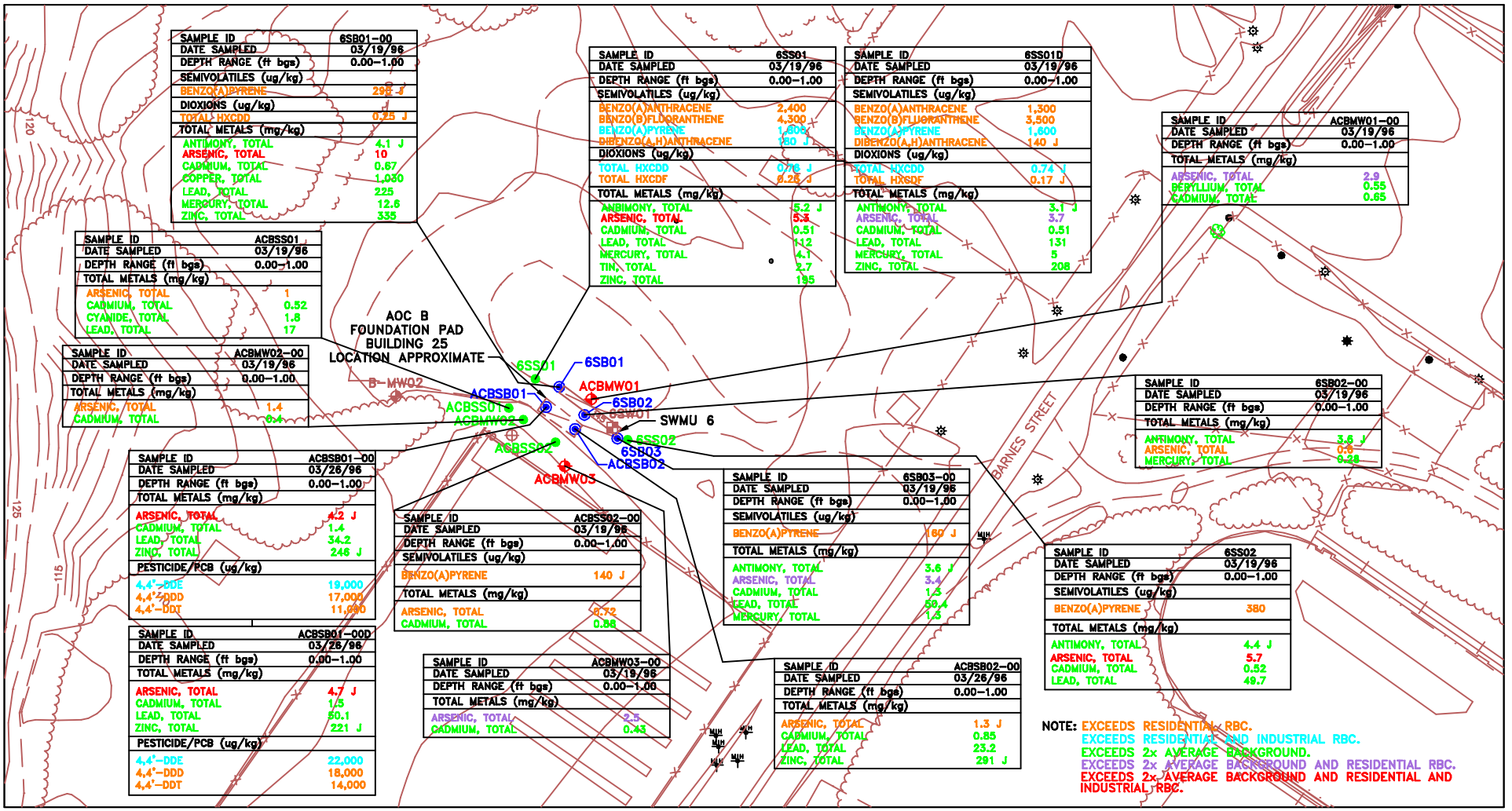

SAMPLE ID	6SB01-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
SEMIVOLATILES (ug/kg)	
BENZO(A)PYRENE	298 J
DIOXIONS (ug/kg)	
TOTAL HXCDD	0.25 J
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	4.1 J
ARSENIC, TOTAL	10
CADMIUM, TOTAL	0.67
COPPER, TOTAL	1,030
LEAD, TOTAL	225
MERCURY, TOTAL	12.6
ZINC, TOTAL	335

SAMPLE ID	6SS01
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
SEMIVOLATILES (ug/kg)	
BENZO(A)ANTHRACENE	2,400
BENZO(B)FLUORANTHENE	4,300
BENZO(A)PYRENE	1,600
DIBENZO(A,H)ANTHRACENE	280 J
DIOXIONS (ug/kg)	
TOTAL HXCDD	0.76 J
TOTAL HXCDF	0.25 J
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	5.2 J
ARSENIC, TOTAL	5.3
CADMIUM, TOTAL	0.51
LEAD, TOTAL	112
MERCURY, TOTAL	4.1
TIN, TOTAL	2.7
ZINC, TOTAL	135

SAMPLE ID	6SS01D
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
SEMIVOLATILES (ug/kg)	
BENZO(A)ANTHRACENE	1,300
BENZO(B)FLUORANTHENE	3,500
BENZO(A)PYRENE	1,600
DIBENZO(A,H)ANTHRACENE	140 J
DIOXIONS (ug/kg)	
TOTAL HXCDD	0.74 J
TOTAL HXCDF	0.17 J
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	3.1 J
ARSENIC, TOTAL	3.7
CADMIUM, TOTAL	0.51
LEAD, TOTAL	131
MERCURY, TOTAL	5
ZINC, TOTAL	208

SAMPLE ID	ACBMW01-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	2.9
BERYLLIUM, TOTAL	0.55
CADMIUM, TOTAL	0.65

SAMPLE ID	ACBSS01
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	1
CADMIUM, TOTAL	0.52
CYANIDE, TOTAL	1.8
LEAD, TOTAL	17

SAMPLE ID	ACBMW02-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	1.4
CADMIUM, TOTAL	0.4

SAMPLE ID	6SB02-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	3.6 J
ARSENIC, TOTAL	0.6
MERCURY, TOTAL	0.28

SAMPLE ID	ACBSB01-00
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	4.2 J
CADMIUM, TOTAL	1.4
LEAD, TOTAL	34.2
ZINC, TOTAL	246 J
PESTICIDE/PCB (ug/kg)	
4,4'-DDE	19,000
4,4'-DDD	17,000
4,4'-DDT	11,000

SAMPLE ID	ACBSB01-00D
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	4.7 J
CADMIUM, TOTAL	1.5
LEAD, TOTAL	50.1
ZINC, TOTAL	221 J
PESTICIDE/PCB (ug/kg)	
4,4'-DDE	22,000
4,4'-DDD	18,000
4,4'-DDT	14,000

SAMPLE ID	ACBSS02-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
SEMIVOLATILES (ug/kg)	
BENZO(A)PYRENE	140 J
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	6.72
CADMIUM, TOTAL	0.88

SAMPLE ID	ACBMW03-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	2.5
CADMIUM, TOTAL	0.43

SAMPLE ID	6SB03-00
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
SEMIVOLATILES (ug/kg)	
BENZO(A)PYRENE	160 J
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	3.6 J
ARSENIC, TOTAL	3.4
CADMIUM, TOTAL	1.3
LEAD, TOTAL	50.4
MERCURY, TOTAL	1.3

SAMPLE ID	ACBSB02-00
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	0.00-1.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	1.3 J
CADMIUM, TOTAL	0.85
LEAD, TOTAL	23.2
ZINC, TOTAL	291 J

SAMPLE ID	6SS02
DATE SAMPLED	03/19/96
DEPTH RANGE (ft bgs)	0.00-1.00
SEMIVOLATILES (ug/kg)	
BENZO(A)PYRENE	380
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	4.4 J
ARSENIC, TOTAL	5.7
CADMIUM, TOTAL	0.52
LEAD, TOTAL	49.7

NOTE: EXCEEDS RESIDENTIAL RBC.
EXCEEDS RESIDENTIAL AND INDUSTRIAL RBC.
EXCEEDS 2x AVERAGE BACKGROUND.
EXCEEDS 2x AVERAGE BACKGROUND AND RESIDENTIAL RBC.
EXCEEDS 2x AVERAGE BACKGROUND AND RESIDENTIAL AND INDUSTRIAL RBC.

SOURCE: LANTDIV, FEB. 1992/1997

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LEGEND

- MONITORING WELL LOCATION (03/96)
- MONITORING WELL LOCATION (1997)
- EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
- SOIL BORING LOCATION (3/96)
- SURFACE SOIL SAMPLING LOCATION (3/96)
- SURFACE WATER LOCATION (3/96)
- PROPERTY BOUNDARY
- TREELINE
- MANHOLE
- STREET LIGHT
- TELEPHONE POLE
- mg/kg - MILLIGRAMS PER KILOGRAM
- ug/kg - MICROGRAMS PER KILOGRAM

80 0 40 80
1 inch = 80 ft.

FIGURE 2-3
SURFACE SOIL DETECTIONS ABOVE SCREENING CRITERIA
SWMU 6 AND AOC B
FORMER BUILDING 25 SITE
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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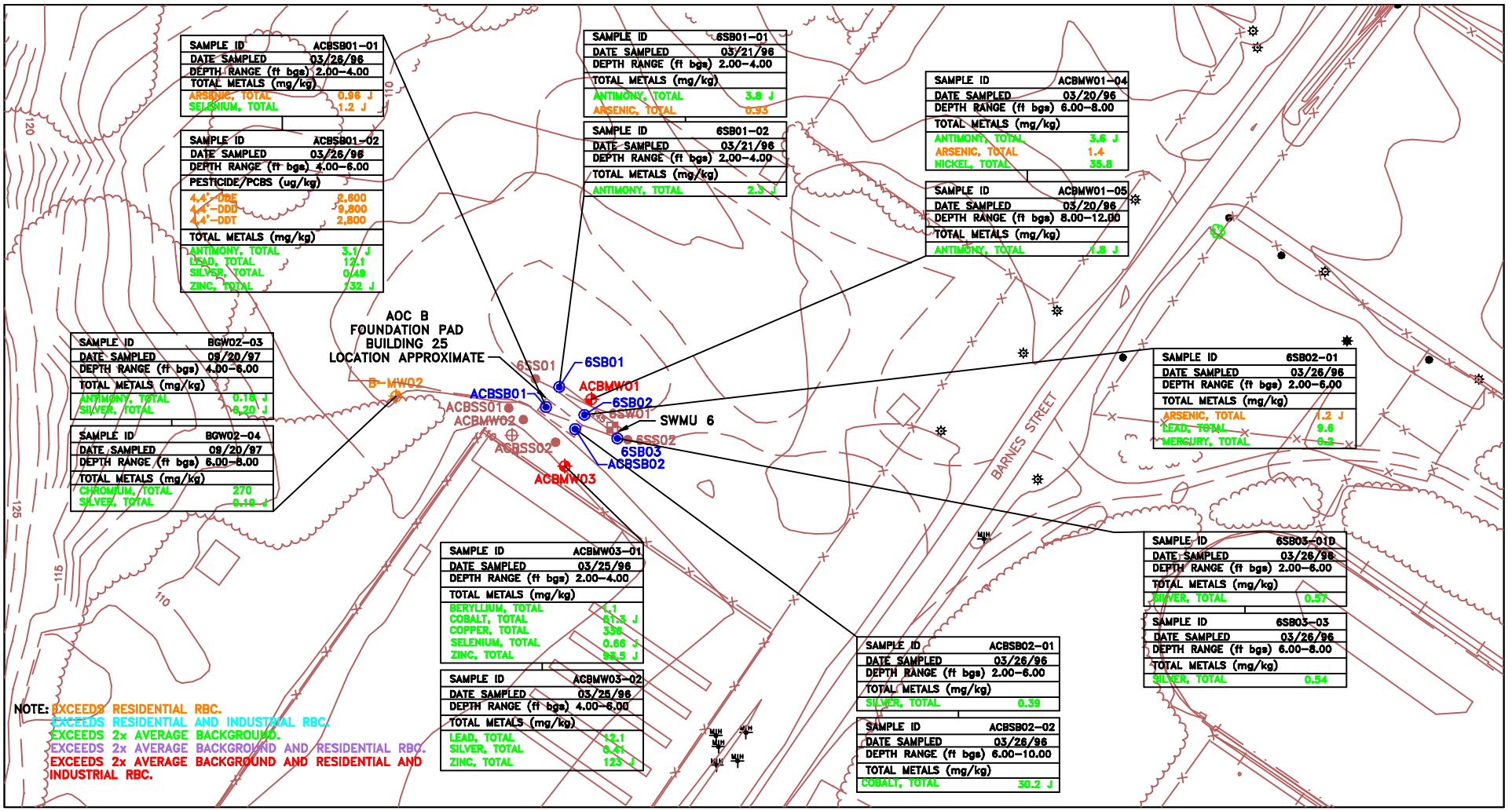

SAMPLE ID	ACBSB01-01
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	2.00-4.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	0.96 J
SELENIUM, TOTAL	1.2 J

SAMPLE ID	ACBSB01-02
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	4.00-6.00
PESTICIDE/PCBS (ug/kg)	
4,4'-DDE	2,600
4,4'-DDD	9,800
4,4'-DDT	2,800
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	3.1 J
LEAD, TOTAL	12.1
SILVER, TOTAL	0.49
ZINC, TOTAL	132 J

SAMPLE ID	6SB01-01
DATE SAMPLED	03/21/96
DEPTH RANGE (ft bgs)	2.00-4.00
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	3.8 J
ARSENIC, TOTAL	0.93

SAMPLE ID	6SB01-02
DATE SAMPLED	03/21/96
DEPTH RANGE (ft bgs)	2.00-4.00
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	2.3 J

SAMPLE ID	ACBMW01-04
DATE SAMPLED	03/20/96
DEPTH RANGE (ft bgs)	6.00-8.00
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	3.6 J
ARSENIC, TOTAL	1.4
NICKEL, TOTAL	35.8

SAMPLE ID	ACBMW01-05
DATE SAMPLED	03/20/96
DEPTH RANGE (ft bgs)	8.00-12.00
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	1.8 J

SAMPLE ID	BGW02-03
DATE SAMPLED	09/20/97
DEPTH RANGE (ft bgs)	4.00-6.00
TOTAL METALS (mg/kg)	
ANTIMONY, TOTAL	0.18 J
SILVER, TOTAL	0.20 J

SAMPLE ID	BGW02-04
DATE SAMPLED	09/20/97
DEPTH RANGE (ft bgs)	6.00-8.00
TOTAL METALS (mg/kg)	
CHROMIUM, TOTAL	270
SILVER, TOTAL	0.19 J

SAMPLE ID	6SB02-01
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	2.00-6.00
TOTAL METALS (mg/kg)	
ARSENIC, TOTAL	1.2 J
LEAD, TOTAL	9.6
MERCURY, TOTAL	0.2

SAMPLE ID	ACBMW03-01
DATE SAMPLED	03/25/96
DEPTH RANGE (ft bgs)	2.00-4.00
TOTAL METALS (mg/kg)	
BERYLLIUM, TOTAL	1.1
COBALT, TOTAL	51.3 J
COPPER, TOTAL	336
SELENIUM, TOTAL	0.66 J
ZINC, TOTAL	98.5 J

SAMPLE ID	ACBMW03-02
DATE SAMPLED	03/25/96
DEPTH RANGE (ft bgs)	4.00-6.00
TOTAL METALS (mg/kg)	
LEAD, TOTAL	12.1
SILVER, TOTAL	0.21
ZINC, TOTAL	123 J

SAMPLE ID	6SB03-01D
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	2.00-6.00
TOTAL METALS (mg/kg)	
SILVER, TOTAL	0.57

SAMPLE ID	6SB03-03
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	6.00-8.00
TOTAL METALS (mg/kg)	
SILVER, TOTAL	0.54

SAMPLE ID	ACBSB02-01
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	2.00-6.00
TOTAL METALS (mg/kg)	
SILVER, TOTAL	0.39

SAMPLE ID	ACBSB02-02
DATE SAMPLED	03/26/96
DEPTH RANGE (ft bgs)	6.00-10.00
TOTAL METALS (mg/kg)	
COBALT, TOTAL	30.2 J

NOTE: EXCEEDS RESIDENTIAL RBC.
EXCEEDS RESIDENTIAL AND INDUSTRIAL RBC.
EXCEEDS 2x AVERAGE BACKGROUND.
EXCEEDS 2x AVERAGE BACKGROUND AND RESIDENTIAL RBC.
EXCEEDS 2x AVERAGE BACKGROUND AND RESIDENTIAL AND INDUSTRIAL RBC.

SOURCE: LANTDIV, FEB. 1992/1997

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LEGEND

- MONITORING WELL LOCATION (03/96)
- MONITORING WELL LOCATION (1997)
- EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
- SOIL BORING LOCATION (3/96)
- SURFACE SOIL SAMPLING LOCATION (3/96)
- SURFACE WATER LOCATION (3/96)
- PROPERTY BOUNDARY
- TREELINE
- MANHOLE
- STREET LIGHT
- TELEPHONE POLE
- mg/kg - MILLIGRAMS PER KILOGRAM
- ug/kg - MICROGRAMS PER KILOGRAM

80 0 40 80
1 inch = 80 ft.

FIGURE 2-4
SUBSURFACE SOIL DETECTIONS ABOVE SCREENING CRITERIA
SWMU 6 AND AOC B
FORMER BUILDING 25 SITE
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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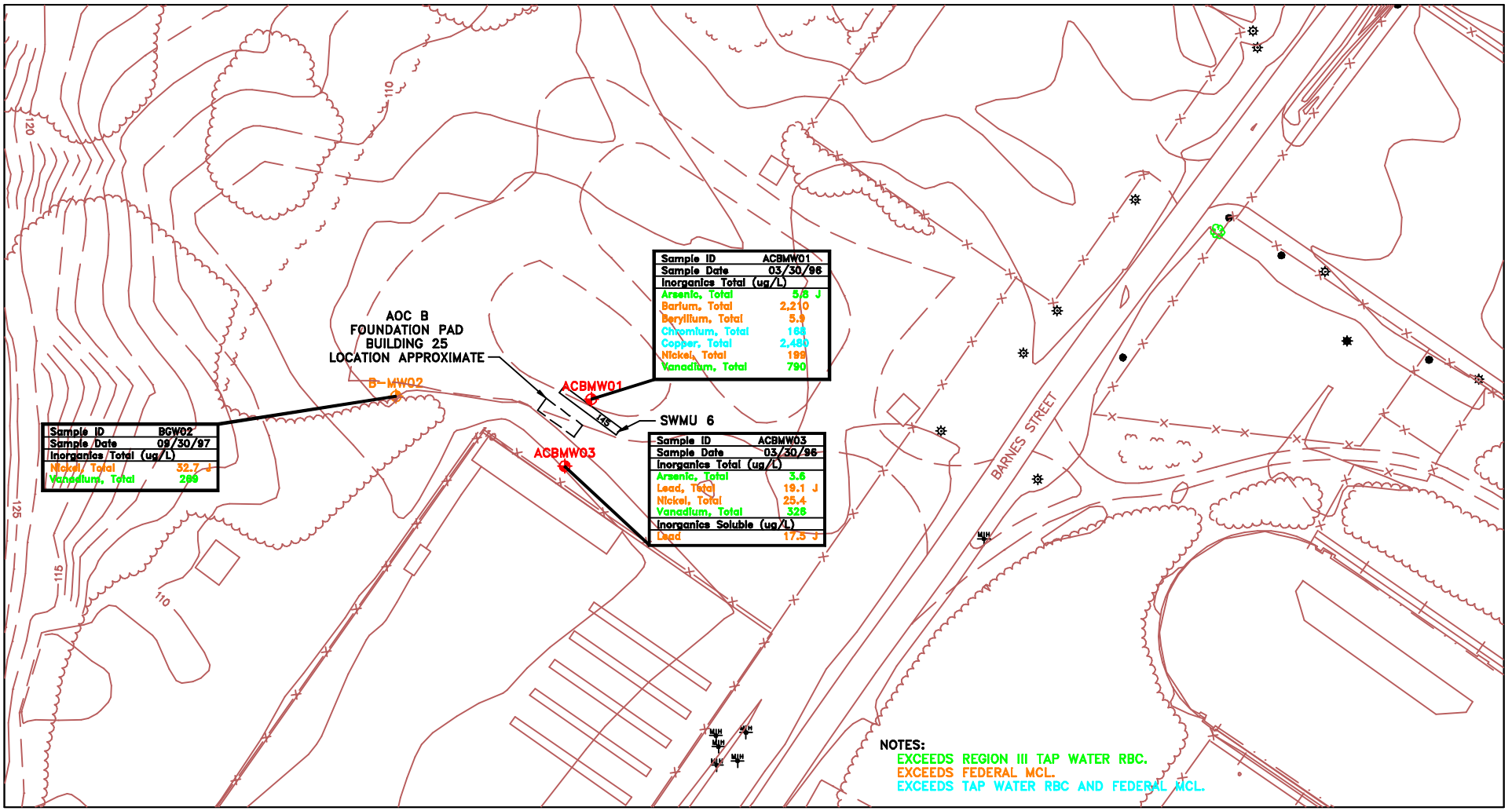

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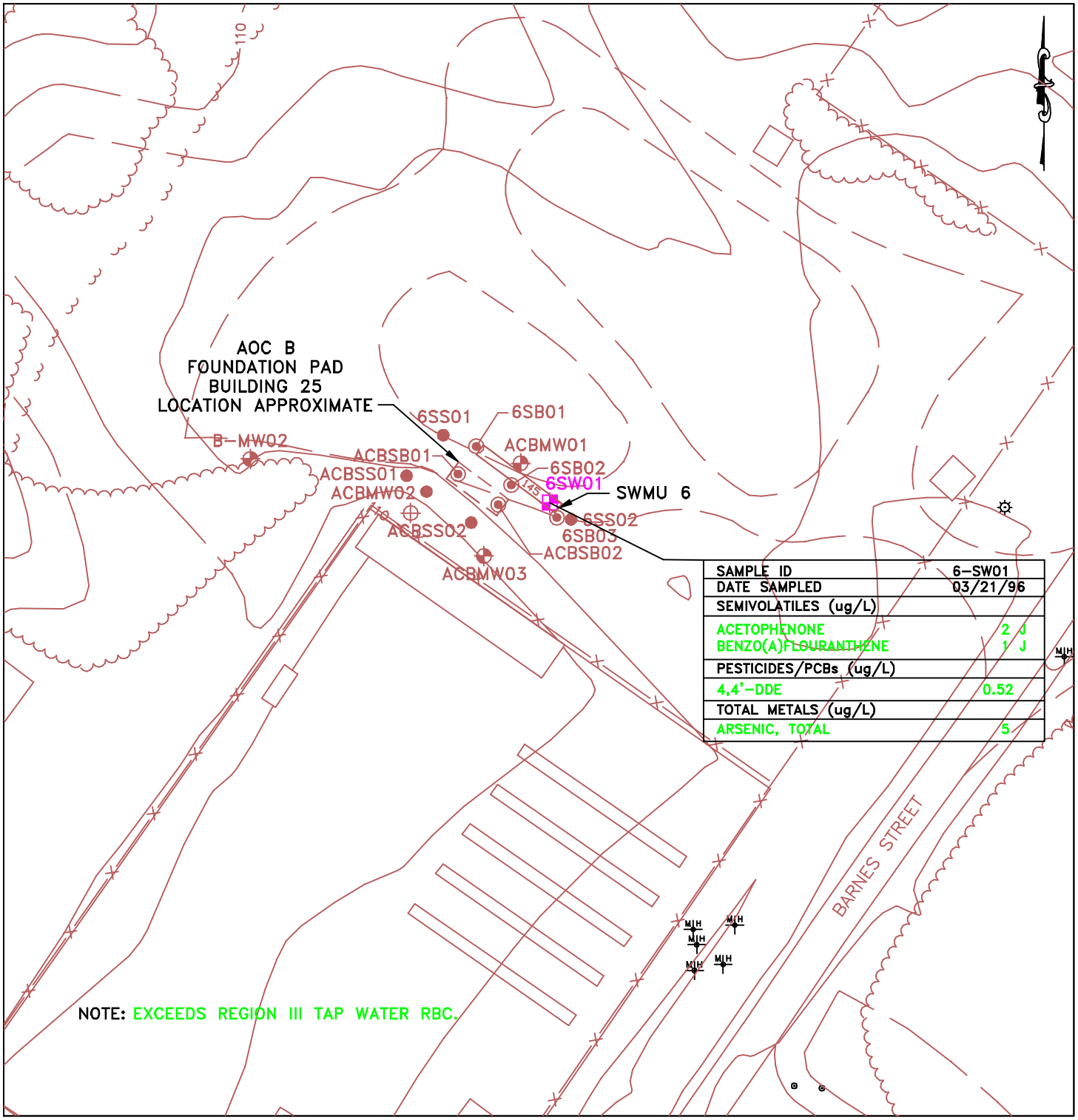
LEGEND

- MONITORING WELL LOCATION (03/96)
- MONITORING WELL LOCATION (1997)
- PROPERTY BOUNDARY
- TREELINE
- MANHOLE
- STREET LIGHT
- TELEPHONE POLE

SOURCE: LANTDIV, FEB. 1992/1997

80 0 40 80
1 inch = 80 ft.

FIGURE 2-5
GROUNDWATER DETECTIONS ABOVE SCREENING CRITERIA
SWMU 6 AND AOC B
FORMER BUILDING 25 SITE
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



SOURCE: LANTDIV, FEB. 1992/1997

80 0 40 80

1 inch = 80 ft.

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LEGEND

- MONITORING WELL LOCATION (03/96)
- MONITORING WELL LOCATION (1997)
- EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
- SOIL BORING LOCATION (3/96)
- SURFACE SOIL SAMPLING LOCATION (3/96)
- SURFACE WATER LOCATION (3/96)
- PROPERTY BOUNDARY
- TREELINE
- M/H – MANHOLE
- ug/L – MICROGRAMS PER LITER
- STREET LIGHT
- TELEPHONE POLE

FIGURE 2-6
SURFACE WATER DETECTIONS ABOVE SCREENING CRITERIA
SWMU 6 AND AOC B
FORMER BUILDING 25 SITE
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

APPENDIX A
PHOTOGRAPHS OF SWMU 6/AOC B

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PHOTOGRAPH 2-1
INTERIOR OF BUILDING 145

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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PHOTOGRAPH 2-2
EXTERIOR AND OPENINGS IN ROOF
OF BUILDING 145

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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PHOTOGRAPH 2-3
CLOSEUP OF OPENING IN ROOF
OF BUILDING 145

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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PHOTOGRAPH 2-4
REMNANTS OF BUILDING 25

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

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APPENDIX B
RISK ASSESSMENT SUPPORT INFORMATION

TABLE B-1

Changes to the Human Health Risk Assessment for SWMU6/AOC B located at Naval Station at Roosevelt Roads in Cieba, Puerto Rico include the following:

	Change	Reason
1	Elimination of Residential Exposures to Surface Water	The response to comments dated November 24, 1998 evaluated the standing, pooled water collected from the bunker (Building 145) as a source of potable water. This is not a realistic exposure pathway for a residential scenario.
2	Adjustment of surface water exposure parameters for on-site commercial/industrial worker to represent an accidental contact scenario rather than drinking water/bathing scenario.	Drinking water/bathing scenario is not realistic for potential exposure to standing, pooled water in Building 145.
3	Changed groundwater exposure scenario for future residential receptors from drinking water to beneficial-use.	Drinking water scenario is not realistic for this SWMU/AOC due to poor quality, relatively low yields, and the availability of public water.
4	Adjustment for Absorbed Dose for all chemicals in surface soil.	USEPA Region III oral ABS values for oral to dermal extrapolation per RAGS Appendix A dated 4/08/99 were used in this revised estimation of risk at SWMU 6 (USEPA, 1999).
5	Changed the Absorption fraction for dermal exposures to surface soil PAHs from 0.1 to 0.01.	USEPA Region III default value (Wester at al, 1990, and Kao et al 1985).
6	Elimination of CSFi for Benzo(a)anthracene, Benzo(b) flouranthene, Dibenzo(a,h)anthracene.	The USEPA Integrated Risk Information System (IRIS) has removed the CSFi for these chemicals (USEPA, 2000).
7	CSFi for Benzo(a)pyrene was changed from 6.1 $(mg/kg\text{-}day)^{-1}$ to 3.1 $(mg/kg\text{-}day)^{-1}$	The CSFi for BaP was changed in IRIS (USEPA, 2000).
8	Beryllium RfDo was changed from 0.07 mg/kg-day to 0.002 mg/kg-day.	The RfDo for Beryllium was changed in IRIS (USEPA, 2000).
9	Elimination of CSFo for Beryllium	Beryllium is no longer considered an oral carcinogen in IRIS (USEPA, 2000)
10	Change the RfDi for Beryllium from 8.4 to 5.7 x 10^{-4} mg/kg-day	The RfDi for Beryllium was changed in IRIS (USEPA, 2000).
11	Change the CSFi for Beryllium from NA to 8.4 $(mg/kg\text{-}day)^{-1}$	The CSFi for Beryllium was changed in IRIS (USEPA, 2000)
12	Changed the CSFo for HxCDD from 150,000 $(mg/kg\text{-}day)^{-1}$ to 6,200 $(mg/kg\text{-}day)^{-1}$	The CSFo for HxCDD is now listed in IRIS with a CSFo; originally a default CSFo for TCDD was used (USEPA, 2000).
13	Changed the CSFi for HxCDD from 150,000 $(mg/kg\text{-}day)^{-1}$ to 4,500 $(mg/kg\text{-}day)^{-1}$	The CSFi for HxCDD is now listed in IRIS; originally a default CSFi for TCDD was used (USEPA, 2000).
14	Changed the CSFi for HxCDF from 150,000 $(mg/kg\text{-}day)^{-1}$ to 15,000 $(mg/kg\text{-}day)^{-1}$	The CSFi for HxCDF was adjusted using a Toxicity Equivalent Factor (TEF) of 0.1 (ATSDR, 1997).

References:

USEPA, 1999. Risk Assessment Guidance for Superfund (RAGS) Volume I. Human Health Evaluation Manual (Part A) Interim Final, Appendix A, last updated April 1999.

USEPA, 2000. USEPA Region III Risk-Based Concentration (RBC) Table. April 2000.

ATSDR, 1997. Agency for Toxic Substances and Disease Registry. Dioxin and Dioxin-Like Compounds in Soil, Part 1: ATSDR Interim Policy Guideline. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Atlanta, Georgia.

TABLE B-2

EXPOSURE INPUT PARAMETERS FOR CURRENT ON-SITE COMMERCIAL/UTILITY WORKERS EXPOSED TO SOIL AND SURFACE WATER
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Input Parameter	Media	Units	Input Values	Comments/References
ED, Exposure Duration	Soil/Surface Water	years	25	USEPA, 1991
EF, Exposure Frequency	Soil/Surface Water	days/year	250	USEPA, 1991
ET, Exposure Time	Soil	hours/day	8	USEPA, 1991
	Surface Water	hours/day	2	Professional Judgement
IR, Ingestion Rate	Soil	mg/day	100	USEPA, 1991
	Surface Water	L/hour	0.05	Professional Judgement
SA, Exposed Surface Area	Soil/Surface Water	cm^2/day	5,300[(1)]	USEPA, 1992
RR, Respiration Rate	Soil	m^3/day	20	USEPA, 1991
FI, Fraction Ingested	Soil	unitless	0.5	Professional Judgement
ABS, Dermal Absorption Factor	Soil	unitless	Chemical-specific[(2)]	USEPA, 1995
AF, Adherence Factor	Soil	mg/cm^2	1	USEPA, 1992
BW, Body Weight	Soil/Surface Water	kg	70	USEPA, 1989
AT_{nc}, Averaging Time - Noncarcinogens	Soil/Surface Water	days	9,125	USEPA, 1989
AT_c, Averaging Time - Carcinogens	Soil/Surface Water	days	25,550	USEPA, 1989

Notes:

(1) Represents exposure to hands, forearms and face.

(2) The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil (USEPA, 1995a):

VOCs (Vapor Pressure > 95.2 mmHg) - 0.05%
VOCs (Vapor Pressure < 95.2 mmHg) - 3%
SVOCs - 10%
Arsenic - 3.2%
Inorganics - 1%

References:

USEPA, 1995. Assessing Dermal Exposure from Soil.
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications ! Interim Report.
USEPA, 1991. Risk Assessment Guidance for Superfund, Volume I ! Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.
USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I ! Human Health Evaluation Manual (Part A) Interim Final.

TABLE B-3

EXPOSURE INPUT PARAMETERS FOR FUTURE MILITARY RESIDENT CHILDREN AND ADULTS EXPOSED TO SURFACE SOIL AND GROUNDWATER SWMU 6/AOC B NAVAL STATION ROOSEVELT ROADS PUERTO RICO

Input Parameter	Media	Units	Input Values		Comments/References
			Child (1 to 6 years)	Adult	
ED, Exposure Duration	Soil/Groundwater[1]	years	4	4	Site Specific Information[4]
EF, Exposure Frequency	Soil/Groundwater[1]	days/year	350	350	USEPA, 1991
ET, Exposure Time	Groundwater[1]	hours/day	0.2	0.2	Professional Judgement
IR, Ingestion Rate	Soil	mg/day	200	100	USEPA, 1989b
	Groundwater[1]	L/day	0.05	0.05	Professional Judgement
SA, Surface Area	Soil/Groundwater[1]	cm^2	2,006[2]	5,300[2]	USEPA, 1989a and 1992
RR, Respiration Rate	Soil as Fugitive Dusts	m^3/day	20	20	USEPA, 1991
ABS, Absorbance Factor	Soil	unitless	Chemical Specific[3]	Chemical Specific[3]	USEPA, 1995
AF, Adherence Factor	Soil	mg/cm^2	1	1	USEPA, 1992
BW, Body Weight	Soil/Groundwater[1]	kg	15	70	USEPA, 1989b
AT_{nc}, Averaging Time - Noncarcinogens	Soil/Groundwater[1]	day	1,460	1,460	Site Specific Information[4]
AT_c, Averaging Time - Carcinogens	Soil/Groundwater[1]	day	25,550	25,550	USEPA, 1989b

Notes:

(1) Evaluation of potential groundwater exposure using beneficial-use scenario (i.e., washing cars, watering lawns). The ingestion rate was used as a conservative estimate that was derived from professional judgement based on USEPA's (1989b) surface water ingestion rate of 0.05 L/hour established for a swimming scenario. The surface water ingestion value of 0.05 L/hour was adjusted to 0.05 L/day, thereby yielding a conservative value that is more reflective of the beneficial use scenario being evaluated, than is the value for the swimming scenario.

(2) Represents approximately 25% of the total body surface area.

(3) The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil (USEPA, 1995):

VOCs (Vapor Pressure > 95.2 mmHg) - 0.05%
VOCs (Vapor Pressure < 95.2 mmHg) - 3%
SVOCs - 10%
Arsenic - 3.2%
Inorganics - 1%

(4) Assumes a 4 year tour of duty for enlisted personnel and dependents, a conservative assumption. A three year tour of duty is the norm at NSRR (Personal communication with Madeline Rivera, RCRA Program Manager, Roosevelt Roads).

References:

USEPA, 1995. Assessing Dermal Exposure from Soil.

USEPA, 1992. Dermal Exposure Assessment: Principles and Applications ! Interim Report.

USEPA, 1991. Risk Assessment Guidance for Superfund, Volume I ! Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.

USEPA, 1989a. Exposure Factors Handbook.

USEPA, 1989b. Risk Assessment Guidance for Superfund, Volume I ! Human Health Evaluation Manual (Part A) Interim Final. EPA/540/1-89/002. December, 1989.

TABLE B-4

EXPOSURE INPUT PARAMETERS FOR FUTURE CONSTRUCTION WORKERS
EXPOSED TO SOIL
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Input Parameter	Units	Input Values	Comments/References
ED, Exposure Duration	years	1	USEPA, 1991
EF, Exposure Frequency	days/year	180	USEPA, 1991
ET, Exposure Time	hrs/day	8	USEPA, 1991
IR, Ingestion Rate	mg/day	480	USEPA, 1991
SA, Exposed Surface Area	cm^2/day	5,300(1)	USEPA, 1992
FI, Fraction Ingested	unitless	1.0	USEPA, 1989
ABS, Dermal Absorption Factor	unitless	Chemical-specific(2)	USEPA, 1995
AF, Adherence Factor	mg/cm^2	1	USEPA, 1992/USEPA 1997
BW, Body Weight	kg	70	USEPA, 1989
AT_{nc}, Averaging Time - Noncarcinogens	days	365	USEPA, 1989
AT_c, Averaging Time - Carcinogens	days	25,550	USEPA, 1989

Notes:

(1) Represents exposure to hands, forearms and face.

(2) The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil (USEPA, 1995):

VOCs (Vapor Pressure > 95.2 mmHg) - 0.05%
VOCs (Vapor Pressure < 95.2 mmHg) - 3%
SVOCs - 10%
Arsenic - 3.2%
Inorganics - 1%

References:

USEPA, 1997. Exposure Factors Handbook, General Factors-Volume I. August, 1997. EPA/600/P-95/002Fa
USEPA, 1995. Assessing Dermal Exposure from Soil.
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications ! Interim Report.
USEPA, 1991. Risk Assessment Guidance for Superfund, Volume I ! Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.
USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I ! Human Health Evaluation Manual (Part A) Interim Final.

TABLE B-5

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Constituents	Oral CSF $(mg/kg/day)^{-1}$	Inhalation CSF $(mg/kg/day)^{-1}$	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral Absorption Factors	WOE	Target Organ (Systemic Toxicants)	Critical Effect (Systemic Toxicants)
Semivolatiles:								
Acetophenone	--	--	1.0E-01 (i)	5.7E-06 (i)	100%	D	--	--
Benzo(a)anthracene	7.3E-01 (e)	--	--	--	NA	B2	--	--
Benzo(a)pyrene	7.3 (i)	3.1 (e)	--	--	NA	B2	--	--
Benzo(b)fluoranthene	7.3E-01 (e)	--	--	--	NA	B2	--	--
Dibenzo(a,h)anthracene	7.3 (e)	--	--	--	NA	B2	--	--
Pesticides:								
4,4'-DDD	2.40E-01 (i)	--	--	--	70%	B2	--	--
4,4'-DDE	3.4E-01 (a)	--	--	--	70%	B2	--	--
4,4'-DDT	3.4E-01 (i)	3.4E-01 (i)	5.00E-04 (i)	--	70%	B2	Liver	Lesions
Dioxins:								
Total HxCDD	6,200 (i)	4,500 (i)	--	--	100%	B2	Liver	Hepatotoxicity
Total HxCDF	150,000	15,000	--	--	100%	B2	Liver	Hepatotoxicity
Inorganics:								
Arsenic	1.5 (i)	1.51E+01 (i)	3.0E-04 (i)	--	95%	A	Skin	Keratosis and Hyperpigmentation

TABLE B-5 (continued)

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
SWMU 6/AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Constituents	Oral CSF $(mg/kg/day)^{-1}$	Inhalation CSF $(mg/kg/day)^{-1}$	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral Absorption Factors	WOE	Target Organ (Systemic Toxicants)	Critical Effect (Systemic Toxicants)
Barium	--	--	7.0E-02 (i)	--	100%	D	--	--
Lead	--	--	--	--	--	--	--	--

Notes:

NA - Not Applicable

i = Integrated Risk Information System (IRIS), 1998.
e = EPA-NCEA (as cited from USEPA, Region III RBC Tables, October 1997).
h = Health Effects Assessment Summary Tables (HEAST), 1997.
a = HEAST Alternative Method, 1997.
w = Withdrawn from IRIS or HEAST.
-- = Information not published

SPREADSHEET 1
ADULT ON-SITE COMMERCIAL/UTILITY WORKER
ACCIDENTAL INGESTION OF SURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Cs*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Description	Adult	
CDI	Chronic daily intake (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	
IR	Ingestion Rate (mg/d)	100	
CF	Conversion factor (kg/mg)	0.000001	
FI	Fraction of soil ingested from site	0.5	
EF	Exposure Frequency (d/yr)	250	
ED	Exposure Duration (yrs)	25	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	9125	

				Adult Worker					
				Carcinogens			Noncarcinogens		
	Cs	CSFo	RfDo	CDI		% Contrib.	CDI		% Contrib.
Parameter	(mg/kg)	1/(mg/kg/d)	(mg/kg/d)	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI
Benzo(a)anthracene	2.4	0.73	NA	4.19E-07	3.06E-07	3.2%	1.17E-06	--	--
Benzo(a)pyrene	1.8	7.3	NA	3.15E-07	2.30E-06	23.8%	8.81E-07	--	--
Benzo(b)fluoranthene	4.3	0.73	NA	7.51E-07	5.48E-07	5.7%	2.10E-06	--	--
Dibenzo(a,h)anthracene	0.18	7.3	NA	3.15E-08	2.30E-07	2.4%	8.81E-08	--	--
4,4'-DDE	22	0.34	NA	3.84E-06	1.31E-06	13.5%	1.08E-05	--	--
4,4'-DDD	18	0.24	NA	3.15E-06	7.55E-07	7.8%	8.81E-06	--	--
4,4'-DDT	14	0.34	0.0005	2.45E-06	8.32E-07	8.6%	6.85E-06	0.01	45.7%
Total HxCDD	0.000076	6,200	NA	1.33E-11	8.23E-08	0.9%	3.72E-11	--	--
Total HxCDF (2378-TCDD TEC)	0.000026	150,000	NA	4.54E-12	6.81E-07	7.1%	1.27E-11	--	--
Arsenic	10.0	1.5	0.0003	1.75E-06	2.62E-06	27.1%	4.89E-06	0.02	54.3%
				Total ILCR:	9.66E-06		Total HI:	0.03	

SPREADSHEET 2
ADULT ON-SITE COMMERCIAL/UTILITY WORKER
DERMAL CONTACT WITH SURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

DAD (mg/kg/d)= (Cs*CF*AF*ABS*A*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Description	Adult	
DAD	Dermally absorbed dose (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	
CF	Conversion factor (kg/mg)	0.000001	
AF	Soil to skin adherence factor (mg/cm2-event)	1	
ABS	Absorption fraction	CS	
A	Skin surface area available for contact (cm2)	5300	
EF	Exposure Frequency (d/yr)	250	
ED	Exposure Duration (yrs)	25	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	9125	

					Adult Worker					
					Carcinogens			Noncarcinogens		
	Cs		CSFd	RfDd	DAD		% Contrib.	DAD		% Contrib.
Parameter	(mg/kg)	ABS	1/(mg/kg/d)	(mg/kg/d)	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI
Benz(a)anthracene	2.4	0.01	0.73	NA	4.45E-07	3.24E-07	0.6%	1.24E-06	--	--
Benzo(a)pyrene	1.8	0.01	7.3	NA	3.33E-07	2.43E-06	4.8%	9.33E-07	--	--
Benzo(b)fluoranthene	4.3	0.01	0.73	NA	7.96E-07	5.81E-07	1.2%	2.23E-06	--	--
Dibenzo(a,h)anthracene	0.18	0.01	7.3	NA	3.33E-08	2.43E-07	0.5%	9.33E-08	--	--
4,4'-DDE	22	0.1	0.34	NA	4.07E-05	1.39E-05	27.6%	1.14E-04	--	--
4,4'-DDD	18	0.1	0.3	NA	3.33E-05	1.00E-05	19.9%	9.33E-05	--	--
4,4'-DDT	14	0.1	0.425	0.0004	2.59E-05	1.10E-05	21.9%	7.26E-05	0.182	75.7%
Total HxCDD	0.000076	0.03	6,200	NA	4.22E-11	2.62E-07	0.5%	1.18E-10	--	--
Total HxCDF (2378-TCDD TEC)	0.000026	0.03	150,000	NA	1.44E-11	2.17E-06	4.3%	4.05E-11	--	--
Arsenic	10.0	0.032	1.58	0.000285	5.93E-06	9.36E-06	18.6%	1.66E-05	0.058	24.3%
					Total ILCR:	5.02E-05		Total HI:	0.2	

SPREADSHEET 3
ADULT ON-SITE COMMERCIAL/UTILITY WORKER
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = Cs * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Description	Adult	
CDI	Chronic daily intake (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFi	Inhalation cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDi	Inhalation reference dose (mg/kg/d)	CS	
Ca	Concentration of chemical in air as fugitive dusts (mg/m3)	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	
PEF	Particulate emission factor (m3/kg)	1.32E+09	
RR	Respiration rate (m3/hr)	0.83	
ET	Exposure time (hrs/d)	8	
EF	Exposure Frequency (d/yr)	250	
ED	Exposure Duration (yrs)	25	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	9125	

					Adult Worker					
					Carcinogens			Noncarcinogens		
	Cs	Ca	CSFi	RfDi	CDI		% Contrib.	CDI		% Contrib.
Parameter	(mg/kg)	(mg/m3)	1/(mg/kg/d)	(mg/kg/d)	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI
Benz(a)anthracene	2.4	1.82E-09	NA	NA	4.22E-11	--	--	1.18E-10	--	--
Benzo(a)pyrene	1.8	1.36E-09	3.1	NA	3.16E-11	9.81E-11	3.4%	8.86E-11	--	--
Benzo(b)fluoranthene	4.3	3.26E-09	.NA	NA	7.56E-11	--	--	2.12E-10	--	--
Dibenzo(a,h)anthracene	0.18	1.36E-10	NA	NA	3.16E-12	--	--	8.86E-12	--	--
4,4'-DDE	22	1.67E-08	NA	NA	3.87E-10	--	--	1.08E-09	--	--
4,4'-DDD	18	1.36E-08	NA	NA	3.16E-10	--	--	8.86E-10	--	--
4,4'-DDT	14	1.06E-08	0.34	NA	2.46E-10	8.37E-11	2.9%	6.89E-10	--	--
Total HxCDD	0.000076	5.76E-14	4,500	NA	1.34E-15	6.01E-12	0.2%	3.74E-15	--	--
Total HxCDF (2378-TCDD TEC)	0.000026	1.97E-14	15,000	NA	4.57E-16	6.86E-12	0.2%	1.28E-15	--	--
Arsenic	10.0	7.58E-09	15.1	NA	1.76E-10	2.65E-09	93.2%	4.92E-10	--	--
					Total ILCR:	2.85E-09		Total HI:	0.0	

SPREADSHEET 4
ADULT ON-SITE COMMERCIAL/UTILITY WORKER
INGESTION OF POOLED SURFACE WATER AT SWMU 6
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Cw*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Description	Adult	
CDI	Chronic daily intake (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	
Cw	Concentration of chemical in water (mg/L)	CS	
IR	Ingestion Rate (L/hour)	0.05	
EF	Exposure Frequency (d/yr)	250	
ED	Exposure Duration (yrs)	25	
ET	Exposure Time (hours)	2	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	9125	

				Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Acetophenone	0.002	NA	0.1	6.99E-07	--	0.0%	1.96E-06	1.96E-05	0.1%
Benzo(b)fluoranthene	0.001	0.73	NA	3.49E-07	2.55E-07	8.7%	9.78E-07	--	--
4,4'-DDE	0.00052	0.34	NA	1.82E-07	6.18E-08	2.1%	5.09E-07	--	--
Total Arsenic	0.0050	1.5	0.0003	1.75E-06	2.62E-06	89.2%	4.89E-06	0.016	99.9%
				Total ILCR:	3E-06		HI:	0.02	

SPREADSHEET 5
ADULT ON-SITE COMMERCIAL/UTILITY WORKER
DERMAL CONTACT WITH POOLED SURFACE WATER AT SWMU 6
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

DAD (mg/kg/d)= (Cw*CF*Kp*SA*EF*ED*ET)/(BW*AT)

ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
HQ = CDI/RfDo Adj RfD Adj = RfD*AD

Parameter	Description	Adult	
DAD	Dermally absorbed dose (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	
SA	Skin surface area available for contact (cm2)	5300	
ET	Exposure frequency (d/yr)	250	
ED	Exposure duration (yrs)	25	
ET	Exposure time (hrs/day)	2	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	9125	
Cw	Concentration of chemical in water (mg/L)	CS	
CF	Conversion factor (L/cm3)	0.001	
Kp	Dermal permeability coefficient (cm/hour)	CS	
AD	Adjustment for Absorbed Dose	CS	

								Adult Worker					
						Adj	Adj	Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	Kp (cm/hour)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	AD (unitless)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Acetophenone	0.002	0.0046653	NA	0.1	1	NA	0.1	3.46E-07	--	0.0%	9.68E-07	9.68E-06	0.5%
Benzo(b)fluoranthene	0.001	0.1	0.73	NA	1	0.73	NA	3.70E-06	2.70E-06	59.2%	1.04E-05	--	--
4,4'-DDE	0.00052	0.24	0.34	NA	1	0.34	NA	4.62E-06	1.57E-06	34.4%	1.29E-05	--	--
Total Arsenic	0.0050	0.001	1.50	0.0003	0.95	1.58	0.000285	1.85E-07	2.92E-07	6.4%	5.19E-07	1.82E-03	99.5%
								Total ILCR:	4.57E-06		HI:	0.00	

SPREADSHEET 6
MILITARY ADULT AND YOUNG CHILD RESIDENTS (AGES 1 TO 6 YEARS) - FUTURE SCENARIO
ACCIDENTAL INGESTION OF SURFACE SOIL IN SWMU6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Cs*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Description	Adult	Young Child	
CDI	Chronic daily intake (mg/kg/d)	CS	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	CS	
HQ	Hazard quotient	CS	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	CS	
IR	Ingestion Rate (mg/d)	100	200	
CF	Conversion factor (kg/mg)	0.000001	1E-06	
FI	Fraction of soil ingested from site	1	1	
EF	Exposure Frequency (d/yr)	350	350	
ED	Exposure Duration (yrs)	4	4	
BW	Body weight (kg)	70	15	
ATc	Averaging time, carcinogens (d)	25550	25550	
ATn	Averaging time, noncarcinogens (d)	1460	1460	

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
	Cs	CSFo	RfDo	CDI		% Contrib.	CDI		% Contrib.	CDI		% Contrib.	CDI		% Contrib.
Parameter	(mg/kg)	1/(mg/kg/d)	(mg/kg/d)	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI
Benz(a)anthracene	2.4	0.73	NA	1.88E-07	1.37E-07	3.2%	3.29E-06	--	--	1.75E-06	1.28E-06	3.2%	3.07E-05	--	--
Benzo(a)pyrene	1.8	7.3	NA	1.41E-07	1.03E-06	23.8%	2.47E-06	--	--	1.32E-06	9.60E-06	23.8%	2.30E-05	--	--
Benzo(b)fluoranthene	4.3	0.73	NA	3.37E-07	2.46E-07	5.7%	5.89E-06	--	--	3.14E-06	2.29E-06	5.7%	5.50E-05	--	--
Dibenzo(a,h)anthracene	0.18	7.3	NA	1.41E-08	1.03E-07	2.4%	2.47E-07	--	--	1.32E-07	9.60E-07	2.4%	2.30E-06	--	--
4,4'-DDE	22	0.34	NA	1.72E-06	5.86E-07	13.5%	3.01E-05	--	--	1.61E-05	5.46E-06	13.5%	2.81E-04	--	--
4,4'-DDD	18	0.24	NA	1.41E-06	3.38E-07	7.8%	2.47E-05	--	--	1.32E-05	3.16E-06	7.8%	2.30E-04	--	--
4,4'-DDT	14	0.34	0.0005	1.10E-06	3.73E-07	8.6%	1.92E-05	0.04	45.7%	1.02E-05	3.48E-06	8.6%	1.79E-04	0.36	45.7%
Total HxCDD	0.000076	6,200	NA	5.95E-12	3.69E-08	0.9%	1.04E-10	--	--	5.55E-11	3.44E-07	0.9%	9.72E-10	--	--
Total HxCDF (2378-TCDD TEC)	0.000026	150,000	NA	2.04E-12	3.05E-07	7.1%	3.56E-11	--	--	1.90E-11	2.85E-06	7.1%	3.32E-10	--	--
Arsenic	10.0	1.5	0.0003	7.83E-07	1.17E-06	27.1%	1.37E-05	0.05	54.3%	7.31E-06	1.10E-05	27.1%	1.28E-04	0.43	54.3%
				Total ILCR:	4.33E-06		Total HI:	0.1		Total ILCR:	4.04E-05		Total HI:	0.8	

SPREADSHEET 7
MILITARY ADULT AND YOUNG CHILD RESIDENTS (AGES 1 TO 6 YEARS) - FUTURE SCENARIO
DERMAL CONTACT WITH SURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

DAD (mg/kg/d)= (Cs*CF*AF*ABS*A*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Description	Adult	Young Child	
DAD	Dermally absorbed dose (mg/kg/d)	CS	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	CS	
HQ	Hazard quotient	CS	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	CS	
CF	Conversion factor (kg/mg)	0.000001	1E-06	
AF	Soil to skin adherence factor (mg/cm2-event)	1	1	
ABS	Absorption fraction	CS	CS	
A	Skin surface area available for contact (cm2)	5300	2006	
EF	Exposure Frequency (d/yr)	350	350	
ED	Exposure Duration (yrs)	4	4	
BW	Body weight (kg)	70	15	
ATc	Averaging time, carcinogens (d)	25550	25550	
ATn	Averaging time, noncarcinogens (d)	1460	1460	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	Cs (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Benz(a)anthracene	2.4	0.01	0.73	NA	9.96E-08	7.27E-08	0.6%	1.74E-06	--	--	1.76E-07	1.28E-07	0.6%	3.08E-06	--	--
Benzo(a)pyrene	1.8	0.01	7.3	NA	7.47E-08	5.45E-07	4.8%	1.31E-06	--	--	1.32E-07	9.63E-07	4.8%	2.31E-06	--	--
Benzo(b)fluoranthene	4.3	0.01	0.73	NA	1.78E-07	1.30E-07	1.2%	3.12E-06	--	--	3.15E-07	2.30E-07	1.2%	5.51E-06	--	--
Dibenzo(a,h)anthracene	0.18	0.01	7.3	NA	7.47E-09	5.45E-08	0.5%	1.31E-07	--	--	1.32E-08	9.63E-08	0.5%	2.31E-07	--	--
4,4'-DDE	22	0.1	0.34	NA	9.13E-06	3.10E-06	27.6%	1.60E-04	--	--	1.61E-05	5.48E-06	27.6%	2.82E-04	--	--
4,4'-DDD	18	0.1	0.3	NA	7.47E-06	2.24E-06	19.9%	1.31E-04	--	--	1.32E-05	3.96E-06	19.9%	2.31E-04	--	--
4,4'-DDT	14	0.1	0.425	0.0004	5.81E-06	2.47E-06	21.9%	1.02E-04	0.25	75.7%	1.03E-05	4.36E-06	21.9%	1.80E-04	0.45	75.7%
Total HxCDD	0.000076	0.03	6,200	NA	9.46E-12	5.86E-08	0.5%	1.66E-10	--	--	1.67E-11	1.04E-07	0.5%	2.92E-10	--	--
Total HxCDF (2378-TCDD TEC)	0.000026	0.03	150,000	NA	3.24E-12	4.85E-07	4.3%	5.66E-11	--	--	5.72E-12	8.57E-07	4.3%	1.00E-10	--	--
Arsenic	10.0	0.032	1.58	0.000285	1.33E-06	2.10E-06	18.6%	2.32E-05	0.08	24.3%	2.34E-06	3.70E-06	18.6%	4.10E-05	0.14	24.3%
					Total ILCR:	1.13E-05		Total HI:	0.3		Total ILCR:	1.99E-05		Total HI:	0.6	

SPREADSHEET 8
MILITARY ADULT AND YOUNG CHILD RESIDENTS (AGES 1 TO 6 YEARS) - FUTURE SCENARIO
INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Ca*RR*ET*EF*ED)/(BW*AT)
Where: Ca = Cs * (1/PEF)

ILCR = CDI*CSFi
HQ = CDI/RfDi

Parameter	Description	Adult	Young Child	
CDI	Chronic daily intake (mg/kg/d)	CS	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	CS	
CSFi	Inhalation cancer slope factor (1/(mg/kg/d))	CS	CS	
HQ	Hazard quotient	CS	CS	
RfDi	Inhalation reference dose (mg/kg/d)	CS	CS	
Ca	Concentration of chemical in air as fugitive dusts (mg/m3)	CS	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	CS	
PEF	Particulate emission factor (m3/kg)	1.32E+09	1.32E+09	
RR	Respiration rate (m3/hr)	0.83	0.83	
ET	Exposure time (hrs/d)	24	24	
EF	Exposure Frequency (d/yr)	350	350	
ED	Exposure Duration (yrs)	4	4	
BW	Body weight (kg)	70	15	
ATc	Averaging time, carcinogens (d)	25550	25550	
ATn	Averaging time, noncarcinogens (d)	1460	1460	

					Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	Cs (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Benz(a)anthracene	2.4	1.82E-09	NA	NA	2.84E-11	--	--	4.96E-10	--	--	1.32E-10	--	--	2.32E-09	--	--
Benzo(a)pyrene	1.8	1.36E-09	3.1	NA	2.13E-11	6.59E-11	3.4%	3.72E-10	--	--	9.92E-11	3.08E-10	3.4%	1.74E-09	--	--
Benzo(b)fluoranthene	4.3	3.26E-09	.NA	NA	5.08E-11	--	--	8.89E-10	--	--	2.37E-10	--	--	4.15E-09	--	--
Dibenzo(a,h)anthracene	0.18	1.36E-10	NA	NA	2.13E-12	--	--	3.72E-11	--	--	9.92E-12	--	--	1.74E-10	--	--
4,4'-DDE	22	1.67E-08	NA	NA	2.60E-10	--	--	4.55E-09	--	--	1.21E-09	--	--	2.12E-08	--	--
4,4'-DDD	18	1.36E-08	NA	NA	2.13E-10	--	--	3.72E-09	--	--	9.92E-10	--	--	1.74E-08	--	--
4,4'-DDT	14	1.06E-08	0.34	NA	1.65E-10	5.62E-11	2.9%	2.89E-09	--	--	7.72E-10	2.62E-10	2.9%	1.35E-08	--	--
Total HxCDD (2378-TCDD TEC)	0.000076	5.76E-14	4,500	NA	8.98E-16	4.04E-12	0.2%	1.57E-14	--	--	4.19E-15	1.89E-11	0.2%	7.33E-14	--	--
Total HxCDF (2378-TCDD TEC)	0.000026	1.97E-14	15,000	NA	3.07E-16	4.61E-12	0.2%	5.37E-15	--	--	1.43E-15	2.15E-11	0.2%	2.51E-14	--	--
Arsenic	10.0	7.58E-09	15.1	NA	1.18E-10	1.78E-09	93.2%	2.07E-09	--	--	5.51E-10	8.32E-09	93.2%	9.65E-09	--	--
					Total ILCR:	1.91E-09		Total HI:	0.0E+00		Total ILCR:	8.93E-09		Total HI:	0	

SPREADSHEET 9
MILITARY ADULT AND YOUNG CHILD RESIDENTS (AGES 1 TO 6 YEARS) - FUTURE SCENARIO
ACCIDENTAL INGESTION OF GROUNDWATER CONSIDERING BENEFICIAL-USE SCENARIO - SWMU 06 / AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Cw*IR*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Description	Adult	Young Child	
CDI	Chronic daily intake (mg/kg/d)	CS	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	CS	
HQ	Hazard quotient	CS	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	CS	
Cw	Concentration of chemical in water (mg/L)	CS	CS	
IR	Ingestion Rate (L/d)	0.05	0.05	
EF	Exposure Frequency (d/yr)	350	350	
ED	Exposure Duration (yrs)	4	4	
BW	Body weight (kg)	70	15	
ATc	Averaging time, carcinogens (d)	25550	25550	
ATn	Averaging time, noncarcinogens (d)	1460	1460	

				Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Dissolved Barium	0.45	NA	0.07	1.76E-05	--	--	3.08E-04	0.004	100.0%	8.22E-05	--	--	1.44E-03	0.021	100.0%
Dissolved Lead	0.0175	NA	NA	6.85E-07	--	--	1.20E-05	--	--	3.20E-06	--	--	5.59E-05	--	--
				Total ILCR:	0.0E+00	0.0%	HI:	0.004	100.0%	Total ILCR:	0.0E+00	0.0%	HI:	0.021	100.0%

NOTES:
NA - Toxicity criterion not available.
-- Not applicable.

SPREADSHEET 10
MILITARY ADULT AND YOUNG CHILD RESIDENTS (AGES 1 TO 6 YEARS) - FUTURE SCENARIO
DERMAL CONTACT WITH GROUNDWATER DURING BENEFICIAL-USE SCENARIO SWMU 06 / AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

DAD (mg/kg/d)= (Cw*CF*Kp*SA*EF*ED*ET)/(BW*AT)

ILCR = CDI*CSFo Adj CSF Adj = CSF/AD
HQ = CDI/RfDo Adj RfD Adj = RfD*AD

Parameter	Description	Adult	Young Child	
DAD	Dermally absorbed dose (mg/kg/d)	CS	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	CS	
HQ	Hazard quotient	CS	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	CS	
SA	Skin surface area available for contact (cm2)	5300	2006	
ET	Exposure frequency (d/yr)	350	350	
ED	Exposure duration (yrs)	4	4	
ET	Exposure time (hrs/day)	0.2	0.2	
BW	Body weight (kg)	70	15	
ATc	Averaging time, carcinogens (d)	25550	25550	
ATn	Averaging time, noncarcinogens (d)	1460	1460	
Cw	Concentration of chemical in water (mg/L)	CS	CS	
CF	Conversion factor (L/cm3)	0.001	0.001	
Kp	Dermal permeability coefficient (cm/hour)	CS	CS	
AD	Adjustment for Absorbed Dose	CS	CS	

								Adult						Young Child					
								Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
Parameter	Cw (mg/L)	Kp (cm/hour)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	AD (unitless)	Adj CSFo 1/(mg/kg/d)	Adj RfDo (mg/kg/d)	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Dissolved Barium	0.45	0.001	NA	0.07	1	NA	0.07	3.73E-07	--	--	6.53E-06	0.0001	100.0%	6.60E-07	--	--	1.15E-05	0.0002	100.0%
Dissolved Lead	0.0175	0.001	NA	NA	NA	NA	NA	1.45E-08	--	--	2.54E-07	--	--	2.56E-08	--	--	4.49E-07	--	--
								Total ILCR:	0.0E+00		HI:	0.0001		Total ILCR:	0.0E+00		HI:	0.0002	

NOTES:
NA - Toxicity criterion not available.
-- Not applicable.

SPREADSHEET 11
FUTURE ADULT CONSTRUCTION WORKER
ACCIDENTAL INGESTION OF SUBSURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

CDI (mg/kg/d)= (Cs*IR*CF*FI*EF*ED)/(BW*AT)
ILCR = CDI*CSFo
HQ = CDI/RfDo

Parameter	Description	Adult	
CDI	Chronic daily intake (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	
IR	Ingestion Rate (mg/d)	480	
CF	Conversion factor (kg/mg)	0.000001	
FI	Fraction of soil ingested from site	0.5	
EF	Exposure Frequency (d/yr)	180	
ED	Exposure Duration (yrs)	1	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	365	

				Adult Worker					
				Carcinogens			Noncarcinogens		
	Cs	CSFo	RfDo	CDI		% Contrib.	CDI		% Contrib.
Parameter	(mg/kg)	1/(mg/kg/d)	(mg/kg/d)	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI
4,4'-DDE	2.6	0.34	NA	6.28E-08	2.14E-08	21.1%	4.40E-06	--	--
4,4'-DDD	9.8	0.24	NA	2.37E-07	5.68E-08	56.2%	1.66E-05	--	--
4,4'-DDT	2.8	0.34	0.0005	6.76E-08	2.30E-08	22.7%	4.73E-06	0.01	100.0%
				Total ILCR:	1.01E-07		Total HI:	0.01	

SPREADSHEET 12
FUTURE ADULT CONSTRUCTION WORKER
DERMAL CONTACT WITH SUBSURFACE SOIL IN SWMU 6/AOC B
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

DAD (mg/kg/d)= (Cs*CF*AF*ABS*A*EF*ED)/(BW*AT)
ILCR = CDI*CSFd
HQ = CDI/RfDd

Parameter	Description	Adult	
DAD	Dermally absorbed dose (mg/kg/d)	CS	(Chemical Specific)
ILCR	Incremental lifetime cancer risk	CS	
CSFo	Oral cancer slope factor (1/(mg/kg/d))	CS	
HQ	Hazard quotient	CS	
RfDo	Oral reference dose (mg/kg/d)	CS	
Cs	Concentration of chemical in soil (mg/kg)	CS	
CF	Conversion factor (kg/mg)	0.000001	
AF	Soil to skin adherence factor (mg/cm2-event)	1	
ABS	Absorption fraction	CS	
A	Skin surface area available for contact (cm2)	5300	
EF	Exposure Frequency (d/yr)	180	
ED	Exposure Duration (yrs)	1	
BW	Body weight (kg)	70	
ATc	Averaging time, carcinogens (d)	25550	
ATn	Averaging time, noncarcinogens (d)	365	

					Adult Worker					
					Carcinogens			Noncarcinogens		
	Cs		CSFd	RfDd	DAD		% Contrib.	DAD		% Contrib.
Parameter	(mg/kg)	ABS	1/(mg/kg/d)	(mg/kg/d)	(mg/kg/d)	ILCR	Total ILCR	(mg/kg/d)	HQ	HI
4,4'-DDE	2.6	0.1	0.34	NA	1.39E-07	4.72E-08	17.6%	9.71E-06	--	--
4,4'-DDD	9.8	0.1	0.3	NA	5.23E-07	1.57E-07	58.6%	3.66E-05	--	--
4,4'-DDT	2.8	0.1	0.425	0.0004	1.49E-07	6.35E-08	23.7%	1.05E-05	0.03	100.0%
					Total ILCR:	2.67E-07		Total HI:	0.03	