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NASD VIEQUES
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RECORD OF DECISION AREA OF CONCERN I (AOC I) ATLANTIC FLEET WEAPONS TRAINING AREA FORMER NAVAL AMMUNITIONS SUPPORT DETACHMENT VIEQUES ISLAND PUERTO RICO

9/1/2014

NAVFAC ATLANTIC

1 Declaration

1.1 Site Name and Location

This Record of Decision (ROD[1]) documents the No Further Action (NFA) determination for Area of Concern (AOC) I, located at the former Naval Ammunition Support Detachment (NASD) in Vieques, Puerto Rico. The former NASD is part of the Atlantic Fleet Weapons Training Area- Vieques, which was placed on the National Priorities List (NPL) on February 11, 2005 (Comprehensive Environmental Response, Compensation, and Liability Information System [CERCLIS] National Superfund database identification number: PRN000204694). AOC I is also known as Operable Unit (OU) 04 in the CERCLIS database.

1.2 Statement of Basis and Purpose

The NFA determination was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The U.S. Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic Division, U.S. Environmental Protection Agency (EPA) Region 2, Puerto Rico Environmental Quality Board (PREQB), and the Department of Interior (DOI) entered into a Federal Facility Agreement (FFA) for the former NASD in 2007, as a result of the NPL listing and pursuant to CERCLA. The FFA establishes the procedural framework and schedule for implementing the CERCLA response actions for Vieques. The Navy is the lead agency and responsible for ensuring the appropriate CERCLA response alternatives are developed and implemented as necessary to protect public health, welfare, and the environment.

The Navy and the EPA jointly select the NFA determination for AOC I, with the concurrence of PREQB. This decision is based on information contained in the Administrative Record for this remedy. Information not specifically summarized in this ROD or its references, but contained in the Administrative Record for this remedy, has been considered and is relevant to the NFA determination for AOC I. Thus, this ROD is based upon and relies on those portions of the Administrative Record file for AOC I in making this decision. This ROD is presented in a format that is conducive for the general public to read and understand the information upon which the decision for AOC I was made, while providing links to the technical details presented in the Administrative Record.

[1] This acronym, and all additional acronyms used, can be found defined in alphabetical order in the list of acronyms at the end of this document.

1.3 Scope and Role of Response Action

Based on the results of environmental investigations and groundwater treatment pilot study conducted, no unacceptable risks to human health or the environment remain at AOC I. AOC I is one of 17 sites within the former NASD having been or currently being evaluated in accordance with CERCLA under the Navy's Environmental Restoration Program (ERP). The Site Management Plan (SMP) for Vieques further details the investigation history and the schedule for CERCLA investigations/remediation activities at the former NASD and is updated annually. The response action selected in this ROD is intended to be the final remedy for AOC I and does not include or affect any other sites at the former NASD under the CERCLA process. The final determinations for the other sites within the former NASD have been documented in past decision documents or will be presented separately in future decision documents.

1.4 Description of Selected Remedy

The selected remedy for AOC I is NFA, based on current site conditions, future anticipated land and resource uses, and the results of environmental investigations and a groundwater treatment pilot study. The Navy and EPA, with concurrence from PREQB, have determined that NFA under CERCLA is appropriate for human health and the environment. There is no unacceptable risk to human health or ecological receptors attributable to past releases that would warrant a CERCLA response action under current and unrestricted future land use scenarios (i.e., the land could be used for residential, commercial, or industrial purposes without any restrictions). This determination is based on the evaluation of the information presented in the environmental investigation and groundwater treatment pilot study reports for AOC I, the risk assessments for human health and ecological receptors conducted during the Remedial Investigation (RI), and an additional human health risk evaluation conducted following the groundwater treatment pilot study.

1.5 Statutory Determination

The NFA decision meets the statutory requirements of CERCLA Section 121 and is protective of human health and the environment, complies with Federal and Commonwealth regulations that are applicable or relevant and appropriate, and allows for unlimited use and unrestricted exposure to site soil and groundwater. A statutory 5-year review is not required for AOC I under the NFA determination.

1.6 Navy Authorizing Signature for the Record of Decision for AOC I, Atlantic Fleet Weapons Training Area - Vieques

Cheryl F. Barnett

Cherryl F. Barnett
Director, Environmental Programs
Naval Facilities Engineering Command, Atlantic

9/30/14
Date

1.7 EPA Authorizing Signature for the Record of Decision for AOC I, Atlantic Fleet Weapons Training Area - Vieques

Walter E. Mugdan

Director, Emergency and Remedial Response Division
Environmental Protection Agency, Region 2

9/30/2014
Date

1.8 PREQB Concurrence Signature

Laura M. Vélez-Vélez
Executive Director
Puerto Rico Environmental Quality Board

26-9-2014
Date

2 Decision Summary

2.1 Site Description and History

Vieques Island is approximately 7 miles southeast of the eastern tip of the main island of Puerto Rico (**Figure 1**). Vieques is the largest island (other than the main island) in the Commonwealth of Puerto Rico, encompassing 33,088 acres. The Navy purchased large portions of Vieques in the early 1940s to conduct activities related to military training. Operations within the former Vieques Naval Training Range (VNTR) (eastern half of Vieques) comprised various aspects of naval gunfire training, including air-to-ground ordnance delivery and amphibious landings, as well as housing the main base of operations for these activities at Camp García. Operations within the former NASD (western one-third of Vieques), where AOC I is located, consisted mainly of ammunition loading and storage, vehicle and facility maintenance, and some training. **Figure 2** shows the location of AOC I within the former NASD.

The Navy ceased facility-wide operations on the former NASD in April 2001, in accordance with the January 30, 2000, Presidential Directive to the Secretary of Defense associated with the transfer of lands of the Navy-owned western portion of Vieques. The land transfer was completed on May 1, 2001, and the Navy has had no military presence at the main operational area since. Currently, the Navy's involvement at the former NASD comprises the environmental restoration program activities.

AOC I is a former asphalt plant, located approximately 900 feet (ft) southwest of Mosquito Pier, adjacent to an active rock quarry within the former NASD property which is currently owned by the Municipality of Vieques (MOV) (**Figures 2 and 3**). The asphalt plant was in operation from the 1960s through around 1999. The former asphalt plant included a large concrete pad, an asphalt mixing drum, an earthen ramp, two concrete-paved containment areas, and an area where two diesel fuel above-ground storage tanks (ASTs) were located (**Figure 3**).

AOC I is located on former U.S. property that was transferred to the MOV as part of a quitclaim deed that transferred the former NASD property to the MOV and the Puerto Rico Conservation Trust.

FIGURE 1
Regional Location Map

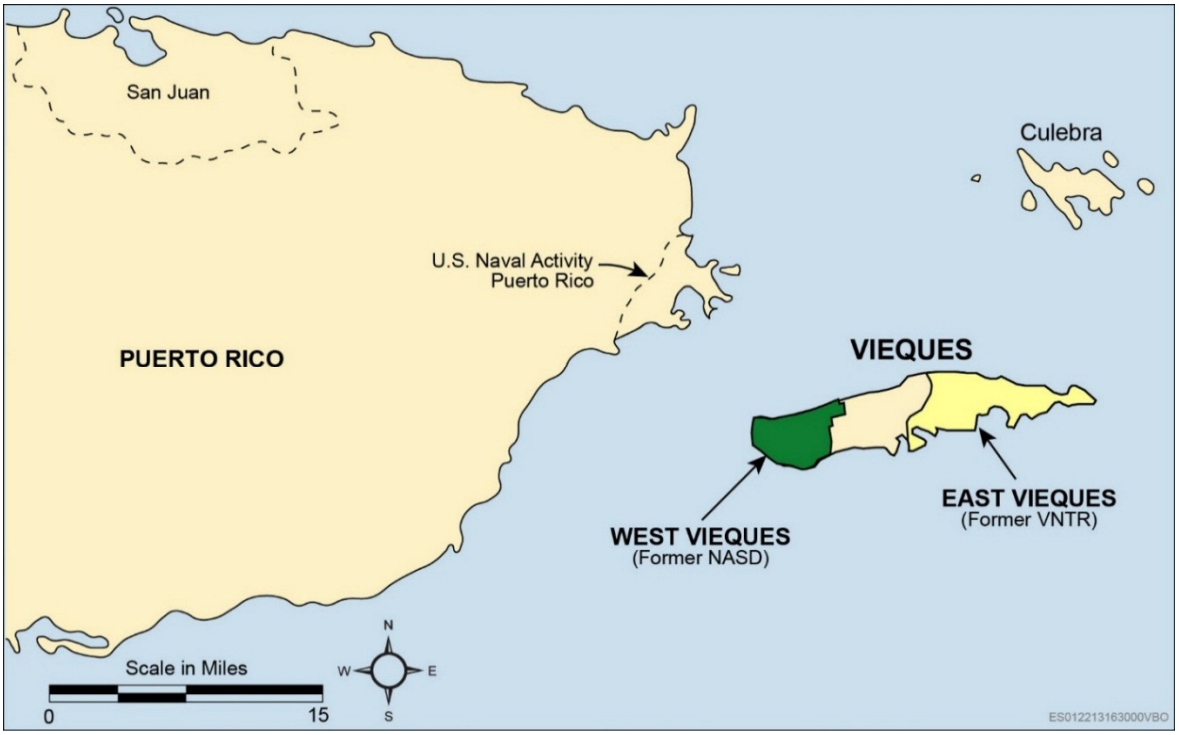
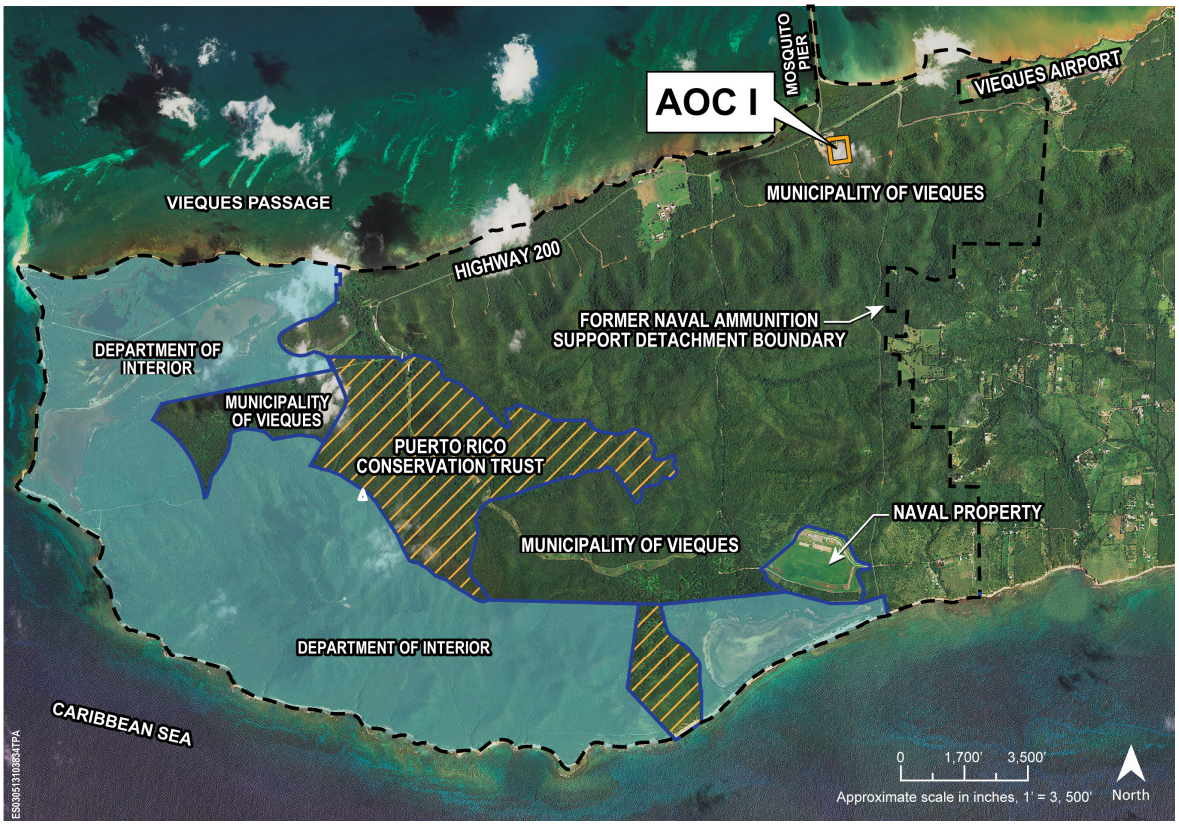


FIGURE 2
Former NASD and AOC I Location Map

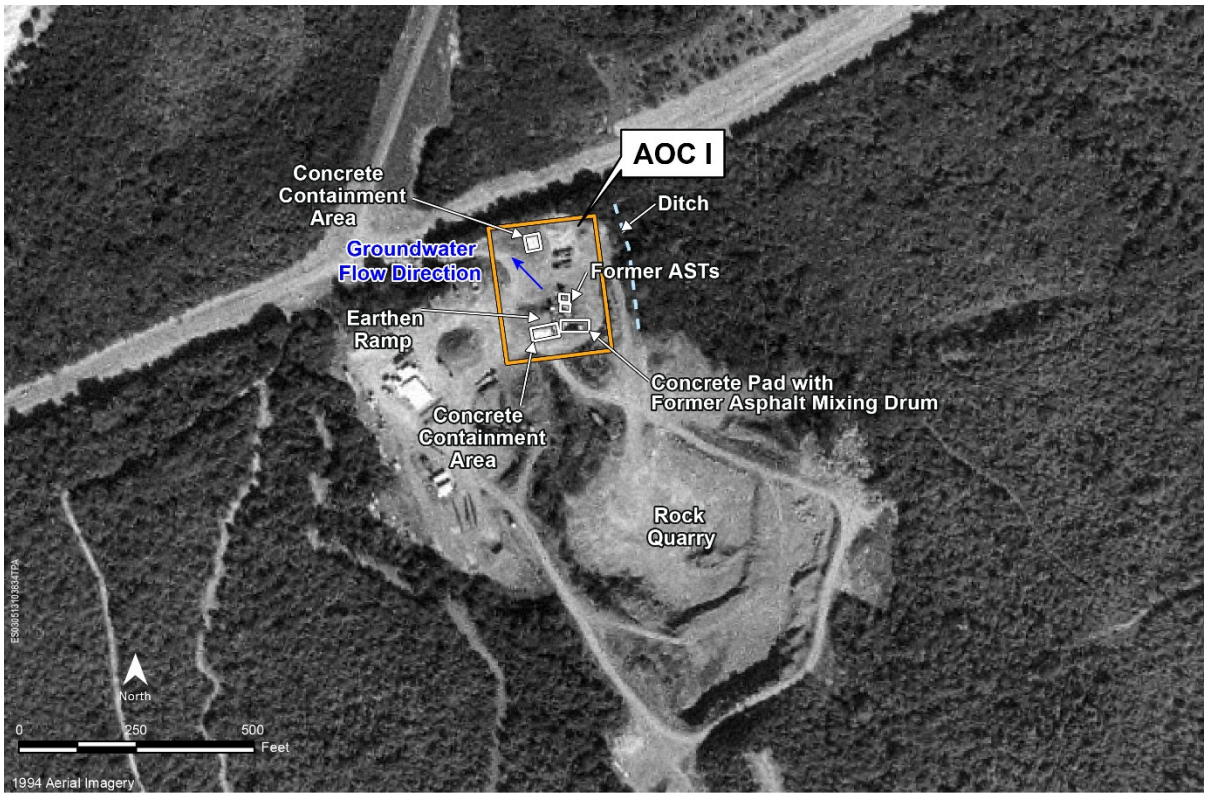


2.2 Site Characteristics

AOC I is generally flat with only slight changes in elevation from a high of approximately 30 ft above mean sea level (amsl) in the southern portion of the site to a low of approximately 27 ft amsl toward the northern end. There are no surface water features on site.

Ecological habitat at the former asphalt plant is minimal, consisting primarily of scrub grass, brush, and small trees growing in and around the former asphalt plant structures and through the gravel-covered terrain. Groundwater at AOC I is within andesite bedrock, overlain by gravel fill interspersed with silty clay and sand, with a relatively thin soil zone consisting of well-graded gravel with sand below the fill. Groundwater occurs at depths ranging from approximately 14 to 22 ft below ground surface (bgs) and flows generally northwest (**Figure 3**) toward the Vieques Passage at approximately 3 to 16 ft per year, with higher velocity measured in the southern and central portion of AOC I.

FIGURE 3
Site Layout Map



2.3 Previous Investigations

Environmental investigations at AOC I were initiated with an Expanded Preliminary Assessment (PA)/Site Investigation (SI), conducted in 2000. Subsequently, RI and Post-RI sampling was conducted in 2004-2006 and 2008, respectively. From 2010 to 2012, an in-situ groundwater treatment pilot study was implemented to determine whether clean up to acceptable levels of chemicals of concern (COCs) could be accelerated. **Table 1** summarizes all previous investigations and the groundwater treatment pilot study conducted at AOC I.

The groundwater treatment pilot study consisted of injecting a five-percent solution of sodium hydroxide-activated sodium persulfate into the contaminated groundwater around the former

asphalt plant to oxidize (break down) the COCs by a process referred to as in-situ chemical oxidation (ISCO). Several months after the ISCO treatment, oxygen-releasing compound (ORC) "socks" were suspended in several wells to provide an ongoing source of oxygen to maintain an aerobic environment and support biodegradation of any remaining COCs via enhanced in-situ bioremediation (EISB). Periodic groundwater sampling for approximately 2.5 years following the ISCO treatment was conducted to confirm COC "rebound" (return of COC concentrations above acceptable levels) did not occur.

TABLE 1
Previous Investigations

Previous Investigation*	Date	Investigation Activities
Expanded Preliminary Assessment/Site Inspection	2000	Based on information from the Environmental Baseline Survey (EBS), an Expanded Preliminary Assessment/Site Inspection (PA/SI) was conducted to determine whether a release had occurred at AOC I. It consisted of an ecological survey and co-located surface and subsurface soil sampling from 26 locations. The Expanded PA/SI **results**[1] indicated that there may have been a release(s) and recommended an RI to delineate the extent of surface soil impacts at the site and conduct a risk assessment (CH2M HILL, 2002).
Initial Remedial Investigation	2004	An initial RI was conducted in August/September 2004. The initial RI included surface soil sampling at 18 locations, subsurface soil sampling at 7 locations, and installation and sampling of 7 monitoring wells to determine the nature and extent of chemicals of potential concern (COPCs) in the AOC I area. The initial RI **results**[2] suggested sufficient soil data had been collected to evaluate the nature and extent of human health and ecological risk, but additional groundwater data were needed to further characterize the extent of groundwater contamination (CH2M HILL, 2005; 2008).
Supplemental Remedial Investigation	2005, 2006	A Supplemental RI was conducted in 2005-2006 and included the installation and sampling of two monitoring wells and sampling of four previously installed monitoring wells (CH2M HILL, 2008). The Supplemental RI also included conducting **human health and ecological risk assessments**[3], which are summarized in Section 2.6 below. C**oncentrations**[4] **of constituents detected in soil and groundwater during the RI**[4] are shown in Table 2 and further discussed in Section 2.4 below.
Post-Remedial Investigation Sampling	2008	Post-RI sampling was conducted to help determine the appropriate path forward for the site. A post-RI round of groundwater samples was collected in July 2008 because 2 years had elapsed since the last RI sampling. The **data**[5] showed COC concentrations in groundwater were limited to a relatively small area, demonstrated a declining trend over multiple years, and were relatively low (CH2M HILL, 2013).
In-Situ Groundwater Treatment Pilot Study	2010-2012	An **in-situ groundwater remediation pilot study**[6] was conducted from 2010 to 2012 to determine if accelerated achievement of acceptable COC concentrations was possible (CH2M HILL, 2013). Groundwater treatment Pilot Study Goals were developed based upon the EPA Maximum Contaminant Levels (MCLs), or other standards for constituents without MCLs. The groundwater treatment pilot study was implemented in a two-step approach using In-Situ Chemical Oxidation (ISCO) with sodium persulfate followed by Enhanced In-Situ Bioremediation (EISB) with oxygen releasing compound (ORC) to initially oxidize the chemical organics and then stimulate an increase in the natural biodegradation rates of COCs in groundwater. The groundwater treatment pilot study technologies coupled with natural processes reduced the **groundwater COC concentrations**[7] (based on post-ISCO injection sampling rounds in November 2010, November 2011, May 2012, and November 2012, as shown in **Table 3**) side-wide to acceptable levels (i.e., Federal, Commonwealth, or risk-based standards) with no rebound for approximately 2.5 years of monitoring performed after implementation of ISCO.

* Documentation associated with the listed studies is available in the Administrative Record and provides detailed information used to support the remedy selection for AOC I. The relevant referenced information is also accessible by the hyperlinks in this document.

2.4 Distribution of Contamination

Analytical data collected as part of the RI and groundwater treatment pilot study provide the basis for evaluating the nature and extent of contamination in soil and groundwater; sample locations are shown in **Figure 4**. Chemical concentrations were compared to risk-based screening values for human health and ecological receptors and Puerto Rico underground storage tank (UST)-based Corrective Action Criteria. Constituents detected, up through the RI, which are above screening criteria (and background concentrations for inorganics) are summarized in **Table 2**. Groundwater COC concentrations during the groundwater treatment pilot study are provided in **Table 3**. The November 2012 groundwater data in **Table 3** are representative of current groundwater conditions.

One semivolatile organic compound (SVOC) and five inorganic constituents were detected above risk-based screening criteria and background concentrations in soil. Five volatile organic compounds (VOCs), four SVOCs, and five inorganic constituents were detected above screening criteria and background concentrations in groundwater during the RI (**Table 2**). Of the chemicals of potential concern (COPCs) identified for groundwater, benzene exceeded the Puerto Rico UST-based Corrective Action Criterion.

The RI results suggest the distribution of constituents and the relatively low associated concentrations in surface and subsurface soil are not indicative of a substantial release, but they appear to be more representative of minor drips and spills likely associated with asphalt plant operations. Further, the RI groundwater concentrations were relatively low, and no non-aqueous-phase petroleum was detected in soil or groundwater, which further substantiates the conclusion no significant release occurred. Contaminants detected in groundwater were limited to the area immediately underlying the main operational activities of the former asphalt plant. Since being detected, the area of impacted groundwater was addressed through ISCO and EISB during the groundwater treatment pilot study. The groundwater data in **Table 3** show that groundwater COC concentrations are below Pilot Study Goals as a result of activities conducted during the groundwater treatment pilot study.

FIGURE 4
Sample Locations

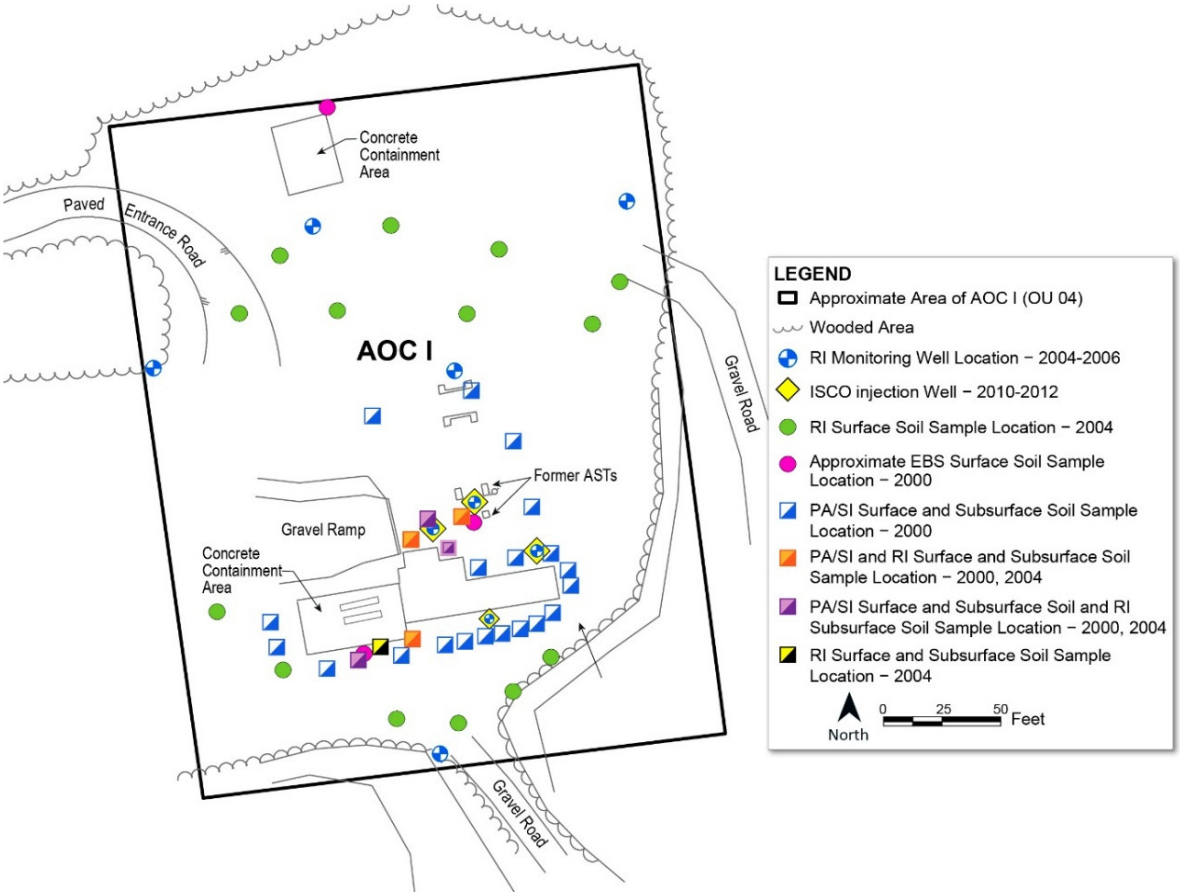


TABLE 2
Soil and Groundwater Exceedances for AOC I

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Background Value[3]	Screening Criteria[1,2]	
				Vieques HHRA SO	Vieques Eco SO
Soil	**Semivolatile Organic Compounds (µg/kg)**				
	Benzo(a)pyrene	145 J	--	62	100
	Total Inorganics (mg/kg)				
	Aluminum	32,600	29,000	7,600	--
	Arsenic	2.6	2.2	0.39	18
	Iron	62,500	39,000	2,300	--
	Thallium	0.93 J	0.67	0.52	1
	Vanadium	188	130	7.8	2

Environmental Media	COPC	Maximum Concentration Detected Above Screening Criteria and Background	Background Value	Screening Criteria[1,2]		
				Vieques HHRA GW	MCL - GW	PREQB UST Corrective Action Criteria
Groundwater	**Volatile Organic Compounds (µg/L)**					
	1,2-Dichloroethane	1.6	--	0.12	5	--
	1,2-Dichloropropane	0.33 J	--	0.16	5	--
	1,4-Dichlorobenzene	0.52	--	0.5	75	--
	Benzene	59.3	--	0.35	5	5
	Trichloroethene	1.4	--	0.028	5	--
	Semivolatile Organic Compounds (µg/L)					
	2-Methylnaphthalene	110	--	2.4	--	--
	Dibenzofuran	5.5	--	1.2	--	--
	Naphthalene	96	--	0.62	--	--
	bis(2-ethylhexyl)phthalate	9.6 J	--	4.8	6	--
	Total Inorganics (µg/L)					
	Arsenic	18.7	15.6 J	0.045	10	--
	Cadmium	8.72	6.35	1.8	5	--
	Iron	1,840	210 J	1,100	--	--
	Manganese	1,930	13.3 J	88	--	--
	Vanadium	46.9 J	37.1 J	3.6	--	--

Notes:

[1] Shading indicates screening criterion exceeded. COPCs in soil selected based on exceedance of HHRA SO and/or Eco SO values. COPCs in groundwater selected based on exceedances of HHRA GW.

[2] The human health and ecological screening criteria were those listed in the Master Standard Operating Procedures, Protocols, and Plans (CH2M HILL, 2007).

[3] Soil background values from former NASD background study (CH2M HILL, 2002); groundwater background values from site-specific up-gradient well.

COPC = Chemical of Potential Concern
HHRA = Human Health Risk Assessment
Eco = Ecological
SO = Soil
GW = Groundwater
MCL = Maximum Contaminant Level
PREQB = Puerto Rico Environmental Quality Board
UST = Underground Storage Tank

2.5 Current and Potential Future Land and Resource Uses

The former NASD occupied approximately 8,000 acres, most of which are undeveloped. Military operations ceased on the former NASD in April 2001, and the land containing AOC I was transferred to the MOV. AOC I is currently fenced, and there is no continuous human presence or use of the site other than potentially as a passageway for trucks to/from the rock quarry from Highway 200. Groundwater beneath AOC I is classified by the Commonwealth of Puerto Rico as follows: (a) potential source as a drinking water supply, (b) for potential agricultural use, and/or (c) as groundwater which flows into waters that support ecological communities of exceptional ecological value. However, groundwater is not currently used as a potable water source at AOC I. No archaeological or cultural resources are located within AOC I. The NFA determination will allow unrestricted use of the AOC I property by the MOV once the quitclaim deed is modified to show the property is no longer encumbered by land use restrictions.

TABLE 3
Pilot Study Groundwater COC Concentrations for AOC I

Environmental Media	Chemical of Concern (COC)	Pre-injection (Baseline) Monitoring	Post-injection Monitoring				Pilot Study Goal[1]
		Maximum Concentration Detected March 2010	Maximum Concentration Detected November 2010	Maximum Concentration Detected November 2011	Maximum Concentration Detected May 2012	Maximum Concentration Detected November 2012	
Groundwater	**Volatile Organic Compounds (µg/L)**						
	1,2-Dichloroethane	ND	ND	ND	ND	ND	3.8
	1,2-Dichloropropane	ND	ND	ND	ND	ND	5
	Benzene	14	10	5.3	2.9 J	2.2 J	5
	Semivolatile Organic Compounds (µg/L)						
	2-Methylnaphthalene	17	20	11	11	11	27
	Naphthalene	21	10	12	3.3	1.6 J	0.14–14
	bis(2-ethylhexyl)phthalate	1.4 J	1.4 J	1.3 J	ND	ND	6

Notes:

ND - Not detected

[1] The Pilot Study Goals were developed based upon EPA Maximum Contaminant Levels, or other standards for constituents without MCLs. For benzene, bis(2-ethylhexyl)phthalate, and 1,2-dichloropropane the Pilot Study Goal is the MCL; for 1,2-dichloroethene the Pilot Study Goal is the Puerto Rico Water Quality Standard; for 2-methylnaphthalene the Pilot Study Goal is the EPA tap water Regional Screening Level based on a Hazard Index of 1; for naphthalene the Pilot Study Goal is the range of tap water RSLs based on the acceptable carcinogenic risk range of 10^{-4} to 10^{-6}.

2.6 Summary of Site Risks

A conceptual site model (CSM) of AOC I is provided as **Figure 5**. Potential human health and ecological risks were quantitatively evaluated based on the receptor scenarios and potentially impacted media identified in the CSM. Summaries of the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) conducted for AOC I during the RI are included in the following subsections and in **Table 4**. The HHRA and ERA, which are included in the RI Report and the residual human health risk evaluation performed following the groundwater treatment pilot study, provide more detailed analysis and evaluation.

TABLE 4
AOC I Risk Assessment Results

Media	Human Health Risk				
	Future Maintenance Workers	Future Industrial Workers	Future Construction Workers	Future Recreational Users	Future Residents[1]
Surface Soil (0-2 ft)	ELCR = $2x10^{-7}$ and HI = 0.03	No exposure pathway	No exposure pathway	Adult: ELCR = $7x10^{-7}$ and HI = 0.01 Youth: ELCR = $9x10^{-7}$ and HI = 0.02 Child: ELCR = $3x10^{-6}$ and HI = 0.7	Adult: ELCR = no COPCs and HI = 0.3 Child: ELCR = no COPCs and HI = 3* Adult/Child: ELCR = $2x10^{-5}$ and HI = no COPCs
Total Soil (0-6 ft)	No exposure pathway	ELCR = $1x10^{-6}$ and HI = 0.2	ELCR = $1x10^{-7}$ and HI = 0.2	No exposure pathway	
Groundwater	No exposure pathway	Pre-Pilot Study ELCR = $8x10^{-5}$ and HI =1.4	No exposure pathway	No exposure pathway	Pre-Pilot Study Adult: ELCR = no COPCs and HI = 4.1 Child: ELCR = no COPCs and HI = 43 Adult/Child: ELCR = $4x10^{-4}$ and HI = no COPCs Post-Pilot Study Adult: ELCR = no COPCs and HI = 0.5* Child: ELCR = no COPCs and HI = 0.5* Adult/Child: ELCR = $3x10^{-5}$ and HI = no COPCs

Media	Ecological Risk
	All Receptors
Soil	**Acceptable**
Groundwater	**No exposure pathway**

ELCR - excess lifetime cancer risk; unacceptable ELCR > 1×10^{-4}

HI - hazard index; unacceptable HI >1

[1] Exposure concentrations were calculated for surface soil (EPA's preferred approach) and total soil (EQB's preferred approach). The higher of the two exposure concentrations for each COPC was used to produce conservative risk estimates.

* Inorganic COPCs (aluminum, antimony, arsenic, cadmium, iron, manganese, thallium, and vanadium) that are wholly or primarily attributable to **background** were not identified as COCs.

2.6.1 Human Health Risk Assessment

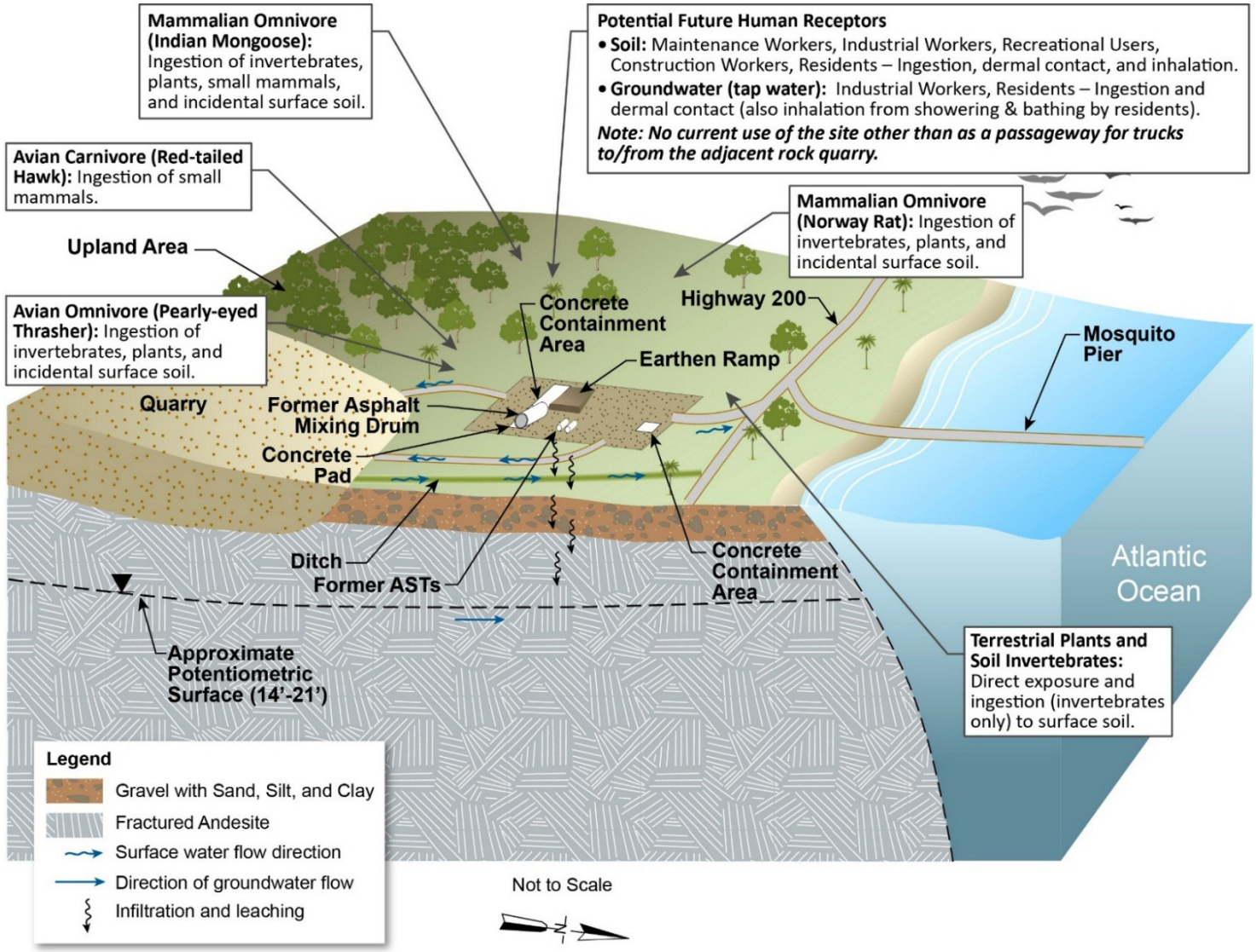
Based on the CSM, human health risks were quantitatively evaluated for **potential human receptors**[8] exposed to surface soil (0-2 ft bgs), total soil (0-6 ft bgs), and groundwater using reasonable maximum exposure (RME) concentrations. The RME assumes the highest level of human exposure that could reasonably be expected to occur. The potential non-cancer hazards, expressed as the hazard index (HI), and cancer risk estimates were calculated using RME exposure assumptions. For non-cancer

effects, a hazard quotient (HQ) represents the ratio between the reference dose and the RME dose for a person in contact with COPCs, and the HI represents the sum of the HQs. An HI exceeding 1 indicates that adverse health effects may occur. For known or suspected carcinogens, acceptable exposure levels generally are concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} (a 1 in 10,000 to 1 in 1,000,000 chance of developing cancer from site exposures) using information on the relationship between dose and response.

Soil and groundwater samples collected during the RI and groundwater samples collected following the groundwater remediation study were used to quantitatively evaluate potential human health risks because of potential exposure to site media. Exposure scenarios evaluated for site media comprised maintenance workers, industrial workers, construction workers, recreational users, and residents, based on current and potential future land use. Conservative exposure pathways comprised ingestion, dermal contact, and/or inhalation of chemicals in soil and groundwater.

No **unacceptable human health risk**[9] was identified in soil. However, potentially unacceptable human health risk was identified (based on groundwater data collected during the RI) for a hypothetical resident exposed to groundwater at AOC I (cumulative excess lifetime cancer risk greater than 1×10^{-4} and an HI > 1), which resulted in six COCs identified in groundwater: benzene, bis(2-ethylhexyl)phthalate, 1,2-dichloroethane, 1,2-dichloropropane, 2-methylnaphthalene, and naphthalene. However, the in-situ groundwater remediation pilot study conducted subsequent to the RI reduced the COC concentrations. These concentrations, which characterized the groundwater quality after the pilot study was completed, were then evaluated following EPA's human health risk assessment process, which begins with screening the concentrations against risk-based concentrations to determine if any concentrations require further analysis, or if they are sufficiently low enough that no further evaluation is needed. The results of this screening concluded that all concentrations were below risk-based concentrations, no additional assessment is needed, and there is no unacceptable risk and, therefore, no COCs associated with exposure to groundwater at AOC I.

FIGURE 5
Conceptual Site Model



2.6.2 Ecological Risk Assessment

An ERA was conducted for AOC I, consisting of Steps 1 through 3A of the ERA process, in accordance with Navy ERA policy, and Navy and EPA ERA guidance. In Step 1 (preliminary problem formulation) the goals, scope, and focus of the ERA were established, and the environmental setting (i.e., habitats, vegetation, wildlife, protected species), types and concentrations of chemicals in surface soil, as well as potentially complete exposure pathways, were described. This information was used to develop the **ecological CSM**[10] and **ecological assessment and measurement endpoints**[11]. Potentially complete pathways were identified for lower trophic level receptors (plants and soil invertebrates) and upper-trophic level receptors (birds and mammals) exposed to surface soil. Surface water bodies are not present at AOC I or the immediate surrounding area; therefore, aquatic exposure pathways are not present.

In Step 2, HQs were calculated to characterize the potential for constituents to pose unacceptable ecological risk using conservative exposure assumptions. HQs represent a ratio of the exposure level to an ecological effect level, and are an estimate of potential risk. Maximum soil constituent concentrations in surface soil were used in Step 2 to estimate potential exposures to upper and lower trophic level ecological receptors selected to represent the assessment endpoints at AOC I. Upper trophic level effects were determined using a food web model that estimated the concentration of each **bioaccumulating chemical**[12] in each relevant dietary component, and then those levels were compared to the total dietary intake of the chemical to wildlife **toxicity reference values**[13] (TRVs). TRVs were based on chronic No Observed Adverse Effect Levels (NOAELs) and chronic Lowest Observed Adverse Effect Levels (LOAELs) obtained from scientific literature. Only constituents with the potential to bioaccumulate were evaluated for food web exposures. For lower trophic level receptors, the exposure concentrations for soil were screened against **ecological soil screening levels**[14] (eco-SSLs) developed by EPA, or alternative regulatory-approved screening values if eco-SSLs were not available. Chemicals with HQs greater than 1 were identified as **ecological COPCs**[15] for further evaluation in Step 3A of the ERA. Identified COPCs at Step 2 comprised VOCs, SVOCs, and inorganic constituents in surface soil.

In **Step 3A**[16], the conservative exposure assumptions employed for Step 2 were refined and risk estimates were recalculated using more realistic assumptions including the use of mean values for soil concentrations, bioaccumulation factors, and exposure parameters. Other factors considered in Step 3A included comparison to background concentrations, other accepted ecological screening values in the scientific literature, frequency of detection, frequency and magnitude of screening value exceedance, and spatial distribution of the COPCs.

The Step 3A refinement resulted in no COCs being identified for either upper or lower trophic level receptors. Chemicals detected above ecological screening criteria were attributable to background and had infrequent exceedances. Thus, risks to ecological receptors are acceptable at AOC I.

2.7 No Further Action Determination

In cooperation with EPA and PREQB, and in accordance with the FFA and applicable guidance, the Navy performed investigations at AOC I to evaluate the nature and extent of contamination associated with past releases, and to assess the potential risks to human health and the environment posed by that contamination. Based on those assessments, the Navy performed a study which addressed groundwater contaminant concentrations above regulatory standards. As a result, the current conditions at AOC I do not pose an unacceptable risk to human health or the environment for unrestricted and unlimited land use, and the no further action determination meets the statutory requirements of CERCLA and the regulatory requirements of the NCP for protection of human health

and the environment. The Navy and EPA, in consultation with PREQB, agree that no further action and no restrictions on land use or exposure are necessary for AOC I.

2.8 Community Participation

The Navy, in consultation with the EPA, PREQB, and United States Fish and Wildlife Service (USFWS), established a community relations program for the Vieques environmental restoration program in 2001. The program promotes communication regarding site investigations and remediation activities between the stakeholder agencies (Navy, EPA, PREQB, and the USFWS) and the public. The community relations program formed a Restoration Advisory Board (RAB) in 2004 to encourage community involvement. RAB meetings are held approximately every 3 months and are open to the public for participation. A summary of the community participation efforts by the stakeholder agencies for this action is presented in Section 3.

3 Responsiveness Summary

The Responsiveness Summary is a concise summary of substantive comments received from the public during the public comment period and the associated responses. The Responsiveness Summary was prepared in accordance with guidance in *Community Relations in Superfund: A Handbook* (EPA, 1992) after the public comment period ended on December 19, 2013.

3.1 Overview

The Proposed Plan presented to the public identified that no further action is necessary for environmental media at AOC I in order to protect human health and the environment.

3.2 Community Involvement Process

In accordance with Section 117(a) of CERCLA, the Navy provided a public comment period between November 4, 2013 and December 19, 2013, for the AOC I Proposed Plan. A **public meeting**[17] was held on November 14, 2013 at the Ice House, located at Carr. 200, Km 3, hm 2, Vieques, Puerto Rico to present information pertinent to the proposed no further action determination and to accept comments and questions regarding this determination. No formal comments or questions were submitted to the Navy, EPA, or PREQB during the public meeting.

The Proposed Plan and previous investigation reports for AOC I were available during the public comment period and are currently available in the former NASD Administrative Record. The Administrative Record is accessible to the public via:

http://www.navfac.navy.mil/vieques

3.3 Summary of the Public Comment Period

No community members expressed opposition to the proposed no further action determination for AOC I. No comments or questions were received by the Navy, EPA, or PREQB during the public comment period.

4 Acronyms

AOC	area of concern
AST	aboveground storage tanks
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COC	chemical of concern
COPC	chemical of potential concern
CSM	conceptual site model
DOI	Department of the Interior
EBS	Environmental Baseline Survey
eco-SSL	ecological soil screening level
EISB	enhanced in-situ bioremediation
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
FFA	Federal Facilities Agreement
ft	feet
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
ISCO	in-situ chemical oxidation
LOAEL	lowest observed adverse effect level
µg/L	micrograms per liter
MCL	maximum contaminant level
MOV	Municipality of Vieques
NASD	Naval Ammunition Support Detachment

NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOAEL	no observed adverse effect level
NPL	National Priorities List
ORC	oxygen releasing compound
OU	operable unit
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl
PREQB	Puerto Rico Environmental Quality Board
RAB	Restoration Advisory Board
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Inspection
SMP	Site Management Plan
SSL	soil screening level
SVOC	semivolatile organic compound
TRV	toxicity reference value
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
VNTR	Vieques Naval Training Range

5 References

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
Ref. 1	**results**	Section 2.3	CH2M HILL, 2002. *Expanded Preliminary Assessment/Site Investigation, Phase II, Seven Sites, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico. November*. Section 5, Tables 5-1 and 5-2.
Ref. 2	**results**	Section 2.3	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Tables 4-1 through 4-3.
Ref. 3	**human health and ecological risk assessments**	Section 2.3	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendices M and N.
Ref. 4	**Concentrations of constituents detected in soil and groundwater during the RI**	Section 2.3	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Tables 4-1 through 4-3.
Ref. 5	**data**	Section 2.3	CH2M HILL, 2013. *Final In-Situ Remediation Pilot Study Report, Area of Concern I (AOC I), Atlantic Fleet Weapons Training Area – Vieques, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* October. Table 5.
Ref. 6	**in-situ groundwater remediation pilot study**	Section 2.3	CH2M HILL, 2013. *Final In-Situ Remediation Pilot Study Report, Area of Concern I (AOC I), Atlantic Fleet Weapons Training Area – Vieques, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* October.
Ref. 7	**groundwater COC concentrations**	Section 2.3	CH2M HILL, 2013. *Final In-Situ Remediation Pilot Study Report, Area of Concern I (AOC I), Atlantic Fleet Weapons Training Area – Vieques, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* October. Section 3, Tables 5 and 6.
Ref. 8	**potential human receptors**	Section 2.6.1	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Figure 6-1.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
Ref. 9	**unacceptable human health risk**	Section 2.6.1	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Sections 6.3 and 6.4.
Ref. 10	**ecological CSM**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Figure 7-1.
Ref. 11	**ecological assessment and measurement endpoints**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendix N, Table N-20.
Ref. 12	**bioaccumulating chemical**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendix N, Table N-5.
Ref. 13	**toxicity reference values**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendix N, Tables N-9 and N-10.
Ref. 14	**ecological soil screening levels**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendix N, Table N-11.
Ref. 15	**ecological COPCs**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendix N, Table N-11.
Ref. 16	**Step 3A**	Section 2.6.2	CH2M HILL, 2008. *Final Remedial Investigation Report, Area of Concern (AOC) I, Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* June. Appendix N, Section N.3.2 and Table N-20.
Ref. 17	**Public meeting**	Section 3.2	Transcript of the Public Hearing for the Meeting of Proposed Plans for AOC E, Former Underground Storage Tank Site and AOC I, Former Asphalt Plant Site, *Former Naval Ammunition Support Detachment, Vieques, Puerto Rico.* November 14, 2013.