

Proposed Plan

Areas of Concern J and R and Solid Waste Management Unit 7

Vieques, Puerto Rico



June 2011

1 Introduction

This **Proposed Plan** identifies the rationale and preferred alternative for **Areas of Concern (AOCs) J and R** and **Solid Waste Management Unit (SWMU) 7**, located at the Former Naval Ammunition Support Detachment (NASD), Vieques, Puerto Rico. The Proposed Plan summarizes the site histories, the results of previous environmental investigations and removal actions, and the preferred alternative, and provides the public an opportunity to review and comment on the Proposed Plan. AOC J, the Former Operations/Staging Area Disposal Site, was used as a solid waste disposal site associated with construction staging activities from the mid-1960s to 1973. AOC R, the Former Operations/Staging Area, was a former construction staging area and public works operational area where carpentry and light vehicle maintenance activities were conducted from 1965 to 1971. SWMU 7, the Former Quebrada Disposal Site, was used as a former disposal site for construction debris from the mid-1960s to the late 1970s.

This document is issued by the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic Division, and the **U.S. Environmental Protection Agency (USEPA) Region 2**, in consultation with the **Puerto Rico Environmental Quality Board**

(EQB), **U.S. Fish and Wildlife Service (USFWS)**, and the **Municipality of Vieques (MOV)**. The Proposed Plan fulfills the public participation requirements in Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)** and in Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.

The **preferred alternative** for each site is **no further action (NFA)**, based on current site conditions, future anticipated land and resource uses, and the results of environmental investigations and debris/contaminated soil removal actions that occurred at all three sites. The Navy and USEPA, in consultation with PREQB and USFWS, will make the final decision on the NFA alternative for AOCs J and R and SWMU 7 after reviewing and considering all information submitted during the 45-day public comment period. Therefore, it is important to the remedy selection process that the public provide input on all alternatives and on the rationale for the Preferred Alternative. If warranted based on public comments and/or new information, consideration of an alternate remedy may result in a modification to the Preferred Alternative. Therefore, public comment on this Proposed Plan is invited and encouraged.

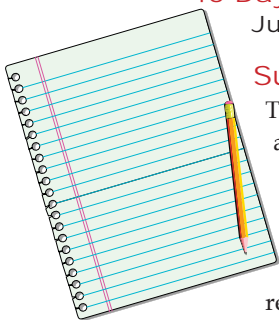
Mark Your Calendar for the Public Comment Period

45-Day Public Comment Period

June 20 - August 3, 2011

Submit Written Comments

The Navy and USEPA will accept written comments on the Proposed Plan during the 45-day public comment period. To submit comments or obtain further information, please refer to page 24.

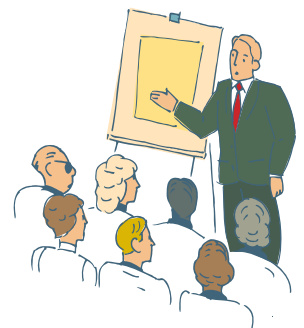


Attend the Public Meeting

Thursday July 7, 2011 at 5:00 pm

Jorge's Ice House
Carr. 200, Km 3, hm 2
Barrio Martineau, Vieques, PR

The Navy will hold a public meeting to explain the rationale for the proposed no further action alternative. Verbal and written comments will also be accepted at this meeting.



Location of Information Repository

Biblioteca Electronica

Benítez Guzmán Street, Corner with Baldorioty de Castro Street
Isabel Segunda
Vieques, PR 00765
(787) 741-2114
Hours of Operation: Monday - Friday, 8:00 a.m. - 4:00 p.m.

This Proposed Plan summarizes information that can be found in greater detail in the **Remedial Investigation (RI)** Report (May 2007) and Post-Removal-Action Risk Assessment Report (February 2011) for AOC J, the RI Report for AOC R (January 2011), and the RI Report (March 2008) and Post-Removal-Action Risk Assessment Report for SWMU 7 (February 2011), and other documents contained in the **Administrative Record** for Vieques. A glossary of key terms used in this document is attached; these key terms are identified in bold print the first time they appear in the text.

2 Site Description, Summary of Previous Investigations and Removal Actions, Site Characteristics, and Site Risks

Vieques is located in the Caribbean Sea approximately 7 miles southeast of the eastern tip of the island of Puerto Rico (**Figure 1**). Vieques is the largest offshore island of the Commonwealth of Puerto Rico. It is approximately 20 miles long and 4.5 miles wide, and has an area of approximately 33,088 acres (51 square miles).

The Navy purchased large portions of Vieques in the early 1940s to conduct activities related to military training. Site operations within the Former NASD consisted mainly of ammunition loading and storage, vehicle and facility maintenance, and some training. The Navy ceased facility-wide operations on the Former NASD on April 30, 2001, in accordance with Presidential Directive to the



Figure 1 - Regional Location Map

Secretary of Defense of January 30, 2000, when the land was transferred to the **Department of Interior (DOI)**, MOV, and the Puerto Rico Conservation Trust (**Figure 2**).

On February 11, 2005, the Atlantic Fleet Weapons Training Area - Vieques (FFA-CERCLA-02-2007-2001) was placed on the **National Priorities List (NPL)**, which required all subsequent environmental restoration activities for Navy Installation Restoration (IR) sites on Vieques to be conducted under CERCLA. On September 7, 2007, the Navy, DOI, USEPA, and PREQB executed a Federal Facility Agreement (FFA) that establishes the procedural framework and schedule for implementing the CERCLA response actions for Vieques. Although the DOI is directed to protect and conserve the transferred land as a wildlife refuge, the Navy retains the responsibility for conducting environmental investigations and cleanup of the property, as warranted.

The FFA identified seven sites within the Former NASD to be investigated. AOCs J and R and SWMU 7 (**Figure 2**) are the subject of this Proposed Plan. Descriptions of each of these sites are presented in Sections 2.1 through 2.3.

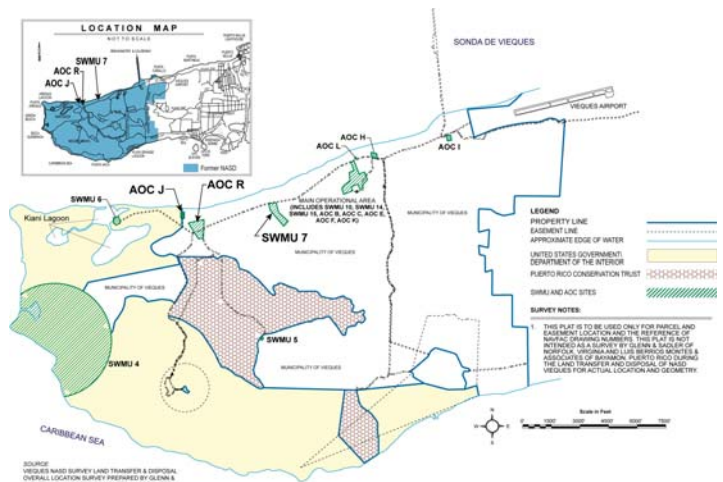


Figure 2 - AOCs J and R and SWMU 7 Location Map

2.1 Area of Concern J – Former Operations/ Staging Area Disposal Site

Environmental Baseline Survey (2000)

AOC J is approximately 1.2 acres located north of Highway 200 on the Former NASD (**Figure 3**). The site was used as a solid waste disposal area for construction staging activities from 1965 until 1973. Debris material included scrap metal from construction equipment, glass fragments, wood, one empty drum, and shell casings. An **ephemeral stream** is located adjacent to the site. The site is located on property owned by the DOI that has been designated as a wildlife refuge.

In preparation for transfer of portions of the Former NASD to the DOI, a subjective boundary was surveyed and defined as the “Remedial Land Use Restriction”

boundary within AOC J. As set forth in the Environmental Summary Document, DOI agreed that use and access to the area defined by the Remedial Land Use Restriction boundary shall be limited until CERCLA-related activities are completed.

2.1.2 Summary of Previous Investigations and Removal Actions

Previous environmental investigations and a removal action have been conducted at AOC J, beginning in 2000. The following subsections briefly summarize the purpose and scope of investigations completed to date.

Environmental Baseline Survey (2000)

An environmental baseline survey (EBS) was conducted in 2000 to disclose relevant information regarding the environmental condition of the site prior to property transfer of the former NASD (Environmental Resources Management [ERM], 2000). Two subsurface soil samples were collected adjacent to a debris pile and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganic constituents. No constituents exceeded regulatory screening criteria.

Expanded Preliminary Assessment/Site Inspection (2000)

An expanded preliminary assessment and site inspection (PA/SI) was conducted in 2000 to determine if there

had been a contaminant release at the site (CH2M HILL, 2000). Soil, **groundwater**, surface water, and sediment samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and inorganic constituents. The results found that inorganic constituent concentrations (aluminum, arsenic, barium, cadmium, copper, iron, lead, manganese, mercury, and/or vanadium) exceeded regulatory screening criteria in soil, groundwater, and surface water.

An additional investigation was recommended to further characterize the nature and extent of contamination and assess potential risks to human health and the environment.

Background Investigation (2000)

A **background** study was conducted in 2000 for the western portion of Vieques to develop a set of background values for inorganic constituents in the soil to help distinguish inorganic concentrations that occur naturally in environmental **media** from those that may be present as a result of a site-related release (CH2M HILL, 2002). The background data were collected specifically from the western portion of Vieques to represent soil types similar to those where environmental sites are located in the Former NASD. The background inorganic constituent concentrations were used for comparison with soil inorganic constituent concentrations collected during the environmental investigations at AOC J.

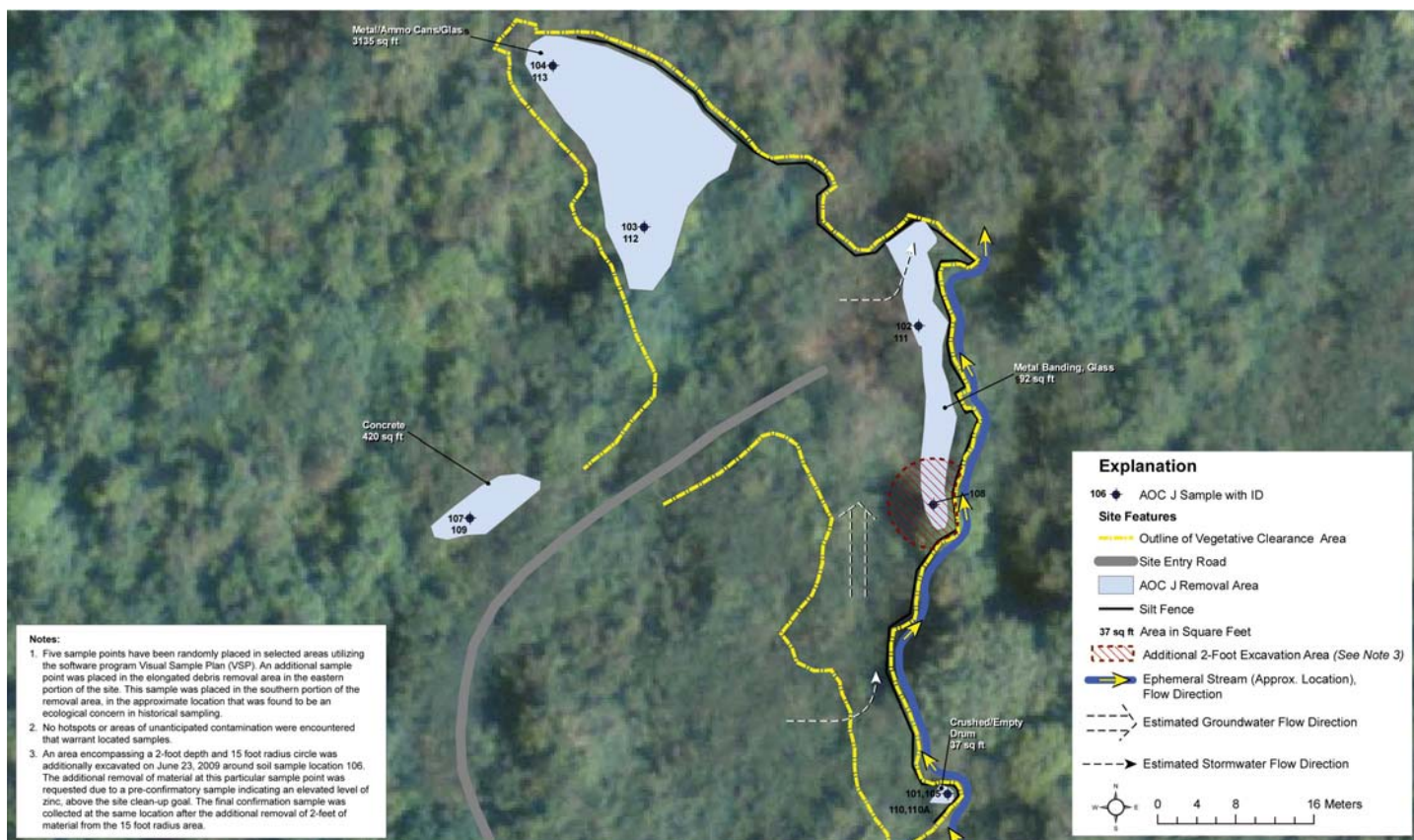


Figure 3 - AOC J Aerial Photograph

Remedial Investigation (2003-2007)

The RI (CH2M HILL, 2007) field activities were conducted from June to October 2003 to assess the nature and extent of contamination and potential environmental and human health risks associated with exposure to contaminant concentrations in site media. Geophysical surveys were conducted to delineate the extent of debris. Soil, groundwater, surface water, and sediment samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and inorganic constituents. The RI Report concluded that although the data suggested that there were no unacceptable risks to human health or the environment posed by contaminant levels identified at the site, there was uncertainty in the conclusion because samples were collected primarily adjacent to debris piles rather than directly through the debris piles (due to safety concerns). Further, there was uncertainty whether the debris represented a potential future source of contaminant release. Therefore, a removal action was recommended for AOC J.

Removal Action (2009)

Based on the recommendations of the RI, an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) was prepared (CH2M HILL, 2005). The EE/CA recommended excavation and off-site disposal of the debris for AOC J. To ensure the residual soil concentrations at the site would be acceptable for unrestricted use and exposure following the removal action, it was determined that not only would the debris be removed, but any soil potentially posing unacceptable human health or ecological risks would also be removed. Based on this objective, pre-removal soil characterization was performed, as described in the Removal Action Work Plan (Shaw, 2007).

The data collected were used to characterize the soil for proper disposal and to determine the extent of soil requiring removal (via pre-removal risk assessments) to allow for unrestricted use of the site after completion of the removal actions. In 2008, pre-removal human health and ecological risk assessments were conducted for AOC J using the data generated from the pre-removal soil characterization and relevant historical investigations (CH2M HILL, 2008b and 2008c). This information was used, in conjunction with visual observation of the extent of waste, to guide the removal action, which was completed in 2009. The details of the removal action, including the quantities of waste and soil removed from the site, are provided in the removal action Completion Report (Shaw, 2010).

Approximately 366 tons of soil and debris were excavated and removed from AOC J. Upon completion of the removal action, confirmatory soil samples were collected for the purpose of performing post-removal human health and ecological risk assessments, which are documented

in the Post-Removal-Action Risk Assessment Report (CH2M HILL, 2011). The removal action eliminated both the potential future sources of contamination (i.e., debris) and soil containing contaminant concentrations posing potentially unacceptable risks for unrestricted use and exposure. No unacceptable risks for any potential receptors were identified based on post-removal conditions at AOC J. As a result, no further remedial action is necessary for unrestricted land use. Following the removal action, a site visit with members of the Restoration Advisory Board (RAB) and general public was conducted to present the post-removal site conditions.

2.1.3 Site Characteristics

Physical Characteristics

AOC J is relatively flat in a wooded area and slopes from approximately 10 feet above mean sea level (msl) to sea level. An ephemeral stream located adjacent to the site drains north to the Vieques Passage. Surface water occurs within the ephemeral stream during periods of heavy and prolonged rainfall or ocean surge action.

Groundwater at AOC J is within alluvial deposits of clay and sandy clay at depths ranging from 5 to 11 feet below ground surface (ft bgs). Groundwater flows generally to the north toward the Vieques Passage, with some localized groundwater flow to the east and northeast toward the ephemeral stream. Groundwater beneath the site is classified by the Commonwealth of Puerto Rico as SG, where groundwater may be intended for use as a source of drinking water supply, agricultural use, and/or flows into waters that support ecological communities of exceptional ecological value.

The site is within a designated wildlife refuge where the future land use will remain the same. Groundwater is currently not used as a potable water source at or in the vicinity of AOC J, and there are no plans for potable use of groundwater in this area. Groundwater beneath AOC J is generally brackish to saline due to sea water intrusion based on site-specific salinity measurements collected from monitoring wells during the RI. No archeological or cultural resources are located within AOC J.

Nature and Extent of Contamination

Groundwater, surface water, and sediment data collected during the Expanded PA/SI and RI and soil data collected during the confirmatory sampling following the removal action provide the primary basis for the evaluation of the nature and extent of contaminated soil, surface water, sediment, and groundwater at the site. Constituents detected above screening criteria and background concentrations (for inorganics) are summarized in **Table 1**.

Table 1 - Soil, Groundwater, Surface Water, and Sediment Exceedances for AOC J

Environmental Media	Screening Criteria					Ecological Criteria
	COPC	Maximum Concentration Detected Above Screening Criteria and Background	West Vieques Background Value (Qa)	West Vieques Background Value (Qa)	May 2010 RSL for Industrial Soil	
Soil	Semivolatile Organic Compounds (mg/k)					
	Benzo(a)pyrene	0.0234J	—	0.015	0.21	—
	Total Inorganics (mg/kg)					
	Aluminum	13,000J	29,000	7,700	99,000	--
	Arsenic	0.66	2.2	0.39	1.6	18
	Chromium	7.3J	74	0.29	5.6	64
	Cobalt	8.1J	33	2.3	30	13
	Copper	24.1J	68	310	4,100	70
	Iron	25,400J	39,000	5,500	72,000	--
	Manganese	831	1,200	180	2,300	220
Vanadium	50.7J	130	39	520	130	
Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			NDW07MW08 Background	2002 PRG for Tap Water, Adjusted	Maximum Contaminant Level	2010 Puerto Rico Water Quality Standards, Class SG
Groundwater	Dissolved Inorganics (ug/L)					
	Arsenic	37.4	2.04 UJ	0.045	10	10
	Barium	580	344	255	2,000	--
	Cadmium	5.18	0.485J	1.82	5	5
	Chromium	13.3	0.696J	11	100	100
	Iron	6,180	801	1,090	--	--
	Manganese	26,000	24,400	87.6	--	--
	Lead	20.7	2J	15	15	15
	Selenium	41.3	9.55	18.2	50	50
	Thallium	43.1	2.54J	0.241	2	0.24
	Total Inorganics (ug/L)					
	Aluminum	72,000	116J	3,650	--	--
	Arsenic	54.6	10.2UJ	0.0448	10	10
	Barium	770	348	255	2,000	--
	Cadmium	3.9	1.78U	1.82	5	5
	Chromium	43	2.9J	11	100	100
	Iron	68,000	83.5U	1,090	--	--
	Manganese	27,000	24,300	87.6	--	--
	Lead	38.2	8.8U	15	15	15
	Selenium	86.7	10.5U	18.2	50	50
Vanadium	330	2.24U	25.5	--	--	
Organic Compounds (ug/L)						
Acetone	114	--	60.8	--	--	
Bromodichloromethane	1	--	0.181	--	--	
Chloroform	8.5	--	0.617	--	--	
Trichloroethylene (TCE)	10.1	--	0.028	5	--	
bis(2-Ethylhexyl) phthalate	6.5	--	4.8	--	--	
Perchlorate	48	--	0.365	--	--	
Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			NDAJSD08 Background	2002 PRG for Tap Water, Adjusted	Marine Ecological Screening Criteria	
Surface Water	Total Inorganics (ug/L)					
	Beryllium	2.25	1.89U	7.3	0.53	
	Barium	385	321	255	--	
Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			NDAJSD08 Background	2002 PRG for Residential Soil	2002 PRG for Industrial Soil	Marine Ecological Screening Criteria
Sediment	Total Inorganics (mg/kg)					
	Barium	77	6.76J	540	6,700	20
	Organic Compounds (mg/kg)					
	p,p'-DDT	0.0043	NA	1.7	7	0.0033

Four VOCs (acetone, bromodichloromethane, chloroform, and trichloroethene [TCE]) were detected above risk-based screening criteria in groundwater. Acetone, bromodichloromethane, and chloroform were identified as likely laboratory contaminants and not site-related. TCE was not detected in the subsequent sampling event in the one sample location previously detected. No VOCs were detected in soil, surface water or sediment above risk-based screening criteria.

One SVOC (benzo(a)pyrene) was detected above a risk-based screening criterion in only one surface soil sample (CH2M HILL, 2007). No SVOCs were detected in groundwater, surface water, or sediment above risk-based screening criteria.

The explosive perchlorate was detected above a risk-based screening criterion in one groundwater sample. However, the initial analytical detection method was prone to false positive detections. Perchlorate was not detected during the subsequent sampling event. No explosives were detected in soil, surface water, or sediment.

The pesticide dichlorodiphenyltrichloroethane (DDT) was detected slightly above the ecological risk-based screening criterion in one sediment sample. However, pesticides were also detected in upstream background samples at similar concentrations and, therefore, were not likely site-related. No pesticides were detected in soil, groundwater, or surface water above risk-based screening criteria. No PCBs were detected above risk-based screening criteria in environmental media at the site (CH2M HILL, 2007).

Inorganic constituents detected above background concentrations and screening criteria in environmental media include aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, selenium, and vanadium (Table 1). Inorganic concentrations detected in groundwater were associated with background and/or the result of high turbidity (over 10 nephelometric turbidity unit [NTU]) and suspended solids during sampling, geochemical conditions, and sea water intrusion (CH2M HILL, 2007).

2.1.4 Summary of Site Risks

A summary of the **human health risk assessment (HHRA)** and **ecological risk assessment (ERA)** conducted for AOC J during the RI (groundwater, surface water, and sediment) and Post-Removal-Action Risk Assessment (soil) are included in the following subsections and shown in **Table 2**. The RI and Post-Removal-Action Risk Assessment reports provide more detailed analysis and evaluation, and are available in the Administrative Record File.

Human Health Risk Assessment

Several HHRA were conducted for AOC J. The HHRA conducted during the RI included all site media; the HHRA conducted just prior to and after the removal actions focused on soil, because this was the only medium identified in the RI Report as warranting an action. The HHRA were conducted to evaluate potential human health risks associated with exposure to soil, groundwater, surface water, and sediment at AOC J and to confirm that post-removal site conditions at AOC J are protective of potential human receptors. Health risks are based on a health-protective estimate of the potential carcinogenic risk and the potential non-cancer hazard, which is expressed as a hazard index (HI). Exposure scenarios evaluated for site media included recreational users/trespassers (adult, youth [6-16 years old], and child [16 years old]), hypothetical future residents (adult and child), future maintenance workers, future industrial workers, and future construction workers. Conservative exposure pathways evaluated, as appropriate, include ingestion, dermal contact, and inhalation of chemicals in soil and groundwater, and ingestion and dermal contact of chemicals in surface water and sediment. It is important to note that some of these exposure scenarios are not likely to occur, but are assumed in the risk assessment process as a health-protective measure to ensure that appropriate decisions are made with respect to the need for remediation.

No **chemicals of concern (COCs)** were identified for soil, sediment, and surface water exposure at AOC J. Both carcinogenic and noncarcinogenic risks were identified for a future industrial worker from exposure to groundwater (primarily from arsenic and manganese), and noncarcinogenic risks were identified for future adult and child residents from exposure to groundwater (primarily from aluminum, arsenic, iron, manganese, vanadium, and/or perchlorate). However, elevated concentrations of the inorganic constituents were determined to be related to background conditions, due to suspended solids from high turbidity during sampling, sea water intrusion, and reducing conditions of the aquifer. In addition, total inorganic constituent concentrations detected in groundwater were used for risk assessment purposes. Dissolved concentrations were much lower, indicating the presence of total constituent concentrations is likely the result of suspended particulates in groundwater typical of the naturally high turbidity conditions. Groundwater at AOC J is not suitable for potable use without filtration and desalination due to its naturally high turbidity and salinity, and the site is located on property mandated by law to remain a wildlife refuge. The wildlife refuge is managed and operated by the United States Fish & Wildlife Service. Therefore, future use of groundwater is unlikely. Further, no COCs were identified for groundwater.

Table 2 - AOC J Risk Assessment Results

Media	Human Health Risk				
	Future Maintenance Worker	Future Industrial Worker	Future Construction Worker	Current/Future Recreational User/ Trespasser	Future Residential
Soil	ELCR = no COPCs and HI = 1×10^{-6} Acceptable	ELCR = no COPCs and HI = 5×10^{-6} Acceptable	ELCR = no COPCs and HI = 2×10^{-5} Acceptable	Adult: ELCR = 2×10^{-7} and HI = 0.04 Youth: ELCR = 2×10^{-7} and HI = 0.07 Child: ELCR = 9×10^{-7} and HI = 0.4 Acceptable	Adult: HI = 0.2 Child: HI = 1 Adult/Child: ELCR = 4×10^{-6} Acceptable
Groundwater	No Exposure Pathway	ELCR = 3×10^{-4} and HI = 25 Acceptable*	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 8×10^{-4} and HI = 69 Child: ELCR = 5×10^{-4} and HI = 160 Acceptable*
Surface Water	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 3×10^{-7} and HI = 0.27 Youth: ELCR = 2×10^{-7} and HI = 0.4 Child: ELCR = 6×10^{-7} and HI = 0.35 Acceptable	No Exposure Pathway
Sediment	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 6×10^{-8} and HI = 0.11 Youth: ELCR = 3×10^{-8} and HI = 0.14 Child: ELCR = 8×10^{-8} and HI = 0.29 Acceptable	No Exposure Pathway

*Inorganic constituents contributed to potential unacceptable risks, but are attributable to background and not site related. Perchlorate was a false detection.

Media	Ecological Risk
	All Receptors
Soil	Acceptable
Groundwater	No Exposure Pathway
Surface Water	Acceptable
Sediment	Acceptable

Ecological Risk Assessment

Similar to the HHRAs, ERAs were conducted during the RI and just prior to and following the removal action. The ERAs were conducted to determine if potential risks to ecological receptors were present that warranted additional assessment or action and to confirm the post-removal site conditions at AOC J are protective of environmental receptors. A screening ecological risk assessment (SERA), constituting Steps 1 and 2 of the ERA process, and the first step (Step 3A) of a baseline ecological risk assessment (BERA) were conducted for AOC J. The screening problem formulation for the ERA includes the selection of ecological endpoints and risk hypotheses,

and the toxicological properties and fate and transport behavior of the chemicals present at AOC J, which are based upon the preliminary conceptual site model. An assessment endpoint is an expression of the environmental component or value that is to be protected. The site is heavily vegetated and provides suitable terrestrial habitat for plant, invertebrate, reptile, bird, and mammal communities. The ephemeral stream is vegetation-lined and likely supports benthic invertebrates and fish, at least periodically. Based on the ecological setting, no unacceptable risks were identified for ecological receptors from exposure to environmental media at AOC J.

What is Human Health Risk and How is it Calculated?

A Human Health Risk Assessment (HHRA) estimates the likelihood of health problems occurring if no cleanup action were taken at a site. This is also referred to as “baseline risk”. HHRAs are conducted using a step-wise process (as outlined in Navy and USEPA HHRA policy and guidance). To estimate baseline risk at a site, the Navy performs the following four-step process:

Step 1: Data Collection and Evaluation

Step 2: Exposure Assessment

Step 3: Toxicity Assessment

Step 4: Risk Characterization

During Data Collection and Evaluation (**Step 1**), the concentrations of chemicals detected at a site are evaluated, including:

- Identifying and evaluating area(s) where site-related chemicals may be found (source areas) and at what concentrations.
- Evaluating potential movement (transport) of chemicals in the environment.
- Comparing site concentrations to risk-based screening levels to determine which chemicals may pose the greatest threat to human health (called “chemicals of potential concern” [COPCs]). The USEPA Region 9 Preliminary Remediation Goals (PRGs) for residential soil and tap water are used to identify COPCs for a site.

In **Step 2**, the Exposure Assessment, potential exposures to the COPCs identified in Step 1 are evaluated. This step includes:

- Identifying possible exposure media (soil, air, groundwater, surface water, sediment).
- Evaluating if/how people may be exposed (exposure pathways).
- Evaluating routes of exposure (for example, ingestion).
- Identifying the concentrations of COPCs to which people might be exposed.
- Identifying the potential frequency and length of exposure.
- Calculating a “reasonable maximum exposure” (RME) dose that portrays the highest level of human exposure that could reasonably be expected to occur.

In the Toxicity Assessment (**Step 3**), both cancer and non-cancer toxicity values are identified for oral, dermal, and inhalation exposures to the COPCs. The toxicity values are identified using the hierarchy of toxicity value sources approved by USEPA.

Step 4 is Risk Characterization, where the information developed in Steps 1-3 is used to estimate potential risk to people. The following approach is used:

- Two types of risk are considered: cancer risk and non-carcinogenic risk.
- The likelihood of developing cancer as a result of site exposure is expressed as an upper-bound probability; for example, a “1 in 10,000 chance.” In other words, for every 10,000 people that might be exposed under the conditions identified in Step 2, one additional case of cancer may occur as a result of site exposure. An additional cancer case indicates one more person than the number that may develop cancer without site exposure.
- For non-cancer health effects, a “hazard index” (HI) is calculated. The HI represents the ratio between the “reference dose”, which is the dose at which no adverse health effects are expected to occur, and the RME dose for a person contacting COPCs at the site. The key concept here is that a “threshold level” (measured as a HI of 1) exists below which no non-cancer health effects are expected to occur.
- The potential risks from the individual COPCs and exposure pathways are summed and a total site risk is calculated for each receptor.
- The risk estimates are evaluated to determine if they are high enough to cause health problems for people at or near the site.

The uncertainties associated with the risk estimates are presented and their effects on the conclusions of the HHRA are discussed.

What is Ecological Risk and How is it Calculated?

An ecological risk assessment (ERA) is conceptually similar to a human health risk assessment except that it evaluates the potential risks and impacts to ecological receptors (plants, animals other than humans and domesticated species, habitats [such as wetlands], and communities [groups of interacting plant and animal species]). ERAs are conducted using a tiered, step-wise process (as outlined in Navy and USEPA ERA policy and/or guidance) and are punctuated with Scientific Management Decision Points (SMDPs). SMDPs represent points in the ERA process where agreement among stakeholders on conclusions, actions, or methodologies is needed so that the ERA process can continue (or terminate) in a technically defensible manner. The results of the ERA at a particular SMDP are used to determine how the ERA process should proceed, for example, to the next step in the process or directly to a later step. The process continues until a final decision has been reached (i.e., remedial action if unacceptable risks are identified, or no further action if risks are acceptable). The process can also be iterative if data needs are identified at any step; the needed data are collected and the process starts again at the point appropriate to the type of data collected.

An ERA has three principal components:

1. Problem Formulation establishes the goals, scope, and focus of the ERA and includes:

- Compiling and reviewing existing information on the habitats, plants, and animals that are present on or near the site.
- Identifying and evaluating area(s) where site-related chemicals may be found (source areas) and at what concentrations.
- Evaluating potential movement (transport) of chemicals in the environment.
- Identifying possible exposure media (soil, air, water, sediment).
- Evaluating if/how the plants and animals may be exposed (exposure pathways).
- Evaluating routes of exposure (for example, ingestion).
- Identifying specific receptors (plants and animals) that could be exposed.
- Specifying how the risk will be measured (assessment and measurement endpoints) for all complete exposure pathways.

2. Risk Analysis which includes:

- Exposure Estimate - An estimate of potential exposures (concentrations of chemicals in applicable media) to plants and animals (receptors). This includes direct exposures of chemicals in site media (such as soil) to lower trophic level receptors (organisms low on the food chain such as plants and insects) and upper trophic level receptors (organisms higher on the food chain such as birds and mammals). This also includes the estimated chemical dose to upper trophic level receptors via consumption of chemicals accumulated in lower food chain organisms.
- Effects Assessment - The concentrations of chemicals at which an adverse effect may occur are determined.

3. Risk Calculation or Characterization:

- The information developed in the first two steps is used to estimate the potential risk to plants and/or animals by comparing the exposure estimates with the effects thresholds.
- Also included is an evaluation of the uncertainties (potential degree of error) that are associated with the predicted risk estimate and their effects on the conclusions that have been made.

The three principal components of an ERA are implemented within the framework of an 8-step, 3-tiered process as follows:

1. **Screening Level ERA (Steps 1-2; Tier 1)** – The Screening Level ERA (SLERA) conducts an assessment of ecological risk using the three steps described above and very conservative assumptions (such as using maximum chemical concentrations).
2. **Baseline ERA (Steps 3-7; Tier 2)** – If potential risks are identified in the SLERA, a Baseline ERA (BERA) is typically conducted. The BERA is a reiteration of the three steps described above but uses more site-specific and realistic exposure assumptions, as well as additional methods not included in the SLERA, such as consideration of background concentrations. The BERA may also include the collection of site-specific data (such as measuring the concentrations of chemicals in the tissues of organisms, such as fish) to address key risk issues identified in the SLERA.
3. **Risk Management (Step 8; Tier 3)** – Step 8 develops recommendations on ways to address any unacceptable ecological risks that are identified in the BERA and may also include other activities such as evaluating remedial alternatives.

2.2 Area of Concern R – Former Operations/ Staging Area

2.2.1 Site Description and History

AOC R comprises approximately 12 acres located north of Highway 200 on the Former NASD (Figure 4). The site was used as a construction staging area and public

works operational area from approximately 1965 to 1971. In the late 1960s, a carpentry shop and an enlisted club were located on a rectangular pad within the site. Light vehicle maintenance activities, such as oil changes, were conducted just northwest of the pad. An aboveground storage tank (AST) was once located at the site. The large concrete pad was present before the Navy owned the

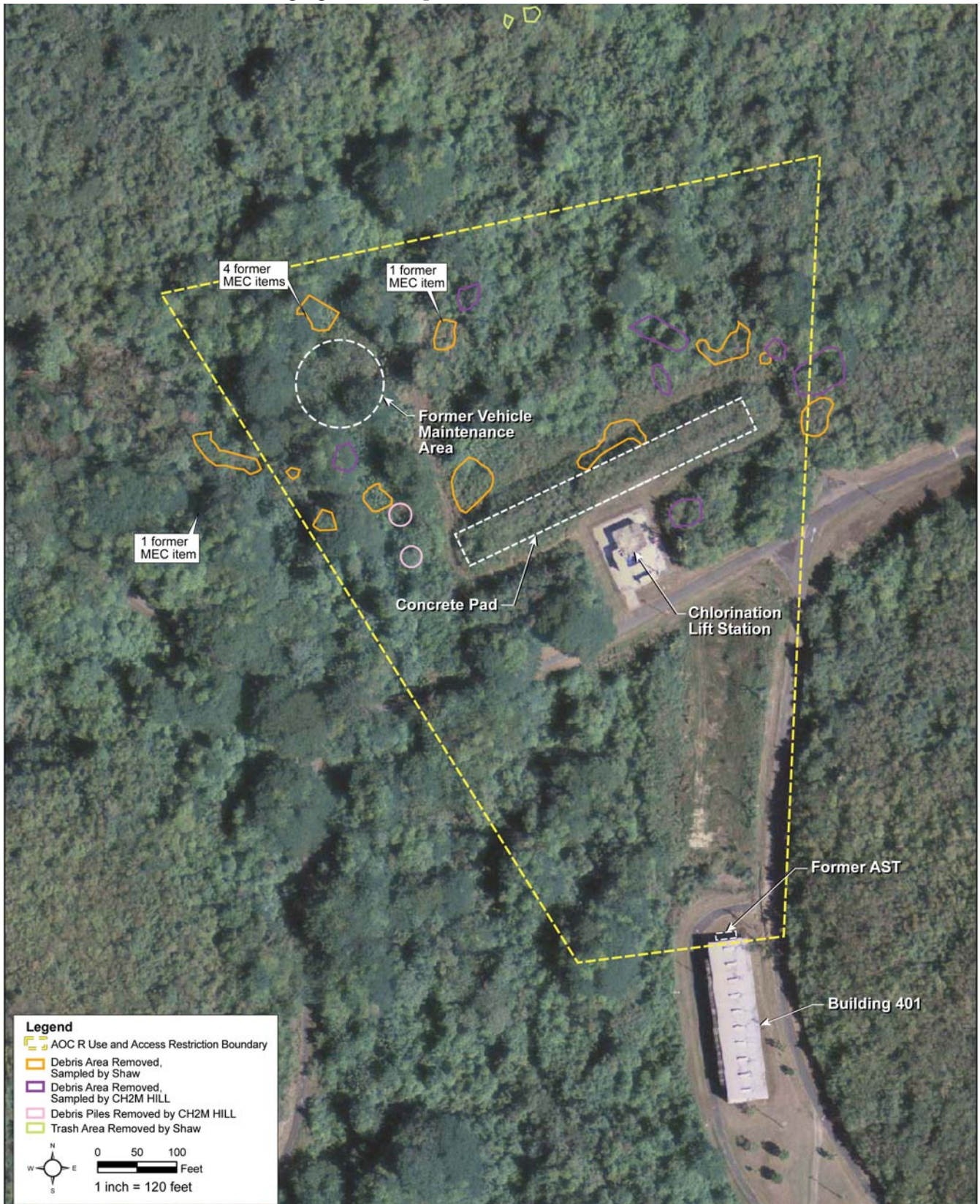


Figure 4 - AOC R Aerial Photograph

area and use during that time is unknown. Inert munitions and explosives of concern (MEC) items at three locations, as well as several debris piles, were identified within AOC R.

A typically dry ephemeral stream is located immediately adjacent to the western portion of the site. The stream drains to the Vieques Passage when flooded during rain events. A potable water lift/chlorination building constructed and operated by the Puerto Rico Aqueduct and Sewer Authority (PRASA) also exists at the site. PRASA's potable water lift/chlorination building is not associated with Navy activities and was not investigated as part of AOC R.

The Navy ceased military operations in April 2001 and transferred the land containing AOC R to the MOV. In preparation for transfer of portions of the Former NASD to the MOV, a subjective boundary was surveyed and defined as the "Remedial Land Use Restriction" boundary within AOC R. As set forth in the Quitclaim Deed, the MOV agreed that use and access to the area defined by the Remedial Land Use Restriction boundary shall be limited to non-residential until CERCLA-related activities are completed.

2.2.2 Summary of Previous Investigations and Removal Actions

Previous environmental investigations and a removal action have been conducted at AOC R, beginning in 2000. The following subsections briefly summarize the purpose and scope of investigations completed to date.

Environmental Baseline Survey (2000)

An EBS was conducted in 2000 to disclose relevant information regarding the environmental condition of the site prior to property transfer of the Former NASD (ERM, 2000). A site visit, aerial photography analysis, and interviews with several employees of the Former NASD identified AOC R as a site recommended for an environmental investigation, based on the identification of a construction staging area, and that the area was used as a temporary public works and motor vehicle maintenance area from approximately 1965 to 1971. However, visual observations of the area did not identify any obvious contamination.

Expanded Preliminary Assessment/Site Investigation (2000)

Based on the recommendation of the EBS, a PA/SI was conducted in 2000 to determine if there had been a contaminant release at the site (CH2M HILL, 2000). Soil samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs, and inorganic constituents. The results found that inorganic constituent concentrations (arsenic, chromium, iron, lead, and vanadium) and SVOCs (primarily polycyclic aromatic hydrocarbons [PAHs])

exceeded regulatory screening concentrations within surface soil. An additional investigation was recommended to further characterize the nature and extent of contamination and assess potential risks to human health and the environment.

Background Investigation (2000)

A background study was conducted in 2000 for the western portion of Vieques to develop a set of background values for inorganic constituents to help distinguish inorganic concentrations that occur naturally in environmental media from those that may be present as a result of a site-related release (CH2M HILL, 2002). The background data were collected specifically from the western portion of Vieques to represent soil types similar to those where environmental sites are located in the former NASD. The background inorganic constituent concentrations were used for comparison with soil inorganic constituent concentrations collected during the environmental investigations at AOC R.

Removal Action (2009)

An EE/CA for a NTCRA was prepared (CH2M HILL, 2005). The EE/CA recommended excavation and off-site disposal of the debris for AOC R. To ensure the residual soil concentrations at the site would be acceptable for unrestricted use and exposure following the removal action, it was determined that not only would the debris be removed, but any soil potentially posing unacceptable human health or ecological risks would also be removed. Based on this objective, pre-removal soil characterization was performed, as described in the Removal Action Work Plan (Shaw, 2007).

The data collected were used to characterize the soil in the debris removal areas for proper disposal and to determine the extent of soil requiring removal (via pre-removal risk assessments). In 2008, pre-removal human health and ecological risk assessments were conducted for AOC R using the data generated from the pre-removal soil characterization (CH2M HILL, 2008c). In addition, data collected during the concurrent RI were used to determine the extent of soil requiring excavation. This information was used, in conjunction with visual observation of the extent of waste, to guide the removal action, which was completed in 2009. The details of the removal action, including the quantities of waste and soil removed from the site, are provided in the removal action Completion Report (Shaw, 2010).

Approximately 3,952 tons of excavated soil and debris were removed. The debris piles consisted of railroad ties, metal pipes, wood power poles, tires, corrugated roofing sheet material, other miscellaneous metal debris, and inert munitions-related items. The removal action eliminated potential future sources of contamination and areas of soil potentially posing unacceptable risks. Following

the excavation, confirmation soil samples at each excavated area were collected. These data were used in conjunction with other data collected during the concurrent RI to assess potential human health and ecological risks at the site, as discussed below. Following the removal action, a site visit with members of the RAB and general public was conducted to present the post-removal site conditions.

Remedial Investigation (2004 - 2009)

RI activities were initiated in August 2004, but upon discovery of munitions-related items, the field work was postponed until an Explosive Safety Submission (ESS) was submitted and resolved. The RI field activities were then conducted from December 2005 to March 2006, followed by supplemental investigations in June and August 2009, to assess the nature and extent of contamination and potential environmental and human health risks associated with exposure to contaminant concentrations in site media. The debris and soil removal action was conducted in 2009, prior to the implementation of the supplemental investigations.

In addition to the confirmatory samples collected in the debris and soil removal areas, soil samples were collected to characterize the nature and extent of contamination on a site-wide basis and potential human health and ecological risks. Groundwater, surface water, and sediment samples were also collected. Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and inorganic constituents.

The RI Report concluded there are no unacceptable human health and ecological risks associated with exposure to environmental media at AOC R. Therefore, no additional remedial actions are necessary for unrestricted land use.

2.2.3 Site Characteristics

Physical Characteristics

AOC R is relatively flat with a slight slope to the north and northwest toward the coastline of the Vieques Passage. The site is vegetated with thorn shrubs and coastal forest. A typically dry ephemeral stream is located immediately adjacent to the western portion of the site that drains to the Vieques Passage when flooded during rain events.

Groundwater at AOC R is within sands of the alluvium at depths ranging from 18 to 31 feet bgs. Groundwater flows north to northwest-ward toward the coastline at an estimated velocity of approximately 15 ft/year. Groundwater beneath the site is classified by the Commonwealth of Puerto Rico as SG, where groundwater may be intended for use as a source of drinking water supply, agricultural use, and/or flows into waters that support ecological communities of exceptional ecological value.

Public access to the site is currently restricted. There has been no evidence of public access to the site except for access to the potable water lift/chlorination building. Groundwater is currently not used as a potable water source at or in the vicinity of AOC R. The results of the HHRA indicate no unacceptable risks from site-related constituents associated with potable use of groundwater. No archeological sites and cultural resources are located at AOC R.

Nature and Extent of Contamination

Analytical data collected during the Expanded PA/SI, RI and supplemental investigations, and removal action confirmatory sampling provide the primary basis for the evaluation of the nature and extent of contamination in soil, surface water, sediment, and groundwater at the site. Constituents detected above screening criteria and background concentrations (for inorganics) are summarized in **Table 3**.

The VOCs methylene chloride (in soil) and chloroform (in surface water) exceeded screening criteria at AOC R; however, these chemicals are not likely site-related constituents. Methylene chloride is identified as a likely common laboratory contaminant and chloroform is a common byproduct of potable water chlorination and is likely the result of discharge from the potable water lift/chlorination station to the ephemeral stream. No VOCs were detected in groundwater or sediment above risk-based screening criteria.

Nine SVOCs were detected above regulatory screening criteria in soil at AOC R, most of which were PAHs at concentrations much lower than pre-removal concentrations. Benzo(a)pyrene was the most frequently observed PAH above a screening criterion. No PAHs were observed in groundwater, sediment, and surface water. Carbazole, 4-nitroaniline, and 2,4-DNT were only observed above the **Site-specific Soil Screening Levels (SSL)**; however, they were not observed in groundwater. Only bis(2-ethylhexyl)phthalate and 4-nitrophenol were observed above screening criteria in groundwater; however, bis(2-ethylhexyl)phthalate is identified as a likely common laboratory contaminant and not likely a site-related contaminant. Atrazine was likely used as a herbicide to control weeds and 4-nitrophenol was likely used as a fungicide; therefore, their occurrences at AOC R are attributable to normal pesticide application and not the result of a spill or from improper storage, disposal, or use.

Inorganic constituents detected above background concentrations and screening criteria in environmental media include aluminum, antimony, arsenic, barium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, vanadium, and zinc (**Table 3**). Copper exceeded screening criteria primarily in soil samples in the area of the concrete pad, but was below screening criteria in

Table 3 - Soil, Groundwater, Surface Water, and Sediment Exceedances for AOC R

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			West Vieques Background Value (Qa)	May 2010 RSL for Residential Soil	May 2010 RSL for Industrial Soil	Ecological Criteria
Soil	Semivolatile Organic Compounds (mg/kg)					
	benzo(a)anthracene	1.83	--	0.15	2.1	--
	benzo(a)pyrene	0.75	--	0.015	0.21	--
	benzo(b)fluoranthene	1.46	--	0.15	2.1	--
	dibenzo(a,h)anthracene	0.163 J	--	0.015	0.21	--
	indeno(1,2,3-cd)pyrene	0.51	--	0.15	2.1	--
	Total Inorganics (mg/kg)					
	Aluminum	34,400	29,000	7,700	99,000	--
	Arsenic	9.8	2.2	0.39	1.6	18
	Chromium	106J	74	0.29	5.6	64
Cobalt	27.8	33	2.3	30	13	
Iron	40,000	39,000	5,500	72,000	--	
Manganese	4,500	1,200	180	2,300	220	
Vanadium	143J	130	39	520	130	
Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			MW01 Background	May 2010 RSL for Tap Water, Adjusted	Maximum Contaminant Level	Puerto Rico Water Quality Standards, Class SG
Groundwater	Dissolved Inorganics (ug/L)					
	Arsenic	1.9J	--	0.045	10	10
	Cobalt	3.2	--	1.1	--	--
	Iron	3,930	--	2,600	--	--
	Manganese	1,980	--	88	--	--
	Vanadium	62	--	18	--	--
	Total Inorganics (ug/L)					
	Aluminum	5,860	--	3,700	--	--
	Arsenic	2.6J	--	0.045	10	10
	Chromium	23	--	0.043	100	100
Cobalt	3.3	--	1.1	--	--	
Iron	14,300	--	2,600	--	--	
Manganese	2,090	--	88	--	--	
Vanadium	61	--	18	--	--	
Organic Compounds (ug/L)						
4-Nitrophenol	0.39J	--	0.12	--	--	
bis(2-Ethylhexyl) Phthalate	62J	--	4.8	6.0	12	
Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			NDAJSW08 Background	May 2010 RSL for Tap Water, Adjusted	Fresh Water Ecological Criteria	
Surface Water	Dissolved Inorganics (ug/L)					
	Arsenic	4.7J	--	0.045	150	
	Barium	289	--	730	4	
	Cobalt	3.8J	--	1.1	23	
	Manganese	2,230	--	88	120	
	Total Inorganics (ug/L)					
	Arsenic	3.3J	--	0.045	150	
Barium	314	--	730	4		
Cobalt	4.8J	--	1.1	23		
Iron	1,190	--	2,600	1,000		
Manganese	2,390	--	88	120		
Organic Compounds (ug/L)						
Chloroform	3.0J	--	0.19	1,500		

Table 3 - Soil, Groundwater, Surface Water, and Sediment Exceedances for AOC R

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			West Vieques Background Value (Qa)	May 2010 RSL Residential Soil	May 2010 RSL for Industrial Soil	Fresh Water Ecological Criteria
Sediment	Total Inorganics (mg/kg)					
	Barium	95J	--	1,500	19,00	20
	Chromium	2.4	--	0.29	5.6	43
	Cobalt	7.0	--	2.3	30	50
	Iron	7,430	--	5,500	72,000	20,000
	Manganese	731J	--	180	2,300	460

all other environmental media. All other inorganic constituents were generally slightly above background levels and are likely associated with background. Although aluminum, iron, and manganese can be associated with the metal debris formerly present at the site, these inorganics are also commonly associated with the chemical weathering of volcanic rocks and can be highly variable due to the occurrence of aluminum rich clays and iron and manganese oxides.

No PCBs were observed above screening criteria in the environmental media at AOC R. Perchlorate was the only explosive constituent observed in soil and groundwater at the site, but all concentrations were below regulatory screening criteria. No explosives were detected in surface water or sediment.

2.2.4 Summary of Site Risks

A summary of the HHRA and ERA conducted for AOC R during the RI is included in the following subsections and in **Table 4**. The RI report provides a more detailed analysis and evaluation, which is available in the Administrative Record File.

Human Health Risk Assessment

The RI HHRA was conducted to evaluate potential human health risks associated with exposure to soil, groundwater, surface water, and sediment at AOC R and to confirm the post-removal site conditions at AOC R are protective of potential human receptors. Health risks are based on a health-protective estimate of the potential carcinogenic risk and the potential non-cancer hazard, which is expressed as a HI. Exposure scenarios evaluated for site media included recreational users/trespassers (adult, youth, and child), hypothetical future residents (adult and child), future maintenance workers, future industrial workers, and future construction workers. Conservative exposure pathways evaluated, as appropriate, include ingestion, dermal contact, and inhalation of chemicals in soil; ingestion and dermal contact of chemicals in groundwater, surface water, sediment, and inhalation exposures to bathroom air from tap water.

Only the future hypothetical child resident exceeded a risk threshold from exposure to groundwater due to aluminum, iron, and manganese. However, these inorganic constituents were not identified as COCs because they are naturally-occurring and were determined to be attributable the chemical weathering of volcanic rocks (i.e., background). Aluminum and iron were a result of higher turbidity and suspended solids, aluminum was not detected in the subsequent round of sampling, and site manganese concentrations were less than the background sample. No other COCs were identified for human receptors based on soil, surface water, or groundwater exposure scenarios at AOC R.

Ecological Risk Assessment

The RI ERA was conducted to determine if potential risks to ecological receptors were present that warranted additional assessment or action and to confirm the post-removal site conditions at AOC R are protective of environmental receptors. A screening ecological risk assessment (SERA), constituting Steps 1 and 2 of the ERA process, and the first step (Step 3A) of a baseline ecological risk assessment (BERA) were conducted for AOC R. The screening problem formulation for the ERA includes the selection of ecological endpoints and risk hypotheses, and the toxicological properties and fate and transport behavior of the chemicals present at AOC R, which are based upon the preliminary conceptual site model. An assessment endpoint is an expression of the environmental component or value that is to be protected.

The site is heavily vegetated and provides suitable terrestrial habitat for plant, invertebrate, reptile, bird, and mammal communities. The adjacent ephemeral stream provides limited exposure pathways to invertebrate and plant aquatic communities because it is often dry. No unacceptable risks to directly exposed plants and animals and other wildlife potentially feeding on those plants and animals were identified.

Table 4 - AOC R Risk Assessment Results

Media	Human Health Risk				
	Future Maintenance Worker	Future Industrial Worker	Future Construction Worker	Current/Future Recreational User/Trespasser	Future Residential
Soil	ELCR = 3×10^{-7} and HI = 4×10^{-3} Acceptable	ELCR = 1×10^{-6} and HI = 0.02 Acceptable	ELCR = 1×10^{-7} and HI = 0.6 Acceptable	Adult: ELCR = 8×10^{-7} and HI = 0.05 Youth: ELCR = 1×10^{-6} and HI = 0.09 Child: ELCR = 5×10^{-6} and HI = 0.4 Acceptable	Adult: ELCR = 2×10^{-5} and HI = 0.2 Child: ELCR = 2×10^{-5} and HI = 1.5 Acceptable*
Groundwater	No Exposure Pathway	ELCR = 2×10^{-5} and HI = 0.77 Acceptable	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 1×10^{-4} and HI = 2.6 Child: ELCR = 1×10^{-4} and HI = 7.1 Acceptable*
Surface Water	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 2×10^{-6} and HI = 0.2 Youth = ELCR = 2×10^{-6} and HI = 0.3 Child = ELCR = 5×10^{-6} and HI = 0.7 Acceptable	No Exposure Pathway
Sediment	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 8×10^{-7} and HI = 0.05 Youth: ELCR = 1×10^{-6} and HI = 0.09 Child: ELCR = 5×10^{-6} and HI = 0.4 Acceptable	No Exposure Pathway

*Inorganic constituents contributed to potential unacceptable risks, but are attributable to background and not site related.

Media	Ecological Risk
	All Receptors
Soil	Acceptable
Groundwater	No Exposure Pathway
Surface Water	Acceptable
Sediment	Acceptable

2.3 Solid Waste Management Unit 7 – Former Quebrada Disposal Site

2.3.1 Site Description and History

SWMU 7 comprises approximately 10 acres located south of Highway 200 on the Former NASD (Figure 5). The site was used as a disposal area for debris such as tires, sheet metal, empty containers (e.g., drums, cans, and bottles), used batteries, and construction rubble from between the early 1960s and late 1970s. An ephemeral stream with surface water present only during rainstorms runs adjacent to the site. The Navy ceased military operations in April 2001 and transferred the land containing SWMU 7 to the MOV. No activity at SWMU 7 has been reported since the late 1970s as the site became overgrown and not readily accessible. In preparation for transfer of portions

of the Former NASD to the MOV, a subjective boundary was surveyed and defined as the “Remedial Land Use Restriction” boundary within SWMU 7. As set forth in the Quitclaim Deed, the MOV agreed that use and access to the area defined by the Remedial Land Use Restriction boundary shall be limited to non-residential until CER-CLA-related activities are completed.

2.3.2 Summary of Previous Investigations and Removal Actions

Previous environmental investigations and a removal action have been conducted at SWMU 7, beginning in 1983. The following subsections briefly summarize the purpose and scope of investigations completed to date.

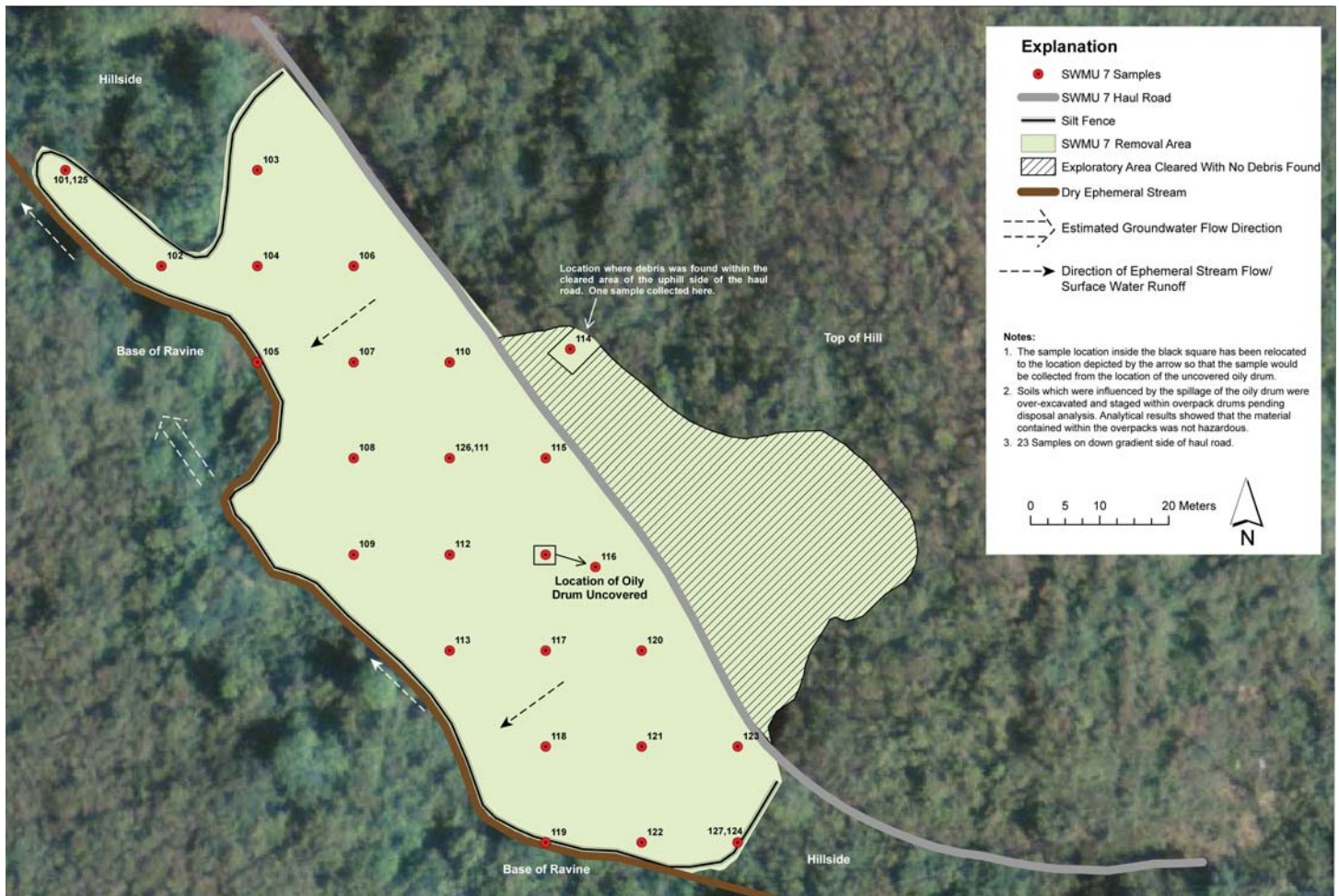


Figure 5 - SWMU 7 Aerial Photograph

Confirmation Study (1983)

A confirmation study was conducted at SWMU 7 to determine where specific toxic or hazardous materials contaminated the environment. Soil, groundwater, and sediment samples were collected. The study found that cadmium, chromium, and nickel exceeded regulatory screening criteria in groundwater.

Environmental Baseline Survey (2000)

An EBS was conducted in 2000 to disclose relevant information regarding the environmental condition of the site prior to property transfer of the Former NASD (ERM, 2000). A site visit, aerial photography analysis, and interviews with employees of the Former NASD identified SWMU 7 as a site recommended for an environmental investigation, based on the identification of miscellaneous solid waste along the ephemeral stream.

Phase I Preliminary Assessment/Site Inspection (2000)

A PA/SI was conducted in 2000 to determine if there had been a contaminant release at the site (CH2M HILL, 2000). Soil, groundwater, and sediment samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explo-

sives, and inorganic constituents. The results found that the SVOC benzo(a)pyrene and inorganic constituent concentrations (aluminum, arsenic, chromium, copper, iron, lead, manganese, thallium, and vanadium) exceeded regulatory screening concentrations within soil, and inorganic constituents (aluminum, antimony, arsenic, iron, manganese, vanadium, and zinc) exceeded screening criteria within groundwater. Inorganic constituents exceeding screening criteria in sediment were determined to be attributable to background. An additional investigation was recommended to further characterize the nature and extent of contamination and assess potential risks to human health and the environment.

Background Investigation (2000)

A background study was conducted in 2000 for the western portion of Vieques to develop a set of background values for inorganic constituents to help distinguish inorganic concentrations that occur naturally in environmental media from those that may be present as a result of a site-related release (CH2M HILL, 2002). The background data were collected specifically from the western portion of Vieques to represent soil types similar to those where

environmental sites are located in the Former NASD. The background inorganic constituent concentrations were used for comparison with soil inorganic constituent concentrations collected during the environmental investigations at SWMU 7.

Remedial Investigation (2003-2008)

The RI field activities were conducted in 2003 to assess the nature and extent of contamination and potential environmental and human health risks associated with exposure to contaminant concentrations in site media. Geophysical surveys were conducted to delineate the extent of debris, and soil and groundwater samples were collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, and inorganic constituents. The RI Report concluded that although the data suggested that there were no unacceptable risks to human health or the environment posed by contaminant levels identified at the site, there was uncertainty in the conclusion because samples were collected primarily adjacent to debris piles rather than directly through the debris piles (due to safety concerns). Further, there was uncertainty where the debris represented a potential future source of contaminant release. Therefore, a removal action was recommended for SWMU 7.

Removal Action (2009)

Based on the recommendations of the RI, an EE/CA for a NTCRA was prepared (CH2M HILL, 2005). The EE/CA recommended excavation and off-site disposal of the debris for SWMU 7. To ensure the residual soil concentrations at the site would be acceptable for unrestricted use and exposure following the removal action, it was determined that not only would the debris be removed, but any soil potentially posing unacceptable human health or ecological risks would also be removed. Based on this objective, pre-removal soil characterization was performed, as described in the Removal Action Work Plan (Shaw, 2007).

The data collected were used to characterize the soil for proper disposal and to determine the extent of soil requiring removal (via pre-removal risk assessments) to allow for unrestricted use of the site after completion of the removal actions. In 2008, pre-removal human health and ecological risk assessments were conducted for SWMU 7 using the data generated from the pre-removal soil characterization and relevant historical investigations (CH2M HILL, 2008b and 2008c). This information was used, in conjunction with visual observation of the extent of waste, to guide the removal action, which was completed in 2009. The details of the removal action, including the quantities of waste and soil removed from the site, are provided in the removal action Completion Report (Shaw, 2010).

Approximately 5,366 tons of soil and debris were excavated and removed from SWMU 7. Upon completion

of the removal action, confirmatory soil samples were collected for the purpose of performing post-removal human health and ecological risk assessments, which are documented in the Post-Removal-Action Risk Assessment Report (CH2M HILL, 2011). The removal action eliminated both the potential future sources of contamination (i.e., debris) and soil containing contaminant concentrations posing potentially unacceptable risks for unrestricted use and exposure. No unacceptable risks for any potential receptors were identified based on post-removal conditions at SWMU 7. As a result, no further remedial action is necessary for unrestricted land use. Following the removal action, a site visit with members of the RAB and general public was conducted to present the post-removal site conditions.

2.3.3 Site Characteristics

Physical Characteristics

SWMU 7 is heavily vegetated and characterized by a gently sloping hill, but with very steep embankments along an ephemeral stream. The ground elevation ranges from approximately 105 to 25 feet above msl. The ephemeral stream runs north toward the Vieques Passage and surface water is only present during rainstorms. Therefore, any sediment samples collected at SWMU 7 were characterized as soil.

Groundwater at SWMU 7 is within alluvial deposits made up of silty sands and within weathered granodiorite (sapolite). Groundwater depths range from approximately 33 to 72 feet bgs. Groundwater flows northwest toward the coastline. Groundwater beneath the site is classified by the Commonwealth of Puerto Rico as SG, where groundwater may be intended for use as a source of drinking water supply, agricultural use, and/or flows into waters that support ecological communities of exceptional ecological value.

Public access to the site is currently restricted. There has been no evidence of public access to the site. Groundwater is currently not used as a potable water source at or in the vicinity of SWMU 7, and there are no plans for potable use of groundwater in this area. No archeological sites and cultural resources are located at SWMU 7.

Nature and Extent of Contamination

Groundwater data collected during the Expanded PA/SI and RI and soil data collected during the confirmatory sampling following the removal action provide the primary basis for the evaluation of the nature and extent of contamination at the site. Constituents detected above screening criteria and background concentrations (for inorganics) are summarized in **Table 5**. No VOCs, pesticides, or explosives concentrations exceeded regulatory screening criteria in soil or groundwater. Four SVOCs (benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene,

thene, and dibenzo[a,h]-anthracene) only exceeded regulatory screening criteria in soil. Seven inorganic constituents (aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium) in soil and six inorganic constituents (aluminum, antimony, arsenic, manganese, vanadium, and zinc) in groundwater exceeded background concentrations and regulatory screening criteria.

2.3.4 Summary of Site Risks

A summary of the HHRA and ERA conducted for SWMU 7 during the RI (groundwater) and Post-Removal-Action Risk Assessment (soil) are included in the following subsections and shown in **Table 6**. The RI and Post-Removal-Action Risk Assessment reports provide a more detailed analysis and evaluation, and are available in the Administrative Record File.

Human Health Risk Assessment

Several HHRA were conducted for SWMU 7. The HHRA conducted during the RI included all site media; the HHRA conducted just prior to and after the removal actions included soil, because this was the only medium identified in the RI Report as warranting an action. The HHRA were conducted to evaluate potential human health risks associated with exposure to soil and groundwater at SWMU 7 and confirm the post-removal site conditions at SWMU 7 are protective of potential human receptors. Health risks are based on a health-protective estimate of the potential carcinogenic risk and the potential non-cancer hazard, which is expressed as a HI. Exposure scenarios evaluated for site media included recreational users/trespassers (adult, youth, and child), hypo-

Table 5 - Soil and Groundwater Exceedances for SWMU 7

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			West Vieques Background Value (KTd)	May 2010 RSL for Residential Soil	May 2010 RSL for Industrial Soil	Ecological Criteria
Soil	Semivolatile Organic Compounds (mg/kg)					
	Benzo(a)anthracene	0.164J	--	0.15	2.1	NA
	Benzo(a)pyrene	0.102	--	0.015	0.21	0.1
	Benzo(b)fluoranthene	0.319	--	0.15	2.1	NA
	Dibenz(a,h)anthracene	0.0174J	--	0.015	0.21	NA
	Total Inorganics (mg/kg)					
	Aluminum	33,900	18,000	7,700	99,000	50
	Arsenic	3.6	1.2	0.39	1.6	10
	Chromium	93.3J	52	0.29	5.6	0.4
	Cobalt	29.3J	13	2.3	30	20
Iron	53,700	28,000	5,500	72,000	200	
Manganese	1,690	1,200	180	2,300	100	
Vanadium	174	80	39	520	2	
Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Screening Criteria			
			NDW07MW08 Background	2002 PRG for Tap Water, Adjusted	Maximum Contaminant Level	2010 Puerto Rico Water Quality Standards, Class SG
Groundwater	Dissolved Inorganics (ug/L)					
	Aluminum	53.1	61.3	365	--	--
	Arsenic	8.4	2.04UJ	0.045	10	10
	Manganese	1,670	21.7	87.6	--	--
	Lead	1.7	1.76UJ	15	15	15
	Vanadium	59.8	8.67	25.5	--	--
	Zinc	20.7	0.492	1,090	--	--
	Total Inorganics (ug/L)					
	Aluminum	4,090	102	3,650	--	--
	Antimony	1.5	2.5U	1.46	6	5.6
	Arsenic	37.1	2.04UJ	0.0448	10	10
	Chromium	29.4	13.6	11	100	100
	Manganese	1,740	23.4	87.6	--	--
Lead	25.1	1.76UJ	15	15	15	
Vanadium	58	8.64	25.5	--	--	
Zinc	2,950	2.67	1,090	--	--	
Organic Compounds (ug/L)						
Perchlorate	2.4	--	0.365	--	--	

Table 6 - SWMU 7 Risk Assessment Results

Media	Human Health Risk				
	Future Maintenance Worker	Future Industrial Worker	Future Construction Worker	Current/Future Recreational User/ Trespasser	Future Residential
Soil	ELCR = 3×10^{-7} and HI = 1.6×10^{-3} Acceptable	ELCR = 1×10^{-6} and HI = 7.9×10^{-3} Acceptable	ELCR = 2×10^{-7} and HI = 0.03 Acceptable	Adult: ELCR = 7×10^{-7} and HI = 0.09 Youth: ELCR = 7×10^{-7} and HI = 0.2 Child: ELCR = 2×10^{-6} and HI = 0.8 Acceptable	Adult: ELCR = 1×10^{-5} and HI = 0.3 Child: ELCR = 1×10^{-5} and HI = 3 Acceptable*
Groundwater	No Exposure Pathway	ELCR = 2×10^{-4} and HI = 4.3 Acceptable*	No Exposure Pathway	No Exposure Pathway	Adult: ELCR = 5×10^{-4} and HI = 10 Child: ELCR = 3×10^{-4} and HI = 25 Acceptable*
Surface Water	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway
Sediment	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway	No Exposure Pathway

*Inorganic constituents contributed to potential unacceptable risks, but are attributable to background and not site related.

Media	Ecological Risk
	All Receptors
Soil	Acceptable
Groundwater	No Exposure Pathway
Surface Water	No Exposure Pathway
Sediment	No Exposure Pathway

thetical future residents (adult and child), future maintenance workers, future industrial workers, and future construction workers. Conservative exposure pathways evaluated, as appropriate, include ingestion, dermal contact, and inhalation of chemicals in soil and groundwater.

No COCs were identified for soil exposure at SWMU 7. Both carcinogenic and noncarcinogenic risks were identified from groundwater exposure through potable use due to total arsenic, iron, and vanadium concentrations in groundwater. However, arsenic and iron were not elevated in the filtered sample, indicating that the detection in the unfiltered sample is likely due to suspended solids in groundwater. Vanadium concentrations were within background levels. Therefore, arsenic, iron, and vanadium were determined to be attributable to background.

Ecological Risk Assessment

Similar to the HHRAs, ERAs were conducted during the RI and just prior to and following the removal action. The ERAs were conducted to determine if potential risks to ecological receptors were present that warranted additional assessment or action and to confirm the post-removal site conditions at SWMU 7 are protective of environmental receptors. The screening problem formulation for the ERA includes the selection of ecological endpoints and risk hypotheses, and the toxicological properties and fate and transport behavior of the chemicals present at SWMU 7, which are based upon the preliminary conceptual site model. An assessment endpoint is an expression of the environmental component or value that is to be protected.

The site was cleared for the removal action, but has become re-vegetated, which provides suitable terrestrial habitat for plant, invertebrate, reptile, bird, and mammal communities. There are no permanent aquatic and wetland habitats within the ephemeral stream, since the stream only flows during rainstorms. No unacceptable risks were identified for ecological receptors from exposure to environmental media at SWMU 7.

3 Scope and Role of Response Action

In cooperation with USEPA, PREQB, and USFWS, and in accordance with the FFA and applicable guidance, the Navy performed investigations at AOCs J and R and SWMU 7 to evaluate the nature and extent of contamination associated with past releases of CERCLA-related contamination and to assess the potential risks to human health and the environment posed by that contamination. In addition, debris and soil containing contaminant concentrations above levels protective of unrestricted use and exposure were removed from the sites. The current conditions at AOCs J and R and SWMU 7 do not pose an unacceptable risk to human health and the environment (relative to background) for unrestricted and unlimited land use and site conditions are compliant with **applicable or relevant and appropriate requirements** (ARARs) and **to-be-considered** (TBC) criteria. However, current and future land use at AOC J is designated as wildlife refuge by law. The response action does not include or affect any sites at the facility under the CERCLA process other than AOCs J and R and SWMU 7.

4 Preferred Alternative

The Navy and USEPA, in consultation with PREQB, USFWS, and MOV, agree that the preferred alternative for AOCs J and R and SWMU 7 is no further action. The preferred alternative meets the statutory requirements of CERCLA for protection of human health and the environment. The environmental investigation findings, including human health and ecological risk assessments conducted during the RI and Post-Removal-Risk Assessments, conclude that there are no unacceptable risks associated with the site following the removal actions conducted. Therefore, no alternative other than the no further action alternative requires evaluation. Under this alternative, no additional response action will be performed at AOCs J and R and SWMU 7 and no restrictions on land use or exposure are necessary. The Navy and USEPA, in consultation with PREQB, USFWS (AOC J), and MOV (AOC R and SWMU 7), may reconsider no fur-

ther action as the preferred alternative or select another alternative upon completion of the **Record of Decision** (ROD), if additional data indicate that another alternative warrants consideration or selection.

5 Community Participation

A community relations program has been ongoing for the Vieques environmental restoration program since 2001. The community relations program fosters two-way communication of investigation and remediation activities between the stakeholder agencies (Navy, USEPA, PREQB, USFWS, and MOV) and the public. A RAB was formed in 2004 to provide for expanded community participation. Regular meetings are held to provide an information exchange among community members, stakeholder agencies, and the MOV. These meetings are open to the public and are held approximately every 3 months.

Public input is a key element in the decision-making process. Nearby residents and other interested parties are strongly encouraged to use the comment period to relay any questions and comments about the preferred alternative at AOCs J and R and SWMU 7. The Navy will summarize and respond to substantive comments in a Responsiveness Summary, which will become part of the official ROD for AOCs J and R and SWMU 7.

This Proposed Plan fulfills the public participation requirements of CERCLA Section 117(a), which specifies that the lead agency (the Navy) must publish a plan outlining any remedial alternatives evaluated for a site and identify the preferred alternative. All documentation pertaining to the investigations and removal actions at AOCs J and R and SWMU 7 and the development of the preferred alternative presented in this Proposed Plan is available for public review in the Administrative Record at the Information Repository.

The public comment period for the Proposed Plan provides an opportunity for input regarding the preferred alternative for AOCs J and R and SWMU 7. The public comment period will be from June 20 to August 3, 2011, and a public meeting will be held on July 7, 2011 at 5:00 PM at Jorge's Ice House, located on Carr. 200 Km 3, hm 2, in Barrio Martineau, Vieques, Puerto Rico. All interested parties are encouraged to attend the public meeting to learn more about the preferred alternative for AOCs J and R and SWMU 7. The meeting will provide an additional opportunity to submit comments on the Proposed Plan to the Navy.

Comments on the preferred alternative, or this Proposed Plan, must be postmarked no later than August 3, 2011. On the basis of comments or new information, the Navy

and USEPA, in consultation with PREQB, USFWS, and MOV, may modify the preferred alternative or choose another alternative. The comment page included as part of this Proposed Plan may be used to provide comments to the Navy.

After the public comment period, the Navy and USEPA, in consultation with PREQB, USFWS (AOC J), and MOV (AOC R and SWMU 7), will make a final decision for the three sites, based on this Proposed Plan and public comments submitted. If any substantial changes are made to the preferred alternative, additional public comments may be solicited. If no changes are warranted or the changes are not substantial, the Navy and USEPA will prepare a ROD, which will be signed by the Navy, USEPA, PREQB, USFWS (AOC J), and MOV (AOC R and SWMU 7).

The technical reports supporting the preferred alternative for AOCs J and R and SWMU 7 are available to the public in the Former NASD Administrative Record, which is located at:

Biblioteca Electronica

Benítez Guzmán Street, Corner with Baldorioty de Castro Street

Isabel Segunda

Vieques, PR 00765

(787) 741-2114

Hours of Operation:

Monday – Friday, 8:00 a.m. – 4:00 p.m.

Or online at: <http://public.lantops-ir.org/sites/public/vieques/default.aspx>

Questions or comments can be submitted to any of the individuals listed in the box below during the public comment period.

Note: This summary is presented in English and Spanish for the convenience of the reader. Every effort has been made for the translations to be as accurate as reasonably possible. However, readers should be aware that the English version of the text is the official version.

During the comment period, interested parties may submit written comments to the following address:

Kevin Cloe

Remedial Project Manager
NAVFAC Atlantic
(Attn: Code EV31KRC)
6506 Hampton Blvd.
Norfolk, VA 23508-1278
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787-767-8181 x. 6129
wilmarierivera@jca.pr.gov

Glossary

Administrative Record: A compilation of documents and information for CERCLA sites that is made available to the public for review.

Applicable or Relevant and Appropriate Requirements: these are federal or state/commonwealth environmental rules and regulations.

Background Concentration: Concentrations of naturally occurring and anthropogenic (due to mankind) constituents, such as inorganic constituents, found in groundwater, soil, sediment, and surface water at levels not influenced by site-specific releases. Background concentrations of some inorganics and other constituents are often at levels that may pose a risk to human health or the environment. However, background concentrations of site chemicals are factored into risk management determinations to ensure remedial actions are not implemented for constituents whose concentrations are attributable to background conditions and not indicative of a site-related release.

Cancer Risk: Cancer risks are expressed as a probability reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances at a particular site and exposure scenario, as described in the Human Health Risk Assessment.

Chemical of Concern (COC): A contaminant that contributes significant risk to an exposure pathway for a receptor.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A Federal law passed in 1980 (United States Code Title 42, Chapter 103), commonly referred to as the “Superfund” Program, that regulates and provides for cleanup and emergency response in connection with numerous existing, inactive hazardous waste disposal sites that endanger public health and safety or the environment. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986.

Department of Interior (DOI): Land owner of the National Wildlife Refuge and Wilderness Area.

Ecological Risk Assessment (ERA): An evaluation of the risk posed to ecological receptors (i.e., plants and animals) if remedial activities are not performed at the site.

Groundwater: The supply of freshwater beneath the Earth’s surface that occurs in the pore spaces between soil grains or within fractures in geologic formations that are fully saturated.

Human Health Risk Assessment (HHRA): A qualitative and quantitative evaluation of the risk posed to human health by the presence of specific pollutants. Elements include: identification of the hazardous substances present in the environmental media; assessment of exposure

and exposure pathways; assessment of the toxicity of the site’s hazardous substances; and characterization of human health risks.

Media (singular, Medium): Soil, groundwater, surface water or sediment at the site.

Municipality of Vieques: Property owner of Vieques.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The Federal regulations (Code of Federal Regulations [CFR], Volume 40, Page 300 [40 CFR 300]) that guide determination of the sites to be corrected under both the Superfund (CERCLA) program and the program to prevent or control spills into surface waters or elsewhere.

National Priorities List (NPL): A list developed by USEPA of uncontrolled hazardous substance release sites in the United States that are considered priorities for long-term remedial evaluation and response.

No Further Action (NFA): Cleanup actions are not necessary to be protective of human health and the environment.

Non-Cancer Risk: Non-cancer hazards (or risk) are expressed as a quotient that compares the potential exposure to contaminants at a particular site to the acceptable level of exposure. There is a level of exposure (the reference dose) below which it is unlikely for even a sensitive population to experience adverse health effects. USEPA’s threshold level for non-cancer risk at Superfund sites is 1, meaning that if the exposure at a particular site exceeds the threshold, there may be a concern for potential non-cancer effects.

Preferred Alternative: With respect to the nine criteria specified in the NCP for evaluating remedial alternatives, the Preferred Alternative is the proposed remedy that meets the threshold criteria and is deemed to provide the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria.

Proposed Plan: A document that presents the preferred remedial alternative and requests public input regarding its proposed selection.

Public Comment Period: The time allowed for the members of a potentially affected community to express views and concerns regarding an action proposed to be taken by USEPA, such as a rulemaking, permit, or Superfund-remedy selection.

Puerto Rico Environmental Quality Board (PREQB): The agency responsible for administration and enforcement of environmental regulations for Puerto Rico.

Receptors: Humans, animals, or plants that may be exposed to contaminants related to a given site.

Record of Decision (ROD): A legal document that describes the cleanup action or remedy selected for a site, the basis for choosing that remedy, and public comments that were considered regarding the selected remedy.

Remedial Action: A cleanup method proposed or selected to address contaminants at a site.

Remedial Investigation (RI): A study in support of the selection of a remedy at a site where hazardous substances have been released. The RI identifies the nature and extent of contamination and analyzes human health and ecological risk associated with the contamination.

To-Be-Considered Criteria: Non-promulgated, non-enforceable guidelines or criteria that may be useful for determining what is protective of human health and the environment.

United States Environmental Protection Agency (USEPA): The Federal agency responsible for administration and enforcement of CERCLA (and other Federal environmental statutes and regulations).

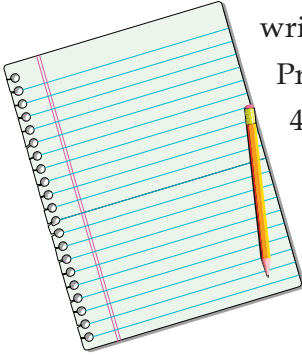
United States Fish and Wildlife Service (USFWS): The Federal agency responsible for the operation and management of the Department of Interior owned land.

Mark Your Calendar for the Public Comment Period

45-Day Public Comment Period
June 20 – August 3, 2011

Submit Written Comments

The Navy and EPA will accept written comments on the Proposed Plan during the 45-day public comment period.

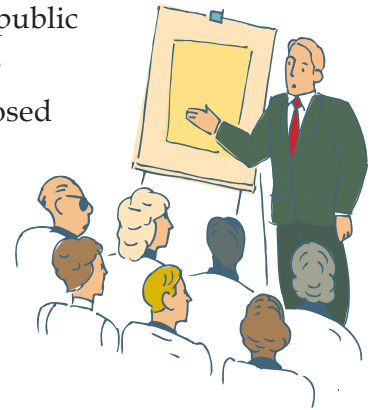


Attend the Public Meeting

Thursday July 7, 2011 at
5:00 pm

Jorge's Ice House
Carr. 200, Km 3, hm 2
Barrio Martineau, Vieques, PR

The Navy will hold a public meeting to explain the rationale for the proposed no action alternative. Verbal and written comments will also be accepted at this meeting.



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Place stamp here

NAVFAC Atlantic
Attention: Code EV31/Mr. Kevin Cloe
6506 Hampton Blvd.
Norfolk, VA 23508-1278